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(continued)

From the Editor

Volume Eight of the *Journal of Music Theory Pedagogy* includes articles on several important subjects. Articles by Charles Burkhart and Carl Schachter, authors known for both their important contributions to music theory pedagogy and to musical analysis, explore ways in which analytical decisions can influence performance. Pedagogical connections between analysis and performance are discussed by Elizabeth West Marvin.

The issue also includes an approach to teaching music theory pedagogy by Thomas Benjamin. We are planning to continue a discussion of this area of teaching through articles by other authors in forthcoming volumes.

The longest article in Volume Eight is an extensive set of recommendations for atonal music pedagogy by Robert Morris, a composer and theorist who is well known for his work in this area. This article should be of immediate use to those who teach and compose atonal music and should be a valuable reference for all of our readers. Professor Morris, of course, takes a different view on hearing and recognizing set-classes than did Professor Thomson in Volume Seven.

Other articles suggest different pedagogical strategies and ways of assessing that ever-present group of students who need remediation in music theory. We have also included two reviews and have continued our current bibliography listing. Finally we are printing the last installment of an exchange about solmization by Professors Micheál Houlahan, Philip Tacka, and Timothy A. Smith.

We welcome your comments and submissions about issues raised in this volume, or about any aspect of music theory pedagogy.

Mary Wennerstrom
Indiana University

Mid-Bar Downbeat in Bach's Keyboard Music[1]

Charles Burkhart

All musicians will recall confronting passages in which the downbeat seems to fall in the middle of the bar—passages in which the player (or listener) *feels* "1 2 3 4" when the score is actually saying 3 4 | 1 2. I will call this phenomenon mid-bar downbeat. It can occur only in duple meters, of course—most readily in those with four pulses to the bar. It is often referred to as "metrical displacement" in that the downbeat is "displaced" from its normal position to an abnormal one. Such a downbeat is also sometimes said to cause a "metrical dissonance" because the listener, not expecting the main downbeat to shift from 1 to 3, experiences a kind of rhythmic bump, gentle or otherwise, when it does. A general virtue of mid-bar downbeat is that it promotes flexibility of phrasing and the avoidance of "four-squareness." But it functions differently in different musical periods because each period has its own rhythmic style.

Since I am discussing Bach here, it is necessary to point out at once that one encounters in early eighteenth-century music, Bach's included, many cases that *look* like mid-bar downbeat, but that are not experienced as such. As Floyd Grave has shown in an excellent article,[2] eighteenth-century music employed various types of qua-

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[1]An earlier form of this article was read as a paper at the Second International Schenker Symposium, Mannes College of Music, New York City, March 27-29, 1992.

[2]Floyd K. Grave, "Metrical Displacement and the Compound Measure in Eighteenth-century Theory and Practice," *Theoria* 1 (1985): 25-60. The following account of eighteenth-century metric theories is based on Grave. On metrical displacement I take no issue with Grave, who covers the subject very thoroughly. What I attempt to offer here is a Schenkerian view of it. For an equally penetrating study of mid-bar downbeat in the Classic era, see Grave's "Common-Time Displacement in

druple meter. One quite common type, manifested in pieces that motivically emphasize half-bar units, was called "compound (*zusammengesetzte*) 4/4"—that is, 4/4 conceived as compounded of two bars of 2/4 time, or 1-2 1-2. As described by early eighteenth-century theorists, the first and third quarters of compound 4/4 are of *equal* weight. Therefore pieces in this kind of meter could just as well be barred in 2/4 with twice the number of bar lines, and no shift of accent can be produced. But theorists writing later in the century, notably Kirnberger, found the first and third quarters to be *un*equal and went on to characterize the first and second halves of the bar as *strong* and *weak*.[3] This makes a very significant difference: it makes beat 3 less strong than beat 1. Also, it makes it possible to perceive the four quarters as a measure of 2/2 time, or, to put it another way, as a kind of "hypermeasure" of two 2/4 bars—one strong, one weak. These two different theoretical explanations of the compound measure were of course the result of a gradual change in musical style. By the late eighteenth century the type of 4/4 measure conforming to the Kirnberger model had become the norm and has remained so to the present.

Mid-bar downbeat cannot be understood without reference to the larger concept of the musical phrase. I have found it helpful to conceive of the phraseology of Bach's music in terms of two basic types—periodic and non-periodic, or regular and irregular. Representing the periodic are the dances, which often feature phrase lengths of 2, 4, or 8 bars. Tending toward the non-periodic are genres of an improvisatory character, such as prelude, toccata, fantasia, and

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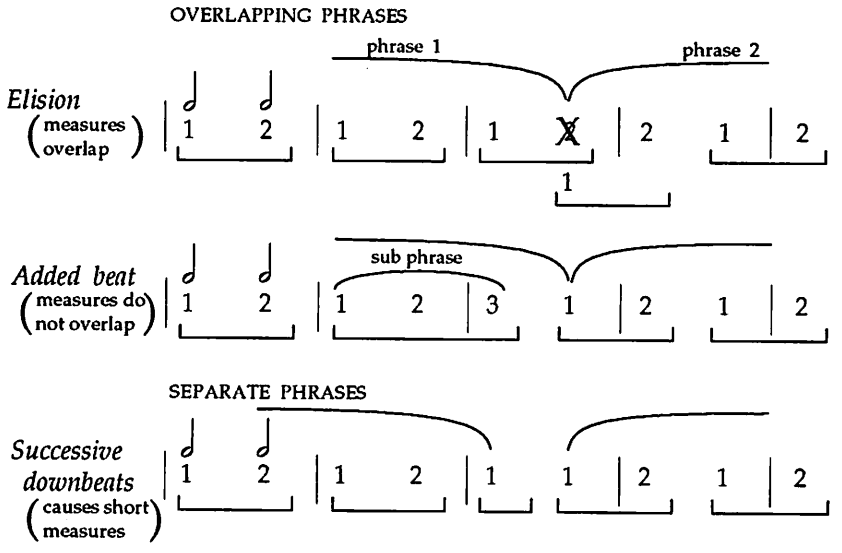
Mozart," *Journal of Musicology* III/4 (Fall 1984): 423-442. Among recent Schenkerian studies that contain significant contributions to the understanding of mid-bar downbeat are Carl Schachter, "Rhythm and Linear Analysis: Aspects of Meter," *The Music Forum* VI/1 (1987): 1-59, especially 17-22 and 53-58; and William Rothstein, *Phrase Rhythm in Tonal Music* (New York: Schirmer Books, 1989), 126, 136, and especially 199-213, which are a discussion of metrical displacement in Mendelssohn's *Songs without Words*.

[3]J.P. Kirnberger, in *Die Kunst des reinen Satzes in der Musik* (1776) (*The Art of Strict Musical Composition*, trans. David Beach and Jurgen Thym, [New Haven: Yale University Press, 1982], 392), explains the metrical hierarchy of the four-quarter measure as 1 2 3 4.

fugue. The slower fugues, particularly those in the *stile antico*, represent the non-periodic side to the most extreme degree. Of course, my two types are actually the two ends of a spectrum. All kinds of situations exist in between, especially in the music of Bach, who wrote fugal dances and dance-like fugues. As for mid-bar downbeat, its effect emerges more clearly when the phrases are both periodic and in rapid tempo. For these reasons the often-remarked fugal entrances on the second half of a measure are generally not heard as such in moderate- to slow-tempo fugues, such as *WTC I*'s C minor fugue. The meter in these fugues is of the older—the 2 x *equal*-2/4—type. But in the pieces I discuss below, regular periodicity and/or faster tempo create unequal (strong/weak) half measures. Thus they employ the later type of compound meter (the "Kirnberger type"), and mid-bar downbeat—that is, a reinterpretation of a written beat 3 to a perceived beat 1—can and does occur. The displacements in most of these pieces are also coordinated with formal divisions of the composition, a factor that would seem to increase their significance.

Since the "modern" compound measure is, as noted, readily perceived as 2/2, I use half notes in Figure 1, which pictures three ways in which mid-bar downbeat comes about. The two most common ways are *elision* and *added beat*. The third, *successive downbeats*, is rarer in Bach but I include it here for the sake of theoretical completeness. Elision and added beat are both the result of overlapping phrases. Of the two, elision is the more drastic because here not only the phrases but also the measures overlap, causing the listener to reinterpret a 2 as a 1. What I call "added beat" (that is, an added half measure) is perceived as producing a measure of 3/2. Very common in non-periodic phrasing, it often occurs just before a given phrase overlaps with the next. The resulting 1-2-3 usually forms a kind of small sub-phrase, often a 3rd-progression. Added beat produces only the very gentlest of bumps. Far from causing a disruption, it promotes the surface evenness and plasticity of phrasing so characteristic of Bach's style. In the case of "separate" (non-overlapping) phrases, the only possible displacement technique is

Figure 1. Three ways of producing mid-bar downbeat



ment technique is that of *successive downbeats*, resulting in a shortened measure.[4]

Example 1, the Allemande of the E major French Suite,[5] is a classic example of eighteenth-century "compound 4/4" (see my 1-2's under the first system). Much could be said about the rhythmic subtlety (not to mention the voice leading and form) of this ingratiating piece, but I will note only its three elisions (marked X, Y, and Z), all of which occur on the half-bar level. The first of these—at m. 8b—shifts the meter out of phase with the bar lines until m. 12. Here a doubling of the normal length of the closing B major chord brings the meter back into phase. In the second large section—m. 13

[4]Rothstein's discussion of phrase irregularity and phrase linkage in *Phrase Rhythm*, 33-63, includes most of the concepts identified in Figure 1. Instead of "elision," he prefers Schenker's term, "reinterpretation." Various authors have spoken of "extra" or "additional" beats or measures.

[5]Mid-bar downbeat is rather frequent in the allemandes of Bach's keyboard suites.

back into phase again. The diagram at the bottom of Example 1 shows that all three elisions occur at the cadential points of the piece's largest phrases.

Example 2, the "Little" Prelude No. 8, or *Preambulum*, as Bach called it, is of a very different rhythmic world from that of the Allemande, though it still clearly features compound measures. At m. 8a the prevailing 1-2's are modified by an "added beat" (see the encircled 1 2 3). Then the 1-2's resume—but out of phase, of course.

Let us take a closer look at mm. 5-8. As the reduction shows, the octave a^2-a^1 is here filled in with descending stepwise half notes. These half notes could have reached their goal—a^1—on the downbeat of m. 8, had they been disposed rhythmically as shown in Example 3. But Bach has *evenly* paced them, thus delaying their goal by half a bar. Not only is bar 8b a "mid-bar downbeat" then, but the entire octave descent (bars 5-8b) is an example of what Schenker calls "serving the diminution organically"[6]—a cryptic expression that Carl Schachter has elucidated as follows:

> A group of bars serves a diminution organically if the *tonal* rhythm [as opposed to the *durational* rhythm] determines the number of bars [or, as here, *half* bars]. This will happen if the elements of the diminution *maintain an even pace*, thereby restricting the role of durational rhythm to an irreducible minimum.[7]

In the Little Prelude, because the eight notes that fill the octave are *evenly paced*, the goal (the lower a) arrives on the second half of a measure. This arrival on the lower a, because of its *tonic* harmony, produces a *tonal* accent that imparts a sense of downbeat at bar 8b. At the same point, the next phrase begins.

In non-periodic phrasing, *tonal* rhythm—the sense of accent imparted purely by the tonal functions alone—holds sway over *durational* rhythm much of the time. This general condition promotes (among many other things) the generation of mid-bar down-

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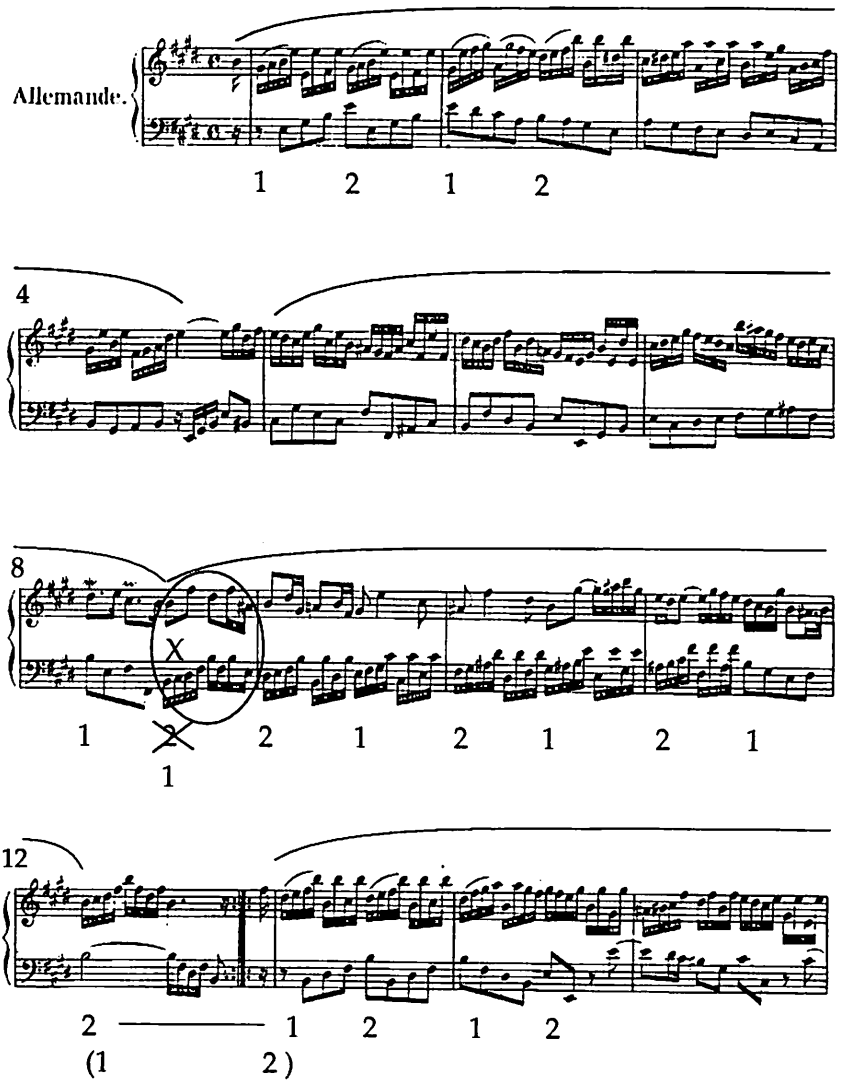
[6]Heinrich Schenker, *Free Composition*, trans. Ernst Oster (New York: Longman, 1979), 124 (Par. 297).

[7]Schachter, "Aspects of Meter," 41 (italics mine). For Schachter's theory of "tonal" and "durational" rhythm, see "Rhythm and Linear Analysis: A Preliminary Study," *The Music Forum* IV (1976), 313-316.

Example 1. J. S. Bach, Allemande, French Suite No. 6 in E Major



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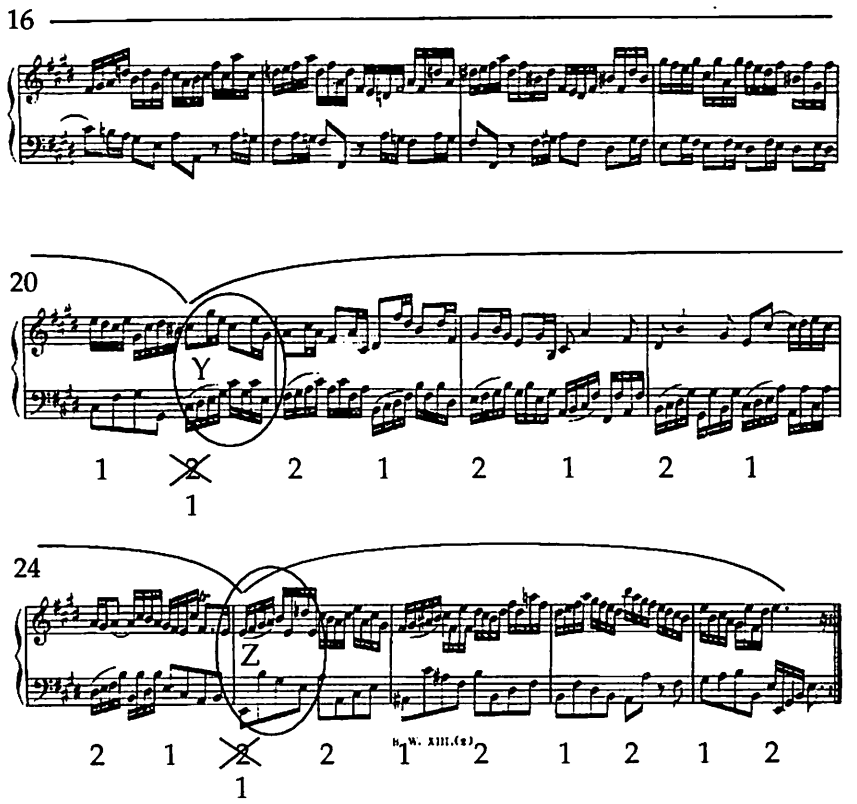
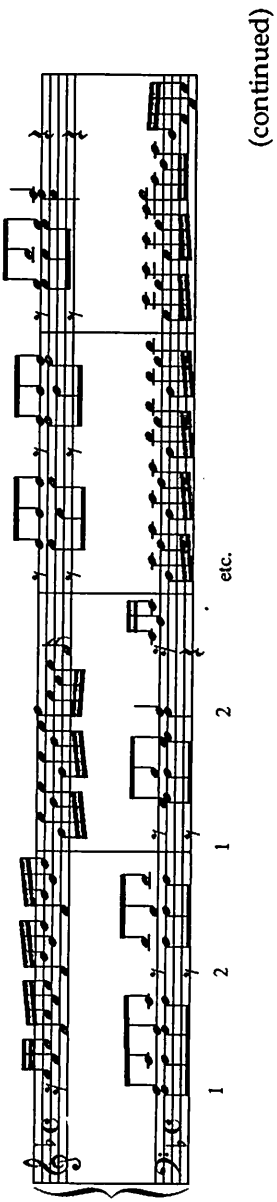
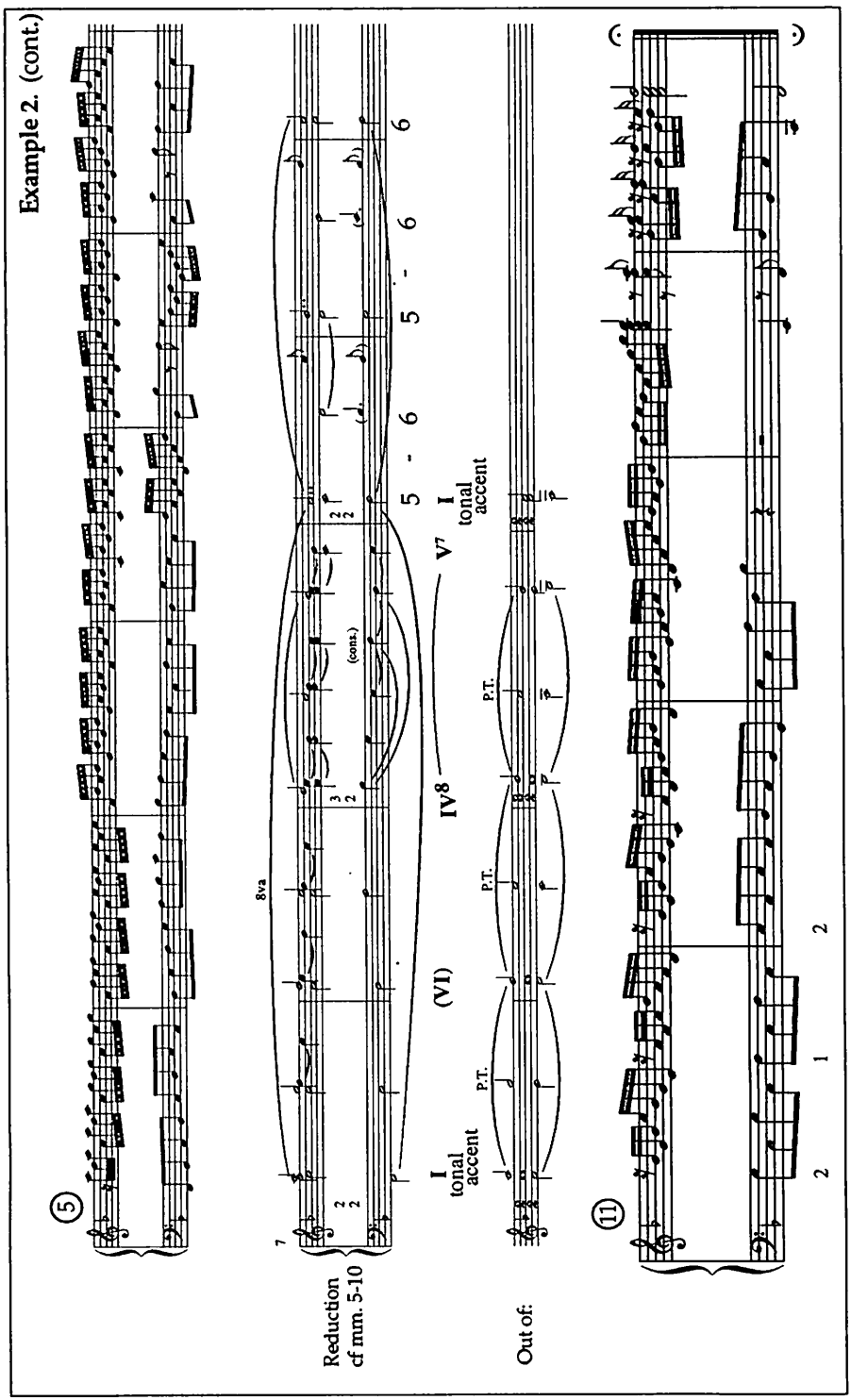
Example 1. (cont.)

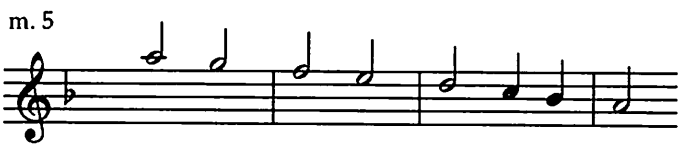


Example 2. J. S. Bach, "Little" Prelude No. 8 in F major




Example 2. (cont.)
5
11
Reduction
cf mm. 5-10
Out of:
8va
(cont.)
P.T.
I
tonal
accent
(VI)
IV8
V7
I
tonal
accent
5 - 6
5 - 6
5 - 6
2 1 2

Example 3. Recomposition of "Little" Prelude No. 8, mm. 5-8



motes (among many other things) the generation of mid-bar downbeat.[8]

A richer case is Example 4, the A major two-part invention. Since the measures divide very clearly into strong-weak halves, and since two-bar measure groups are quite prominent throughout, the metrical displacement at bar 12b is quite noticeable, albeit very gentle. There are just two displacements in this piece. The elision at 12b, which dissipates the looming threat of too many two-bar hypermeasures, throws the meter out of phase until the added third beat at 17b. It seems noteworthy that this out-of-phase passage is constantly modulating, developmental, and contains no full statement of the subject, and that measure 18, the point of return to metrical normalcy, is simultaneous with the return not only of the subject but of the structural tonic as well.

This example is particularly interesting because the displacement apparently mixed up Bach himself as he was writing the piece down for the first time. Example 5 is a facsimile of a page of the manuscript of the first version of the invention, as found in the *Clavier-Büchlein vor Wilhelm Friedemann Bach.*[9] As Bach moved from the second to the third system he forgot that the meter was dis-

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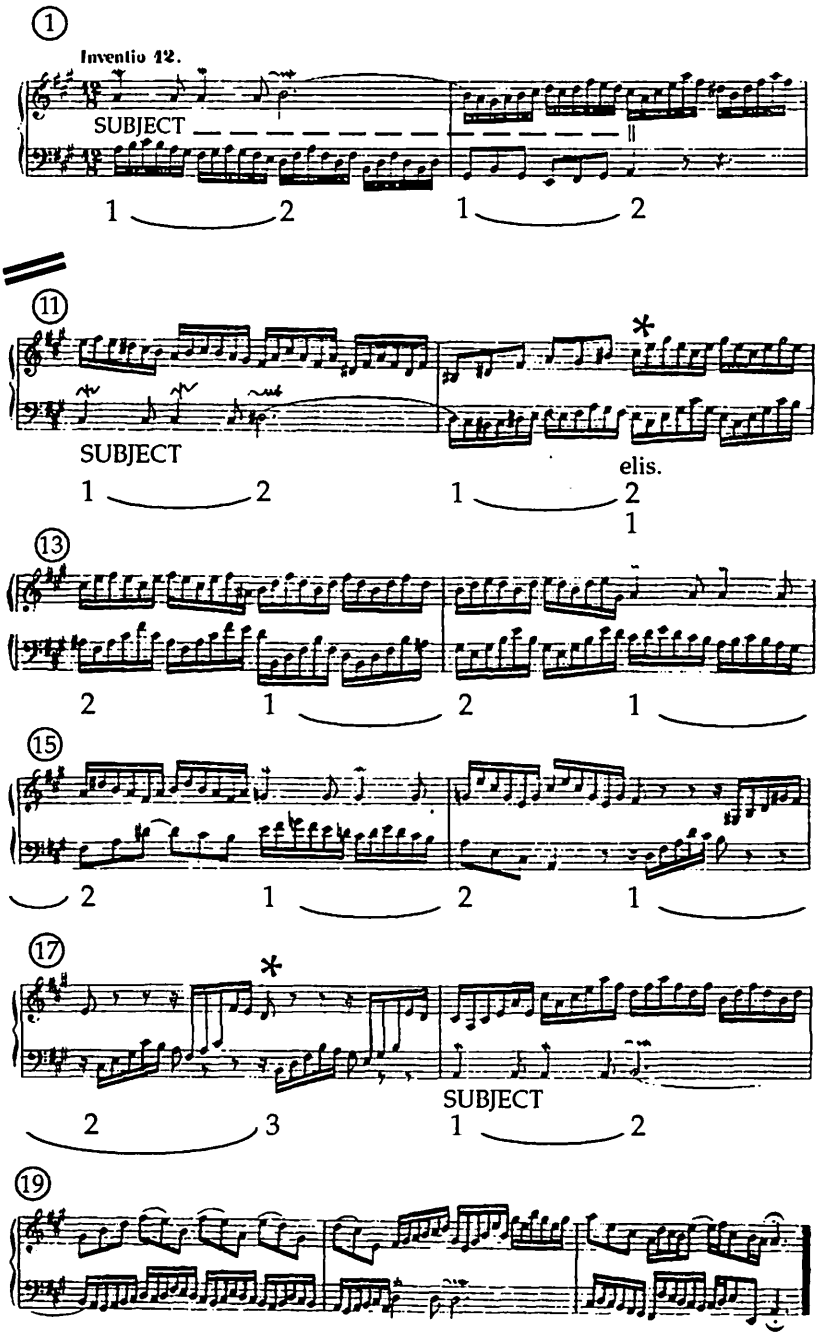
[8]Schenker's unpublished 1929 analysis of this Little Prelude (New York Public Library, Oster Collection, File 69/75) reveals that he also heard the metrical displacement I have described here. His sketch distinguishes between the perceived and written downbeats by means of light and heavy bar lines.

[9]Johann Sebastian Bach, *Clavier-Büchlein vor Wilhelm Friedemann Bach,* edited in facsimile with a preface by Ralph Kirkpatrick (New Haven: Yale University Press, 1959), 90-91.

Example 4. J. S. Bach, Two-part invention No. 12 in A Major



placed and wrote three wrong bar lines which he then had to cross out and replace with correct ones. This manuscript error seems to leave no doubt that the displacement exists and that Bach felt the two halves of the written measure as strong to weak.

Example 6, two passages from the A minor invention, requires little comment. Example 6a illustrates *successive downbeat* (see the "N.B."). Earlier in the piece—at measure 6b—an important displacement has occurred that determines the perceived meter of this passage. The reduction further clarifies my interpretation of the meter. Example 6b shows the invention ending out of phase. Being nonperiodic, like the Little Prelude, it is not required to end in phase.

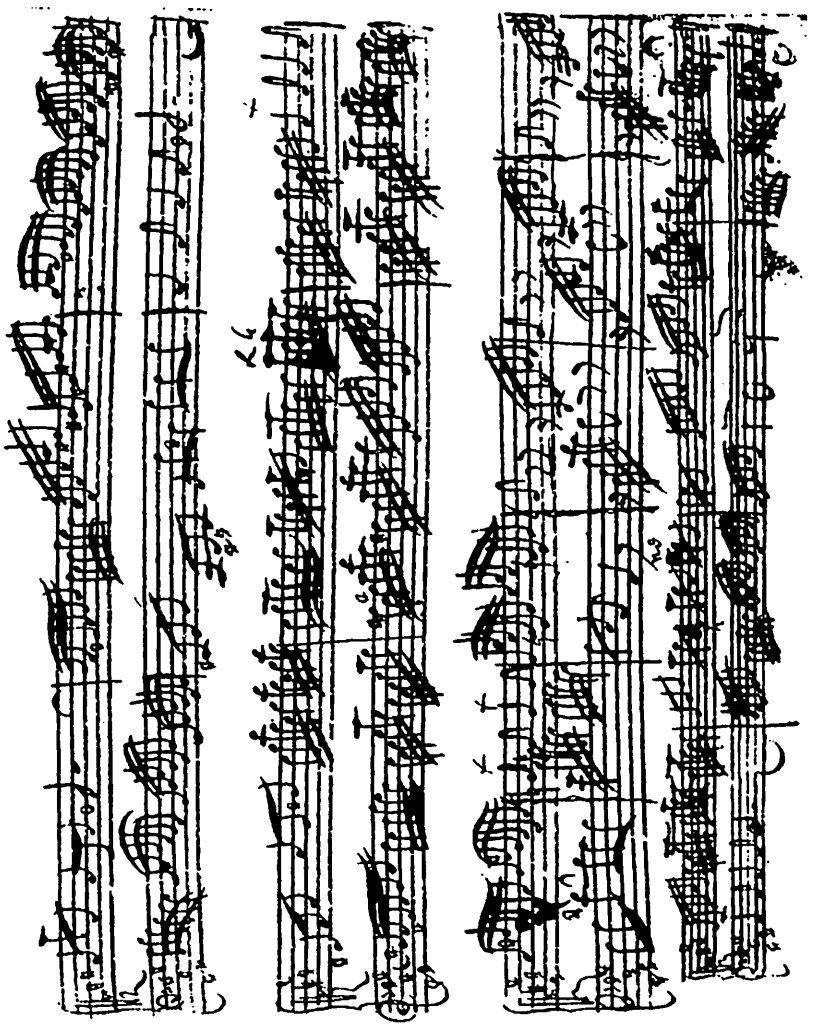
The gigue from the G major French suite returns us to the rhythmic world of the dance, but here the accouterments of fugal style require that the phrases feature much rhythmic irregularity (Ex. 7). Unlike the meter of the *WTC I* C minor fugue mentioned earlier, the meter of this "fugue" (thanks to the design of its subject, which clearly divides each bar into strong and weak halves) is able to produce displacement. It has eight instances of added beat, the first shifting the meter by half a bar, the second putting it right again, and so on. The exposition is metrically regular, but during the first episode, the added beat in 12a causes the next statement of the subject to begin in the second half of the bar (14b).

Example 7 shows only the first large section of the gigue, in which just two of the eight displacements occur. The accompanying reductions show not only how the rhythmic displacements are coordinated with the quite complex voice leading and the harmonic structure but also how they are produced by equal pacing.

An unusual manner of barring characterizes my concluding Example 8, the first version of the sinfonia (or "three-part invention") No. 13 in A minor. In this version (also found in the *Clavier-Büchlein*, where it is called *Fantasia 6*) Bach used the uncommon practice of alternating short and long bar lines.[10] Modern scholars

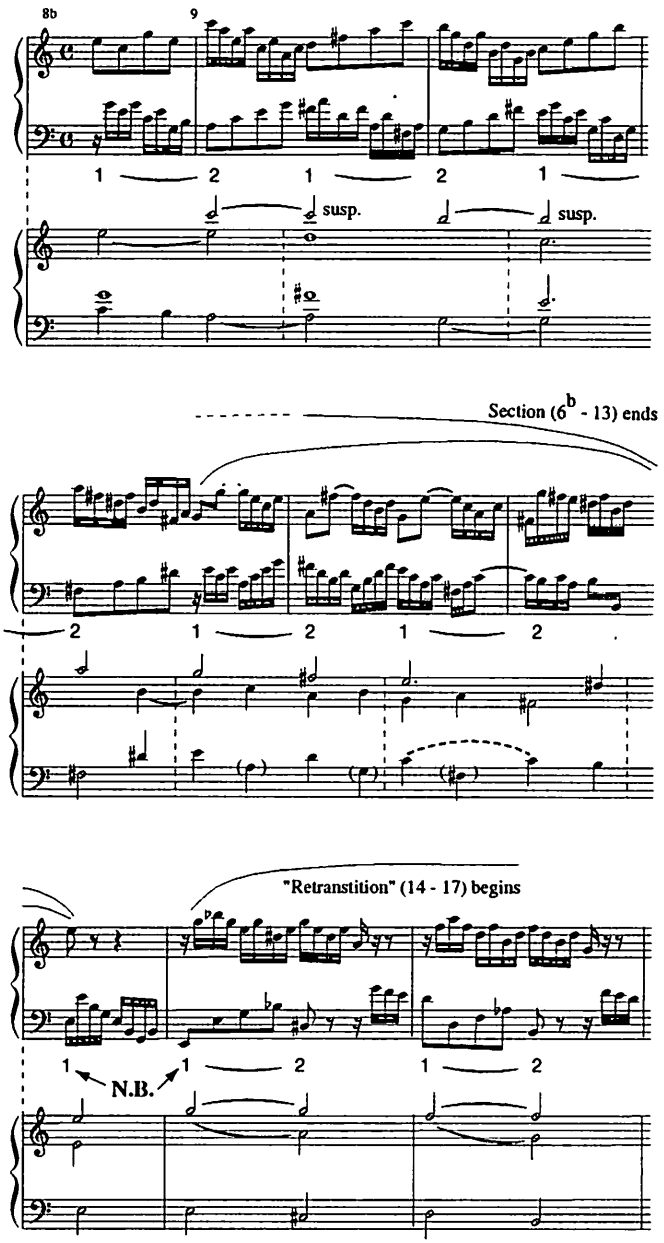
[10]Example 8 is reproduced from pages 128-129 of the facsimile edition cited in footnote 9. The unusual manner of barring is not unique to this piece. Bach notated some half dozen keyboard works in this way, but in nearly all cases he abandoned it when making later copies. (See David Schulenberg, *The Keyboard Music of J. S. Bach* (New York: Schirmer Books, 1992), 466, under "Double Measures.") Bach retained it in the Presto of the

Example 5. Facsimile of the concluding page of the first version of the A major invention. The piece is included in the *Clavier-Büchlein vor Wilhelm Friedemann Bach*, where it is called "Praeambulum 9."



Example 6. J. S. Bach, Two-Part Invention No. 13 in A minor

a) mm. 8b-15. See successive downbeats at N.B.



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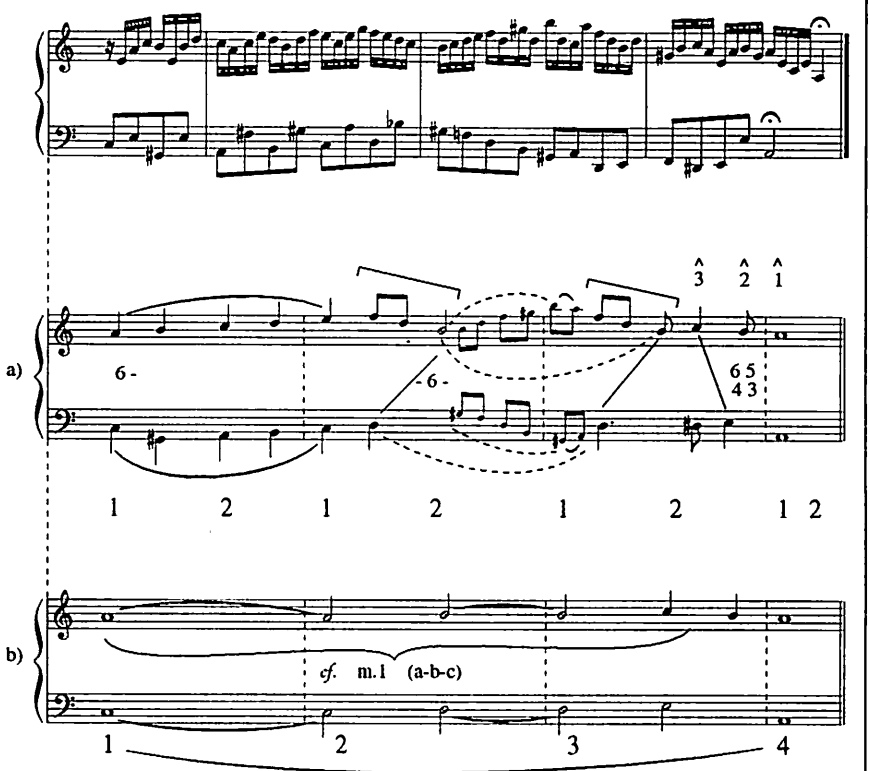
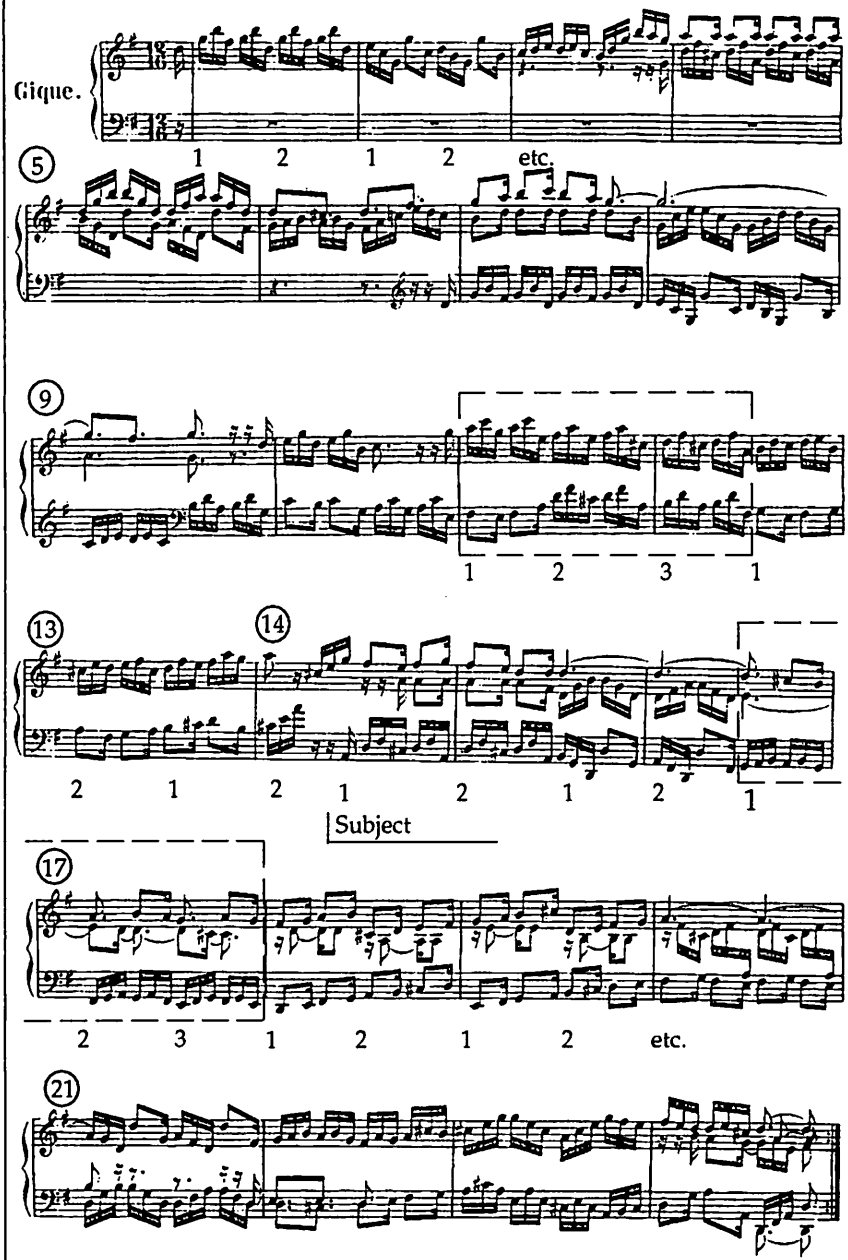
Example 6. (cont.)

b) mm. 22b-25. The piece ends out of phase with the barring



Example 7. J. S. Bach, Gigue, French Suite No. 5 in G major, mm. 1-24.



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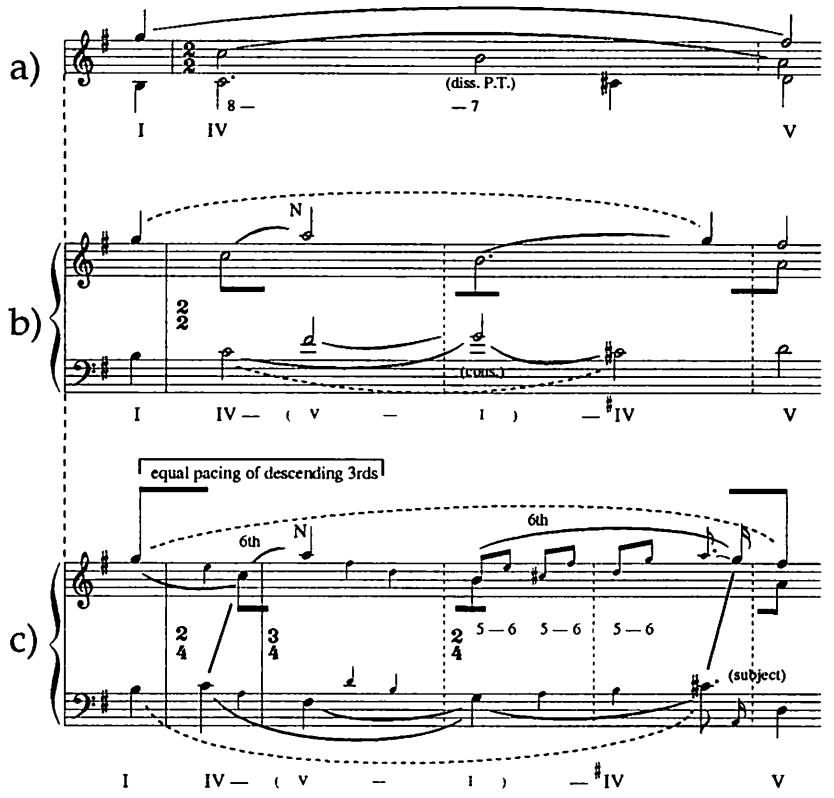
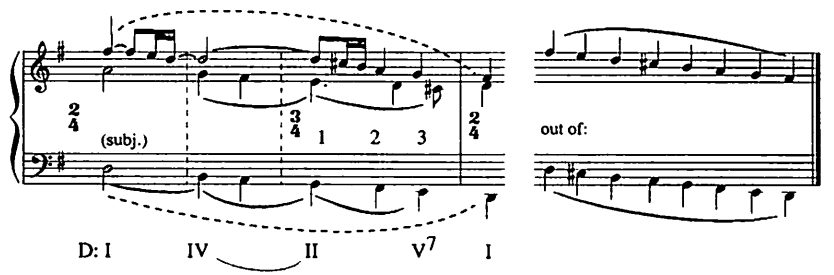
Example 7. (cont.)

Mm. 9^{b} - 14^{b}



Mm. 14^{b} - 18^{a}



do not know precisely what this unusual manner of barring means, but assume that it was intended to picture both the single 3/8 measures and the two-bar hypermeasures. I believe that it also means that the three-beat units are to be somewhat more pronounced than they would be in the more flowing 6/8 meter.

This charming piece in trio-sonata texture incorporates fugal procedure, even stretto, without seeming the slightest bit "learned." Of its many rhythmic subtleties, what chiefly concerns us here is that its four episodes are all precisely spanned by metrical displacement. All begin with an elision, and (except for the very last) end with another elision or an added beat. As a result, throughout each episode Bach's differentiated bar lines are out of phase. These displacements give the piece something of the metrical irregularity typical of fugue, and, in particular, they counter the effect of periodicity produced by the fact that all the statements of the four-bar subject begin on the first bar of a four-bar hypermeasure.[11]

Close scrutiny of Bach's manuscript reveals that, again, one of the displacements tripped him up: notice in Example 8, fifth system, that my arrow at "N.B." points to a bar line that "should" be short. (Did Bach try to cross out his error in the left hand staff?) I think he made this little slip because he felt an elision occurring at the start of Episode II. See the end of the previous system and the metrical analysis below it, and then try playing this spot *without* feeling an elision here. It should be noted that when Bach later came to make the fair copy of this piece, he opted for conventional barring, perhaps concluding that the short and long bars introduced complications better avoided (Ex. 9[12]). But this in no way alters the effect of the displacements.

G minor solo violin sonata. Handel and Telemann also used this manner of barring. As far as I have been able to discover, it is not discussed by theorists of the time.

[11]Similar displacements enclose the "transition" (mm. 8-12) within the exposition. Here the prolongation of V together with the dropping out of the bass create the impression, at least to me, of bar 8 being extended for five measures.

[12]Johann Sebastian Bach, *Two- and Three-Part Inventions,* Facsimile of the Autograph Manuscript, with an introduction by Eric Simon (New York: Dover Publications, 1968), 56.

Specialists in music theory will note that I have said little here about higher rhythmic levels, and they could raise the objection that mid-bar downbeat can be fully understood only within a larger theoretical construct. I would agree, but am uncertain what that larger construct is. We are on firmer ground with Classic-Romantic rhythm because it features regular periodicity (four- and eight-bar phrases) to a much greater extent than Baroque rhythm does. A more comprehensive theory of Baroque rhythm[13] will make it possible to address the problem of higher-level rhythm, and to understand details like mid-bar downbeat even better.

But meanwhile, does our present knowledge of mid-bar downbeat have a bearing on performance? Since most mid-bar downbeats are so intimately connected with *phrases*—they demarcate points where phrases of some kind overlap—performers certainly should be aware of them. Does that mean they should make a special effort to "bring them out?" I would say yes, at least in the general way that a sensitive performer responds to a normal phrase overlap, the kind occurring at the beginning of the bar. True, no overlap can be treated exactly as one would treat a full stop because the overlap impels the momentum on. For that reason it could be argued that all overlaps, wherever they may occur, should simply be allowed to "speak for themselves"—that trying to "bring them out" risks getting too fussy. I would concur that perhaps some cases, especially those in works of very brisk tempo, might better be left alone, but I feel that many *mid-bar* overlaps, precisely because their occurrence in mid-bar makes them relatively unexpected, ask to be expressed in some way—to be given some kind of subtle emphasis. Such an emphasis can be sonic—a change of dynamic or color; it

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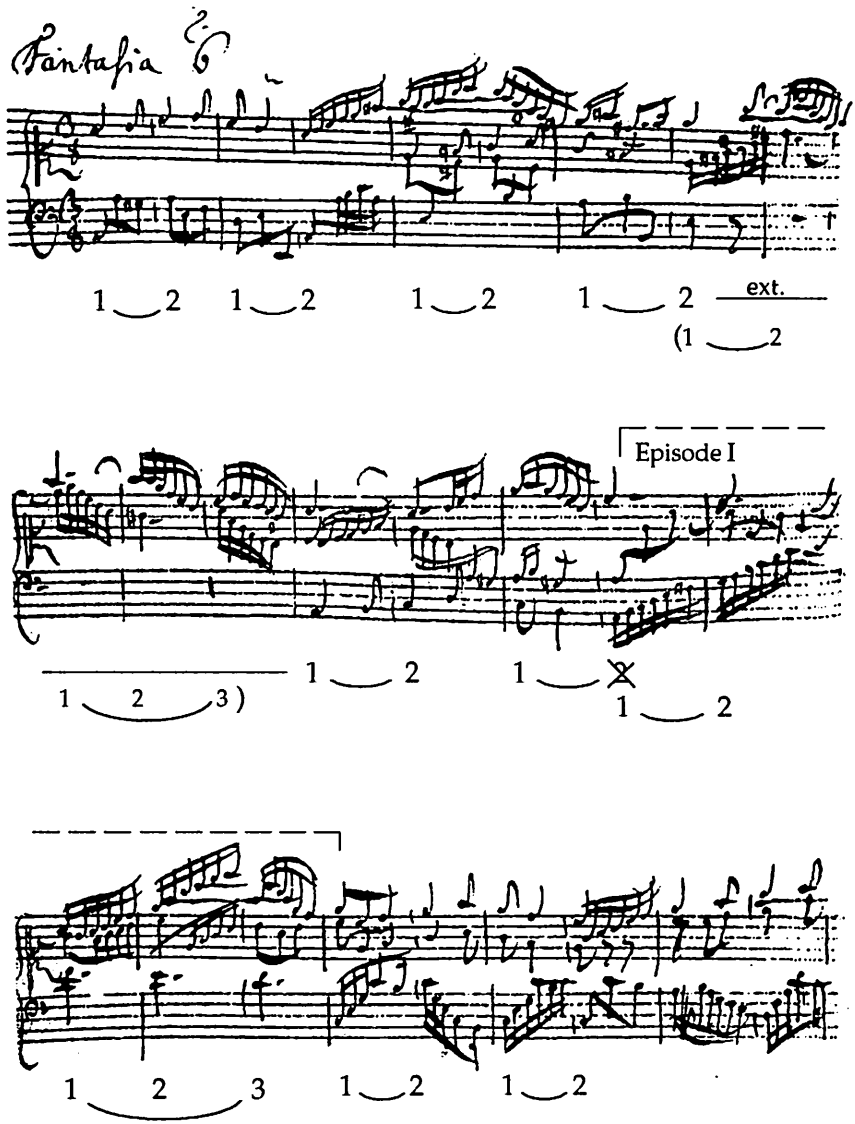
[13]Recent studies bearing on this elusive subject are Mauro Botelho, "Meter and the Play of Ambiguity in the Third Brandenburg Concerto," *In Theory Only* 11/4 (Feb. 1990): 1-35; Justin London, "Metric Ambiguity (?) in Bach's Brandenburg Concerto No. 3," *In Theory Only* 11/7-8 (Feb. 1991): 21-53; and Channan Willner, (1) "Metrical Displacement in Handel's Instrumental Music," unpublished article, 1985 (expanded version to appear in the author's forthcoming doctoral dissertation, CUNY), and (2) "Nascent Periodicity and Bach's 'Progressive' Galanterien," paper read at the annual meeting of the American Musicological Society, Pittsburgh, 1992.

Example 8. Facsimile of the first version of the "three-part invention" No. 13 in A minor, mm. 1-45. From the *Clavier-Büchlein* (begun 1720), where it is called "Fantasia 6." (The space between the systems has been widened and analysis inserted.)



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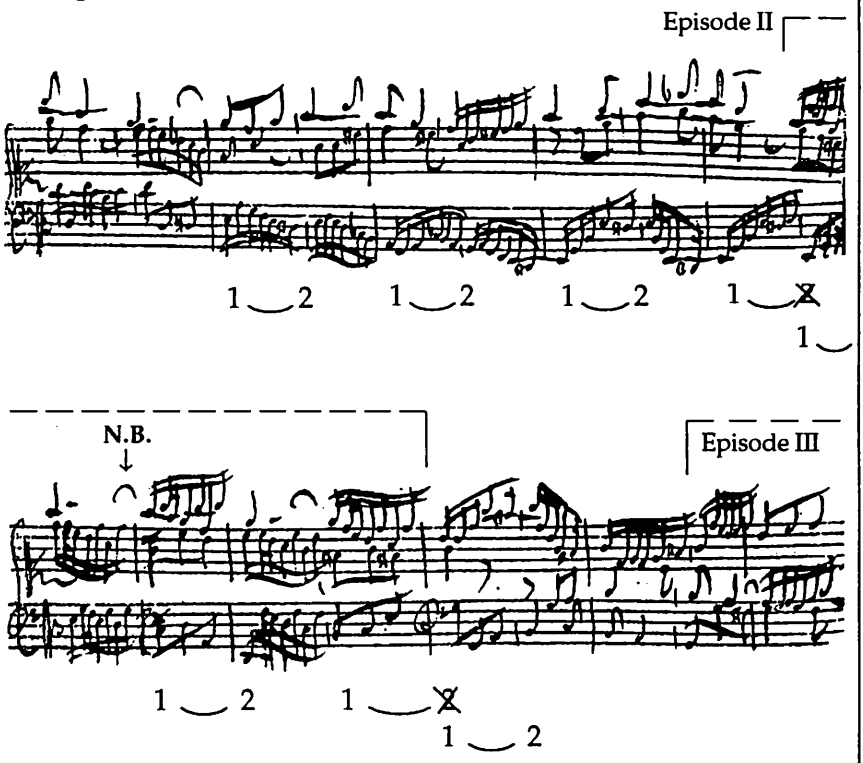
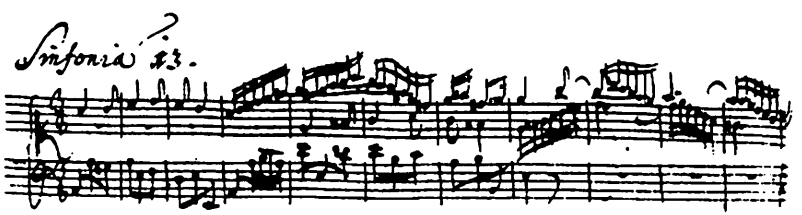
Example 8. (cont.)



Example 9. Facsimile of the beginning of the Sinfonia 13. This is the second version of the piece as given in the fair copy of the "two- and three-part inventions," 1723.

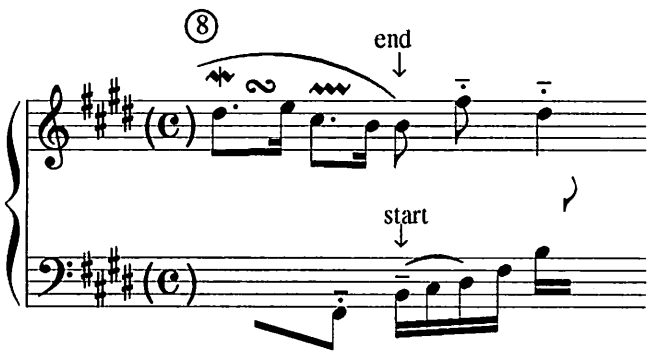


can be rhythmic—a more deliberate "placing" of the beat, or a slight lengthening of the beat's first note; or it can be achieved by a combination of sonic and rhythmic elements. There are many possible ways to do it. Exactly how will depend on the context of the individual case, the type of instrument, and, of course, the performer's personal style.

So how might I actually perform a few of the examples I have shown above?

To project the elision at the beginning of m. 8b of the Allemande (Ex. 1), I suggest proceeding as shown in Example 10.

Example 10. Performance of m. 8, Allemande from French Suite No. 6



Release the left hand's low F#, then treat the following B as a fresh start by attacking it firmly, perhaps with a bit more tone and/or a slight tenuto. This B is of course both end and start, but think start. No ritard! This would be bad for many reasons; for one, it will weaken the sense of a start. Meanwhile the right hand should make its b^1 sound like an *end.* Phrase into it. Set it off from what follows. Then think of 8b-9a as one four-beat measure consisting of just one B-major harmony, and allow it to sound "static" by maintaining a relatively uniform touch until the downbeat at 9b.

I intend the performance advice offered here to be basically applicable to both piano and harpsichord. Of course, pianists will avail themselves of their instrument's greater resources for dynamic

shading to project the metrical structure, and harpsichordists will make a greater use of tiny rhythmic inequalities and other articulations to the same end. The structure remains the same, after all.

In the A major invention (Ex. 4), the large sequences initiated at bar 12b will cause the listener to reinterpret this point as a "1." It is quite defensible to play straight through this point without nuance, as many players do. Personally, I like to shift to a slightly different color or texture at this point by "binding" (holding down the keys) through each harmony if I'm playing the harpsichord, or similarly pedalling slightly if playing the piano. Since the entire 12b-14a is so homogeneous, the new color should be maintained throughout these two bars.

The "Little" Prelude in F (Ex. 2) virtually cries for a special performance of its mid-bar downbeat (m. 8b). Prepare for this point as you play bars 5 and 6: in each of these two bars the design of the chordal sequence (see reduction in Ex. 2) creates an obvious metrical "1-2," or "strong-weak." Play these strongs a little more firmly than the weaks.[14] It will now take a bit more skill to shape the unexpected "1-2-3" covering bars 7-8a: lighten up on the "2" and especially the "3." (On the piano a slight decrescendo can be effective here.) At 8b the left hand leads. Attack its sixteenths quite firmly and legato. (The harpsichordist should rhythmically "place" the beginning of 8b and further emphasize this beat by binding the left hand chord.) At 9a lighten up again and detach the Bb's (see Ex. 11).

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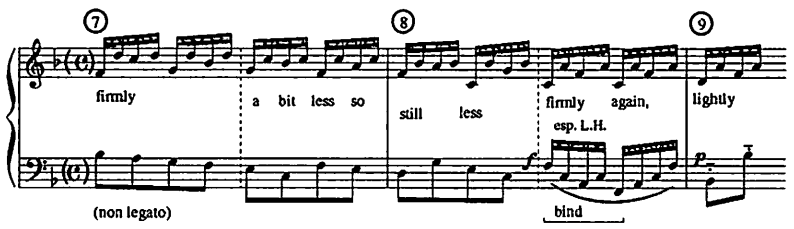
[14]In speaking to students one needs to make it quite clear that the terms "strong" and "weak," as in "strong and weak beats," are conceptually totally different from "loud" and "soft." Grosvenor W. Cooper and Leonard B. Meyer long ago made this important point in *The Rhythmic Structure of Music* (Chicago: University of Chicago Press, 1960), 8, where they distinguished between "accent," which is purely metrical, and "stress," which is dynamic. But while it is true that accent exists wholly independently of stress, it is also true that in performance the two are often intimately related, and that a performer will often use stress, however slight, to make accent clear. Couched in Cooper and Meyer's terms, the sentence before this footnote would read: "Give slightly more stress to the accented beats than to the unaccented."

Example 11. Performance of mm. 7-9, "Little" Prelude No. 8



a^1 to be a suspension over bass Bb and therefore think that it should be leaned on and released in the traditional manner. Not so. I cannot fully discuss here the unusual and complex voice leading of this passage, but the bass Bb is its least determining element, as the reduction in Example 2 shows. Therefore this Bb cannot turn the a^1 above it into a very meaningful suspension. To the extent it can be said to do so, that suspension would be of the rare kind that occurs on a weak rather than a strong beat.

In the search for an effective way to perform this and all the other mid-bar downbeats I have cited in this article, the most important thing is the player's *awareness* of them. Awareness (coupled, of course, with imagination and taste) will lead to the discovery of a way of projecting them that is best suited to the interpretive style and external conditions of the particular performance at hand.

Chopin's Prelude in D major, Opus 28, No. 5: Analysis and Performance

Carl Schachter

Introduction

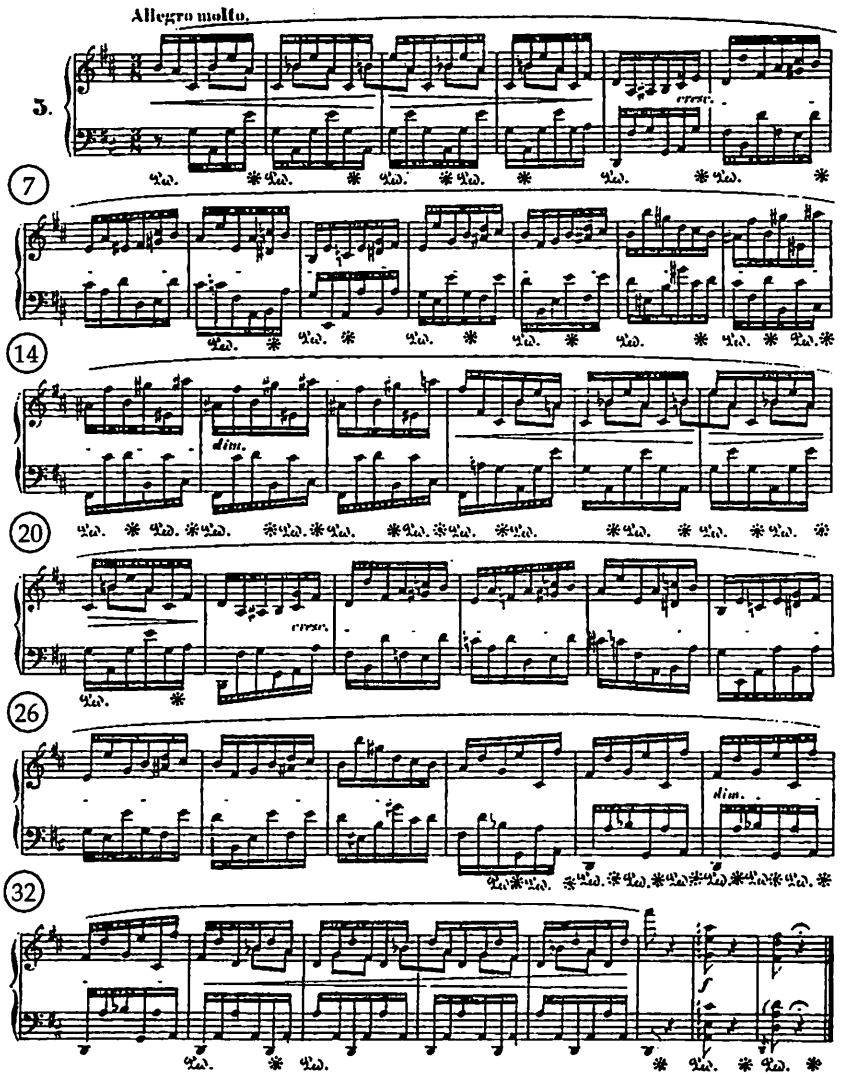
An interesting piece of music, like an interesting person, will probably have some qualities that set it apart. Of these unusual qualities, some may be displayed on the surface, accessible to everyone; others may become evident only to those who have lived with the piece or person for a long time. If Chopin's D major Prelude were a person, he or she would be not only interesting but also more than a bit eccentric, for the piece packs an unusually large number of unusual characteristics (both evident and concealed) into a very small space.

In trying to understand the Prelude (see Ex. 1), we might do well to begin with one of its more obvious eccentricities as a way to gain access to the piece as a whole, including its more hidden aspects. And in general, when we analyze a piece in preparation for performing it, a useful first approach is often to become aware of its special, idiosyncratic elements and to ask the piece why they are there. We may have to work rather hard at our questioning before the piece deigns to give us an answer (most people wouldn't answer such a question right away either). But if the piece does begin to reveal itself to us, we shall be in a position to play it in ways that fit its individual character rather than with a generalized, one-size-fits-all, sort of expression.

The slur

One of the Prelude's peculiarities is so glaring that we can spot it by looking at the score from a distance that would preclude our actually reading the notes: a single slur covers the entire piece ex-

EXAMPLE 1. Chopin, Prelude in D major Op. 28 No. 5



Note: The last note in the right hand of m. 16 appears erroneously in many scores as an A♯ instead of an A♮.

cept for the last two bars. What does this slur mean? In piano music, of course, the basic meaning of a slur is that the notes under it are to be played legato. According to the great singer Pauline Viardot as reported by Camille Saint-Saëns, however, "when huge slurs extend over entire musical periods [in Chopin], they indicate this *spianato* playing, without nuances or discontinuities in the rhythm."[1] The term "spianato," an Italian word meaning "made level or smooth," comes from the traditions of bel canto singing, traditions that strongly influenced Chopin both as composer and pianist. But Viardot's interesting comment cannot be relevant to the giant slur in the Prelude, though it may well be valid for some other passages in Chopin. First of all, the Prelude is not a cantabile piece to which principles of bel canto singing would apply (though, as in all of Chopin, there are unmistakable connections to vocal style in the compositional fabric); secondly, Chopin himself has placed nine crescendos and decrescendos within the slur, so he hardly had a delivery "without nuance" in mind.

Thus this slur certainly retains its more usual meaning: all the notes under it form a continuous legato line. Although Chopin could have achieved approximately the same result by writing "legato" at the beginning of the piece (as he does in the E♭ major Prelude from the same opus), the single immense slur suggests a stricter legato without any of the breathing pauses that would normally signal the ends of rhythmic groups and phrases even in pieces that are played legato. Places where such "breaths" might reasonably occur are by no means lacking in the Prelude: for example, after m. 4 (or perhaps the first note of m. 5), after m. 8, and in similar places. In fact at least one well-known editor of the past, Karl Klindworth, "improved" on Chopin by putting in just such points of articulation; indeed he substituted thirteen little slurs for Chopin's one big

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[1]Pauline Viardot was a composer and an excellent pianist as well as one of the most famous singers of her time. She and Chopin were good friends, and he is known to have accompanied her when she sang. Later in life she gave her impressions of Chopin to Saint-Saëns, who published them. The remark about "spianato" performance is quoted in the indispensible book of Jean-Jacques Eigeldinger, *Chopin: pianist and teacher as seen by his pupils*, trans. Naomi Shohet with Krysia Osostowicz and Roy Howat (Cambridge: Cambridge University Press, 1986), 54.

slur![2] Klindworth's suggested points of articulation are by no means implausible; nonetheless, his misguided editing amounts to an act of vandalism, for no editor has the right to falsify the composer's text and misrepresent it to performers. Klindworth's corrupt text not only leads to performances with faulty articulation—conventional performances of a most unconventional piece—but also blocks access to possibly important insights of a general nature, for such an unusual feature as the single big slur probably relates to other aspects of the composition. We can't ask Chopin what his reasons might have been for putting almost the whole piece under one slur. But if the editor lets us know that the composer has done just that, we can try to discover what there might be about this piece that would call for a performance "all in one breath." Let us begin this process by looking at the Prelude's form.

Large form

A feature of the Prelude that is almost as striking as the slur is the fact that it seems to go over the same ground (or almost the same ground) twice. Measures 1-16 recur in mm. 17-32 with only slight variation. These two segments take us almost to the end of the piece; following them, mm. 33-36 take place over a tonic pedal and 37-39 contain a I-V-I cadence, so we might be inclined to regard these seven bars (which do not repeat anything heard earlier) as a coda. If we regard the form of the Prelude as resulting primarily from the patterns of repetition and contrast of its motivic contents, then it would fall into two large sections: A (1-16) + A varied (17-32) + Coda (33-39).

Four-bar groupings

Looking a bit more closely at the inner subdivisions of this large formal scheme, we can see that virtually all of it is organized in four-bar groups that articulate its motivic design and regulate its tonal motion; each new group represents a forward step through tonal space. Only the last group—three bars instead of four—con-

[2]Frédéric Chopin, *Œuvres Complètes*, ed. Karl Klindworth, rev. ed., vol. 2, no. 7 (Berlin: Bote und Bock, 1909), 165.

tradicts this grouping in fours, and even it can be heard as the greater part of a four that fades into (and is more or less completed by) the silence of the final rest with fermata. Concentrating on the larger outlines of the motivic design, the bass and the harmonic structure, we can plot the four-bar steps of the tonal motion as in Figure 1. The symbols that designate the design elements will be explained later.

FIGURE 1. Four-bar groups

Measure	Design	Main bass tone/harmony	
1	x	A	(V of D)
5	a	D	(I)
9	a	E	(II)
13	b	F♯	(III♯)
17	x	A	(V of D; starts on second beat)
21	a	D	(I)
25	a	E	(II)
29	b	F♯	(I^6 of D)
33	x	D	(I)
37	cadence	D-A-D	(I-V-I) in 37-39

In two important ways, Figure 1 confirms the large picture of the Prelude's form described above. In the first place, the sequence of design elements—"x"-"a"-"a"-"b"—unfolds twice, starting in mm. 1 and 17. And in keeping with this division into two sections, the bass line goes over the same ground twice with the repeated pattern A-D-E-F♯ (see the brackets in the chart). Note that the only significant contrast in harmony between the two sections—F♯ major (III) in bar 13 versus D major (I) in 29—goes together with an equally significant similarity in the contour of the bass line, for the D major begins with F♯ as its lowest note. Both segments, therefore, contain a stepwise ascent D -E- F♯, but the second F♯ assumes a different harmonic function in order to lead convincingly to the Prelude's impending close.

Large-scale harmony

A still closer view of the Prelude, however, would lead one to regard the A + A + Coda scheme given above as somewhat oversimplified. The problem centers on the opening four bars, which are remarkably unstable in rhythm and harmony; they sound much less like the clearly marked beginning of the piece than like the slightly chaotic process of searching for such a beginning. Lacking perceptible downbeats and sustaining a dissonant dominant sonority made more intense by the clash between ♮$\hat{6}$ and ♭$\hat{6}$, the opening four-bar group is clearly a kind of introduction. It takes place outside of the structure, though it leads into the opening tonic of that structure in the way an upbeat leads into a downbeat. The theorist Edward T. Cone has suggested that a basic rhythmic shape of much nineteenth-century music is precisely one of an upbeat—often an extended upbeat like this one—leading into a "structural downbeat": a point of arrival in the tonal structure as well as the rhythm.[3] The beginning of our Prelude would, I think, form a perfect illustration of an extended upbeat preceding a structural downbeat. The dominant that recurs in m. 17 with the repetition of the opening bars creates a second extended upbeat, which leads into the tonic downbeat of m. 21.

If we chart the music's form from the perspective of tonal structure and large-scale rhythmic shape, then, the primary landmarks that articulate the music's flow occur at mm. 5 and 21. If we chart according to pattern repetition (as in Fig. 1), the main division would occur at m. 17, where the music "starts over." Because of this overlapping between tonal motion and motivic design, there is no uncontested point of articulation or formal division in the middle of the piece. This blurring of boundaries produces a special kind of continuity for the Prelude; perhaps Chopin's extravagant slur is at least in part the external sign of this inner continuity. In any case, the Prelude's form results from the tension it maintains between two articulative forces, design and structure. I have tried to incorporate the notion that the piece "really" begins at m. 5 into Figure 1

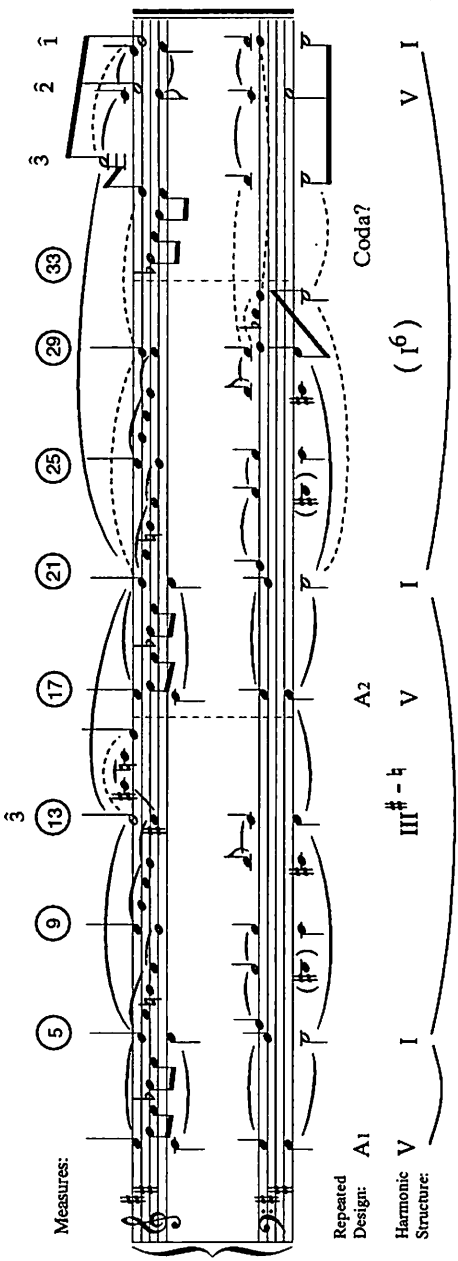
[3]Edward T. Cone, *Musical Form and Musical Performance* (New York: Norton, 1968), 24-25.

by labelling the design element of mm. 1-4 as "x" and the one starting at m. 5 as "a." The "x" element is introductory; sounding over tonic harmony near the end, it is recycled to resemble a coda. The "a" is expository, with a stable beginning and increasing instability and intensity thereafter—a process enhanced by the sequential repetition one step higher of mm. 9-12. The "b" idea, with its repeated cadential figure, represents the conclusion that caps each of the two phases of the musical discourse.

There is still more to be said about the overlapping between pattern repetition and tonal structure. The I chord of m. 21 is not only the beginning of a new phase of motion; it is also the end of the preceding one. As I show in Example 2, a voice-leading sketch of the Prelude, I read the first big harmonic progression as I-III♯-V-I, and the second one as I-I^6-V-I. The tonic of m. 21, therefore, does double duty as the end of the old and the beginning of the new. My inference of a I-III♯-V-I structure for mm. 5-21, rather than, say, I-II-V-I, results from my hearing the III♯ as one of the structural pillars that form important beginnings and goals of motion. On the other hand, I regard the E minor chord (II) of m. 9 as subordinate to the I and III—specifically as a passing chord leading from I to III—because it falls in the middle of the motion and continues the motivic pattern begun in m. 5. The D and F♯, on the other hand, begin and end the stepwise ascent, and each of them is emphasized by a new motivic idea.

Thus the V of mm. 17-20 forms an integral part of a larger cycle of harmonic movement, leading from a beginning on I to a closure on I (though that close, in turn, becomes a new beginning). The apparently identical V of mm. 1-4, on the other hand, enters without any preparation and leads into the harmonic cycle without forming part of it. The two dominants, therefore, have quite different meanings and functions especially with regard to rhythm: the second one sounds like an upbeat *inside* a larger tonal and rhythmic structure, whereas the opening one sounds like an upbeat *outside* the structure. I suspect that some readers who have played or heard Opus 28 as a set have shared my impression that the upbeat formation at the beginning of the D major Prelude seems to grow naturally out of the closing chord of the piece before it, the E minor Prelude: the first note of the right-hand part, B, belongs to the E minor

EXAMPLE 2. Chopin, Prelude Op. 28 No. 5, Voice-leading sketch



tonic chord, and sounds like a suspended ninth resolving into the dominant note of D major. I know of absolutely no evidence to support the speculation that the introductory bars of our Prelude form a link from the preceding piece (though we do have such evidence for the third and fourth Etudes of Opus 10). But my ear persists in telling me that at least three of the Opus 28 Preludes—those in G major, E minor, and D major—seem to be dovetailed one into the next. (I am not at all trying to suggest that these pieces must be performed as a group, only that they may be so performed to very good effect.)

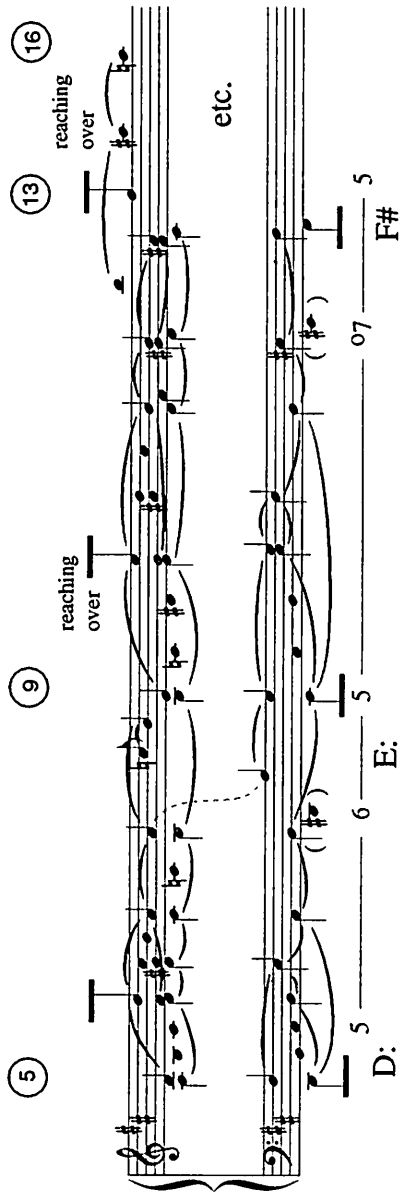
A closer look at the harmony

Example 3 contains a more detailed voice-leading sketch of mm. 5-16. In it we see that the bass notes D and E (mm. 5 and 9) both move to their upper fifths, A and B, before proceeding to the next move in the rising stepwise line. This motion creates a pattern of ascending fifths, D (m. 5), A (m. 7), E (m. 9), B (m. 11), and F♯ (m. 13). Since D is the beginning of the motion, F♯ its goal, and E the stepwise connection of beginning to goal, these lower bass notes and the chords they support outweigh in significance the upper fifths. Rhythmic emphasis also underscores the centrality of the rising third D-E-F♯, for each of these notes marks the beginning of a four-bar group. Readers familiar with Schenkerian analysis will recognize the *unfolding* of a 5-6-5 progression in the bass motion leading from D to E and a variant of this motion, a 5-^{0}7-5 unfolding, in the continuation from E to F♯. In both phases of the ascent, an applied chord—dominant or diminished seventh—prepares the next goal by means of a chromatic inflection, D♯ to E and E♯ to F♯. The E♯ diminished seventh chord reappears in m. 28, when the ascending motion is repeated, but there it functions as a common-tone diminished seventh resolving to I rather than as a leading-tone chord directed to III.

Large-scale melodic structure

Example 2 shows my view of the overall contour of the top voice. Because of the density of the writing and the highly contrapuntal character of the texture, the upper voice is initially much harder to

EXAMPLE 3. Chopin, Prelude Op. 28 No. 5. mm. 5-16, more detailed sketch



follow than the bass. A thread through the labyrinth is provided by the emphasis that accrues to the right-hand D at the downbeat of m. 5, an emphasis generated by its forming a focal point both of tonal motion (resolving the prior C♯) and of rhythm (resolving the extended upbeat). This D is then transferred up one octave in the next bar, and in this higher register, it resolves the E, highest and most prominent pitch in the introductory dominant. In Example 2, note the motion of the opening tenth C♯-E in the treble clef into the octave on D; this picture compresses into vertical intervals the polyphonically conceived right-hand part, in which the polyphony is seemingly dissolved into a single melodic line.

If we now follow the larger melodic line at the four-bar junctures that mark the Prelude's course, we see that it ascends from the initial D to E (mm. 9-10) and F♯ (mm. 13-16). This stepwise ascent moves through the same scale degrees as the bass, a procedure that would have led to parallel octaves were it not for the considerable melodic, harmonic, and contrapuntal activity in between the octaves, activity which breaks up the parallel motion. In Schenkerian theory, incidentally, the rising lines of the bass and upper voice would be weighted differently. In the bass, the tonic of m. 5 would count as the primary structural pitch, which generates all the others including the F♯. In the top voice, however, the F♯ would function as the first tone ($\hat{3}$) of the descending melodic structure, and the D and E before it would form an *initial ascent* leading to the F♯ (see the disposition of half notes and quarter notes in Ex. 2). Examples 2 and 3 also show that the rising motion of this initial ascent is effected by means of the technique of *reaching over*; each new note in the ascent represents an element belonging to an inner voice that crosses over the previously higher part.

Since the second half of the piece begins to repeat the first half with only slight variations, the music of mm. 17-28 has the same top-voice structure as the corresponding bars of the first section. But the harmonic change that occurs in m. 29—I^6 instead of III♯—brings with it a melodic change as well: instead of rising to F♯, the upper line sinks back to D. (The F♯'s that occur on the third beat of each bar are subordinate to the D's, which are the main notes in these bars.) Now, if the first half of a piece rises to a high F♯ as a goal, and if the second half begins to repeat the same ascent with

only slight variation, listeners would naturally expect the climactic event to recur. And in general, we would expect the repetition of a large-scale pattern to equal (or even surpass) the impact produced by its model. Chopin's avoidance of the climactic F♯, therefore, creates a kind of frustration for the melodic line, which turns back from the expected goal at the very moment it should arrive there. The frustration is only increased by the events that follow, for they sound, first of all, like a final cadence repeated several times (mm. 29-32), and then like the beginning of a coda announcing that the Prelude has already reached its conclusion (mm. 33-36). As the apparent coda unfolds, however, the crescendo suggests that something momentous is about to occur; and indeed in m. 37, Chopin gives us our F♯, lifted into the splendor of a higher octave and made all the more welcome because the piece was already sounding as if it were just about over.

The surprising advent of the high F♯ sheds light on the Prelude's form, large-scale rhythm, and emotional tone. First as to the form: if we understand the structural meaning of a coda to be an extension of the final tonic, after the piece's story has been told, then these last bars do not form a true coda, but an integral part—indeed the capstone—of the Prelude's structure. Note that Chopin refuses to let go of this hard-won F♯ once he has achieved it; the top-voice resolution $\hat{3}$ $\hat{2}$ $\hat{1}$ is submerged in the middle of the right-hand chords, with F♯ ringing out on top of it. The arrival on F♯ also creates a focal point in the Prelude's rhythmic structure: m. 37 becomes another structural downbeat and indeed the most impressive one in the entire piece. The four bars preceding it, then, function as an extended upbeat preparing this climactic event. And as to the emotional tone: the way Chopin deceives us at first into hearing a coda shows an important and often overlooked facet of his artistic personality—his playfulness, wit, and humor. Indeed the entire Prelude should be performed with this humorous ending in mind; the very real tensions it builds up are comic tensions.[4]

[4]Chopin's sense of humor, by the way, was not limited to his music; he could draw clever caricatures, and he was known among his circle of friends as an outstandingly gifted and amusing mimic.

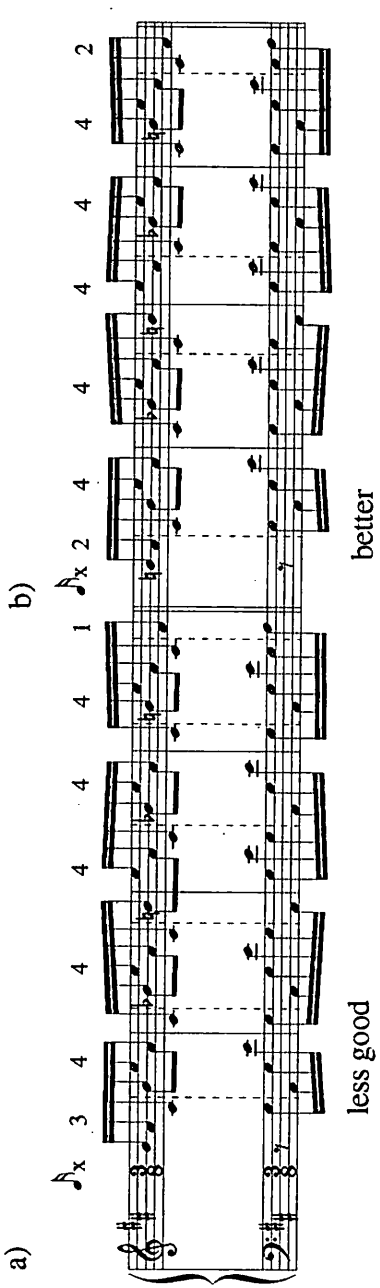
The first four bars: rhythm

The first build-up of tension occurs right at the outset of the Prelude, in the drawn-out dominant, the modal clashes and the rhythmic uncertainties of the opening four bars. That so much tension is generated so early on in a piece is most unusual, and it contributes to the sense of tonal and rhythmic resolution with the arrival of the structural tonic and structural downbeat in m. 5. How ought one to feel the rhythmic groupings within this extended upbeat? Two possibilities suggest themselves, shown in Example 4, a and b. In the first of these, we divide the twenty-four sixteenth notes into three plus five groups of four plus one (3 + 20 + 1 = 24). In the second solution, we divide the twenty-four into two plus five groups of four plus two (2 + 20 + 2 = 24). I believe that the second scansion of the music produces far better results, for it highlights the B-A figure and gives a syncopated quality to the low A's of the left hand and the B♮'s and B♭'s of the right hand. The syncopation arises because these prominent sounds, which attract accents, fall on the second note of each four-note group, a normally "weak" position. The other solution has much less character, for it loses the tension of the syncopations. The prominent notes now fall on the first sixteenth of each group. I believe that confirmation of my view occurs at the repetition of this passage in m. 17, which begins after two sixteenth notes that still express an F♯ harmony (III). The "harmonic rhythm" thus produced divides the steady sixteenths into two plus four, rather than three plus four. The greater clarity of the later passage reflects back on the more obscure opening bars.

The first four bars: chromaticism

The syncopated melodic figure of the right hand grows out of the Prelude's first two notes, B and A; they are repeated in doubled values to form the syncopated motive. The rhythmic figure continues, but at the second statement, a chromatically inflected note, B♭, usurps the place of the B♮. The B♮ and B♭ then alternate for the remainder of the four-bar introduction, with B♮ having the final word. (The A♯ in m. 5 is a subtle hint that we have not heard the last of B♭.) The two alternating sounds are, of course, the major and minor forms of the same scale degree, $\hat{6}$, rivals whose close juxtaposition creates

EXAMPLE 4. Measures 1-4, rhythmic subdivisions: two versions



the potential for a kind of dramatic conflict: which one will ultimately prevail? In our Prelude, the B♮ certainly predominates during the four-bar introduction and its repetition midway through the piece. When the syncopations return over tonic harmony near the end, however, B♭ displaces B♮ altogether (mm. 33-36). The more intense chromatic sound, with its minor-mode associations, helps to generate the momentum that will carry the upper line to the climactic high F♯ of m. 37.

There is, I think, a slightly subversive aspect to the triumph of this chromatic interloper over its more respectable (or at least more usual) diatonic and major-mode rival. It is a victory, moreover, that is foretold by an extraordinary occurrence in mm. 13-16. These bars contain a repeated cadential figure in F♯ major, III♯ in the key of D. Just before the III moves on to V, however, the major changes to minor; A♯ gives way to A♮. As Example 5 shows, the A♯-A♮ progression is the enharmonic transformation of the two-note figure B♭-A from m. 2—an incredible example of what Schenker calls "hidden repetition."[5] Through the hidden repetition, Chopin is able to allude to the B♭ in a harmonic context where a genuine B♭ could not possibly appear. Although the chromatic half step A♯-A♮ and the diatonic half step B♭-A function in very different ways, the similarity in sound—a kind of musical pun—establishes a motivic connection between them.

The contrast between B♮ and B♭ is so fundamental an element of the Prelude's design that its importance must, I think, be underscored in performance. For this to happen, the pianist should give a different kind of inflection—a different color, really—to the two chromatic variants. In playing the Prelude myself, I try to achieve this differentiation with the help of fingering: I use the normal 3-2 for the B-A of m. 1, but I use 2-2 for the B♭-A, sliding the second finger from the black key to the white. A result of this approach is an imperceptible hesitation before the B♭ and an equally slight lingering on it; it takes me a fraction of a second to get my second finger over the B♭ and another microsecond to prepare my hand for

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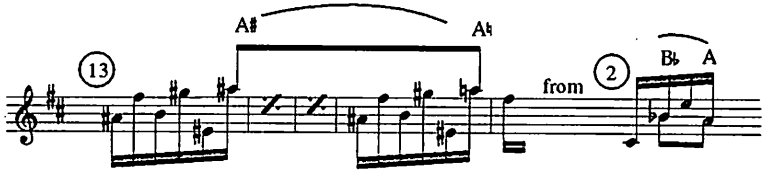
[5]This "hidden repetition" is lost in the versions of the score of this Prelude where the end of m. 16 contains an A♯ in the right hand instead of an A♮.

EXAMPLE 5. A♯-A♮, mm. 13-16

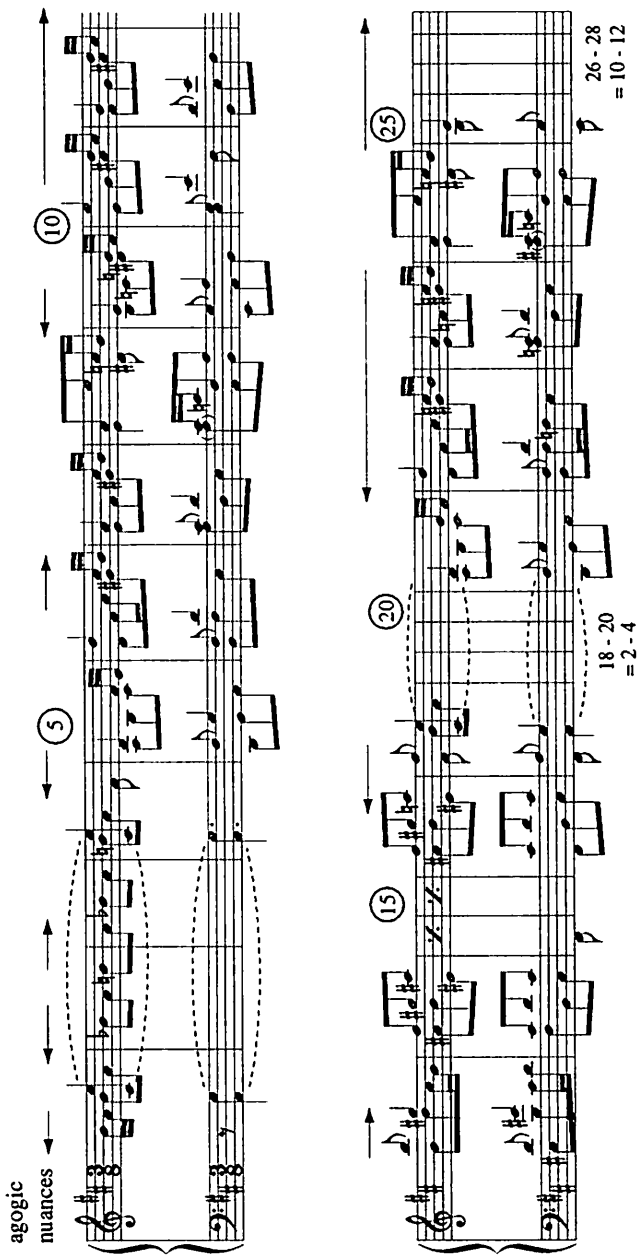


the sliding motion. The agogic accent thus produced helps to highlight this crucial pitch, and I try to enhance the effect with a very small increase in tone. I find that producing these nuances sets limits to the speed with which I play the Prelude, though I try for as quick a pace as is compatible with these differentiated details. In any case, the actual speed of the Prelude's *Allegro molto* is conditioned by the extremely dense texture, which suggests a rich polyphony and which goes together with a rapid rhythm of melodic progression and of chord changes—very often three chords per 3/8 bar. People can't always hear as fast as pianists can play, and there is no point in racing through the Prelude if its melody, harmony, and counterpoint are reduced to a kind of sonic rubble in the listeners' ears.

Foreground reduction

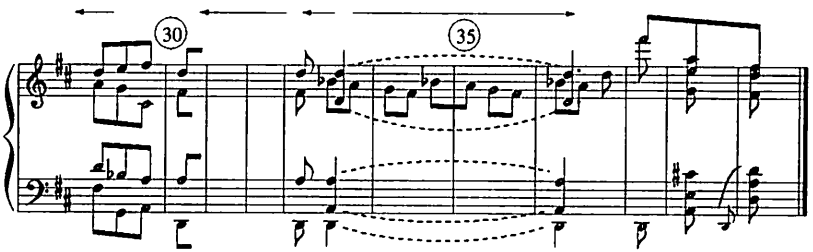
Example 6 contains a bar-by-bar reduction of the Prelude, which attempts to show the density of its texture and the consequent rapidity of its melodic, harmonic, and contrapuntal rhythms. The arrows above the upper staff in Example 6 are my suggestions for agogic nuances; those pointing left indicate a slight holding back in the tempo, while those pointing right indicate a forward push. In my opinion, such deviations from strict time are necessary in playing almost any piece, and they are particularly crucial to an effective performance of the Prelude. This is because the continuous legato required by Chopin's slur prevents our using articulation as a shaping element, so that a distinctive profile in performance can

EXAMPLE 6. Foreground reduction with suggested agogic nuances



(continued)

EXAMPLE 6. (cont.)



arise only out of dynamics and agogics. My reasons for suggesting these specific nuances are listed below:

m.1, 1st two notes, hold back a bit because of the importance of the two-note motive ($\hat{6}$ $\hat{5}$).

m. 2, B♭-A, (and parallel places), hold back very slightly for reasons explained above. The B♮-A figure in tempo.

mm. 5-6, hold back downbeat of 5 to highlight arrival on tonic. The wide skips in the left-hand part will make this happen automatically if one doesn't purposely rush them. (The holding back, then, will be distributed on both sides of the barline.) The motion to the more active upper fifth, A, in the harmony of mm. 6 and 7 provides an opportunity to regain the basic pace. Since the big melodic line D-E-F♯ leads to its goal in the upper octave, be sure to give the high D of m. 6 enough tone and time to let it sing out, thus highlighting the beginning of the line. (The weak metrical position of this important note might tempt some players to slight it.) In order not to drag the tempo, I suggest holding down the D through the next two sixteenth notes rather than delaying those notes.

m. 9, a bit of time for the left-hand E, but very little. Then (mm. 10-12) intensify the rising sequence by moving forward imperceptibly. The high E of m. 10, like the D of m. 6, needs to be clearly enunciated.

m. 13, give F♯, the culminating note of the line, enough tone to make it sound like a goal. Since this note appears four times (mm. 13-16), no special agogic emphasis is needed.

mm. 16-17, the last beat of 16 and the first two of 17 need time, first to bring out the A♮ of the right hand (see above), and then to clarify the harmony change from III to V.

mm. 17-21, like 1-5. I would make the repetition more intense than the first statement, playing at a slightly higher dynamic level and emphasizing the B♮-B♭ contrast.

mm. 22-24, the slight changes from 6-8—greater chromaticism and minor-mode color—suggest a very slight holding back, to be made up in mm. 25-28, which are the same as 9-12.

mm. 29-32, I would take a little time at the first two notes of m. 29 to underscore the arrival on a D major (instead of F♯ major) chord. I would then support the diminuendo by holding back the tempo, as though this really were a coda and the piece was relaxing into its conclusion. Near the end of the passage (m. 32), the ritenuto (though not exaggerated) should be outspoken enough to be perceptible to listeners, just as it might be if the piece were really to end at the downbeat of m. 33.

mm. 33-36, support the crescendo by moving forward, but take a little time on the first B♭. The accelerando must develop enough momentum to restore the original tempo after the quasi-ritenuto of the preceding four-bar group.

Except for mm. 16-17 and 29-36, these nuances of time must be so slight as to be almost imperceptible, and they must be performed smoothly enough to give the impression (or should I say illusion?) of a steady pace. An overly hectic pushing and pulling of the tempo would contradict both the continuous sixteenth notes of the surface rhythms and the humorous spirit of this wonderful little piece.

Intrinsic Motivation: The Relation of Analysis to Performance in Undergraduate Music Theory Instruction

Elizabeth West Marvin

Psychologists now have scientific verification for a pedagogical principle that good teachers already know by experience and intuition: students learn better when motivated by their own intrinsic interest in a subject, rather than by external systems of rewards and punishments. "Intrinsic motivation"—the subject of a series of investigations by two University of Rochester researchers, Edward Deci and Richard Ryan—is "founded on the belief that people are naturally curious, active, and productive creatures, eager for and deserving of self-fulfillment in their pursuits."[1]

One example drawn from many experiments conducted by Deci, Ryan, and their collaborators has particular relevance for pedagogues. In this study, undergraduates were asked to read unfamiliar material in neurophysiology; half the students were told that they would be tested on the material, while the other half were told that they would have to teach the material to someone else. After completing the reading, students in the "teaching" group reported more interest in the subject matter, more enjoyment in learning about the topic, and more willingness to participate in another such ex-

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[1]Denise Bolger Kovnat, "Interior Motives," *Rochester Review* (Spring 1991): 4. An overview of Deci and Ryan's work can be found in this article and two others by Edward L. Deci: "Motivating Children to Learn: What You Can Do," *Learning86* 14/7 (March 1986): 42-44, and "The Well-Tempered Classroom," *Psychology Today* (March 1985): 52-53. For further reading, consult their coauthored volume, entitled *Intrinsic Motivation and Self-Determination in Human Behavior* (New York: Plenum Publishers, 1985) and "Motivation and Education: The Self-Determination Perspective," Deci et al., *Educational Psychologist* 26 (1991): 325-346.

periment than the other group reported. The experimenters concluded that the students in the "teaching" group—those who were asked to put the information to real use—were engaged in what Deci calls "conceptual" learning: "It's learning how to solve problems. . . , knowing how to deal with new situations, knowing how to research a problem. It's organizing material, understanding how things fit together, rather than simply the rote memorization of information."[2]

How do intrinsic motivation and conceptual learning figure into Deci's and Ryan's classrooms? Ryan describes his approach as follows:

> I try to open up questions—questions that they can apply to themselves, so they're not just thinking of a set of facts that they need to learn for an exam, but rather they're learning something that has relevance to the here and now in their daily lives. . . . My assumption is that the motivation is already there; it just doesn't always get sparked. A teacher's job is to provide nutriment, so that motivation can take root and grow.[3]

How better to describe undergraduate music majors? The "motivation is already there." These students would not be in our classrooms if they had not already devoted years of their lives to the pursuit of professional music careers—years of lessons, coachings, recitals, auditions, rehearsals, and practice rooms. Most of our students are deeply and intrinsically motivated to become the best performers they can, but they do not always see the connection between what we do in music theory classrooms and what they do on the concert stage. To make that connection is our job as teachers. The articles in this issue of the journal by Charles Burkhart and Carl Schachter, which relate analysis to performance, offer teachers the opportunity to make many such connections. Indeed, their insights are vital to the "mission" implied by the journal's existence: to share ideas for the classroom and to strengthen and improve the quality of music theory teaching among its readership.[4]

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[2]Kovnat, 6.

[3]Ibid., 5.

[4]An excellent discussion of analysis and performance applied to theory teaching has already appeared in the pages of this journal: Cynthia Folio's "Analysis and Performance of the Flute Sonatas of J. S. Bach: A Sample Lesson Plan," *Journal of Music Theory Pedagogy* 5/2 (1991): 133-159.

Assuming that the incorporation of performance applications to theory study is valuable and will foster intrinsic motivation among students, thus enabling them to learn more effectively, how can undergraduate theory teachers make time for such study in an already crowded curriculum? The answer to this question will probably not be found by squeezing yet another unit into each semester; rather, it lies in an overall approach to each day's teaching that embraces some features of the comprehensive musicianship movement—an approach that combines harmonic and formal analysis of music literature with elements of historical and stylistic study, directed listening, partwriting, model composition, and in-class performance and discussion. In a nutshell, undergraduate theory curricula that restrict their subject matter to the study of permissible chord progressions and SATB part-writing exercises are probably doomed to seem irrelevant to young performers. ("What can the avoidance of parallel fifths in chorale style writing have to do with preparation for my upcoming concerto competition?") On the other hand, theory classes that nurture students' intrinsic motivation will focus on practical applications of harmony study in the analysis of music literature, in "stylistic" composition projects, and (perhaps most importantly) in performance.

Possibilities abound for bridging between analysis and performance in such a classroom. For example, students who learn not only a set of part-writing rules for the preparation and resolution of dissonance, but who also experience and discuss the powerful musical effect of suspensions and appoggiaturas in literature for their own instruments are much more likely to make the connection to dynamic stress or agogic accent in performance. Students who learn not only how to spell and resolve a Neapolitan sixth, but who also discuss and experience (through examples from music literature) its distinctive "color" in approaching the dominant, are more likely to consider a change in tone quality in performance of a passage that features Neapolitan harmonies. Students who learn voice-leading patterns that prolong the tonic—and who find, perform, and discuss these patterns as they recur in music written for various instruments—are less likely to dwell in performance upon each verticality, and more likely to direct the musical line toward important tonal goals. The more theory teachers can connect music-theo-

retical concepts—like periodicity of phrases or hypermetric accentuation (Burkhart), like hidden motivic repetition or the distinction between structure and design (Schachter)—to interpretive decision-making in performance, the more they provide students with the nutrients necessary to foster intrinsic motivation, allowing it to "take root and grow," to use Ryan's words.

Let us turn, then, to Professors Burkhart's and Schachter's analyses to see when and how their insights might be shared with undergraduates. Charles Burkhart's study concerns specifically the mid-bar downbeat in Bach's keyboard music, but the more general issues he raises about phrase structure in the Baroque period are certainly appropriate topics for a freshman music theory class, with the mid-bar downbeat an intriguing issue to be discussed once the more traditional phrase models have been mastered. Phrase structure is usually introduced in the first year of study, once students are familiar with the basic cadence types; these are classes in which students typically memorize a list of terms: antecedent, consequent, parallel, contrasting, phrase, period, sentence, and so on. While such classes tend to focus on the balanced phrases of the Classical period, students are meanwhile probably performing music from many periods and perhaps assuming that these terms are applicable to all tonal repertory.

Why not begin these lessons instead with Burkhart's distinction between "periodic" and "nonperiodic" phraseology? Perhaps an aural introduction to this concept might be made in class through directed music listening, during which students would hear a succession of 16- or 32-bar excerpts from diverse pieces of music. As each excerpt is played, students would be asked to determine the meter by ear and to conduct along, counting bars if possible. Whenever they heard a "resting point" in the excerpt, students might be asked simply to look up at the instructor. After each excerpt, a brief discussion could follow up on the presence or absence of 4 + 4 periodic construction, of complete or incomplete tonal motion at each resting point, of parallel or contrasting phrases or of continuously developmental working out of motives, and so on. After introducing the two basic types of phraseology (periodic and nonperiodic), the instructor might suggest categories of composition that feature one type or the other—as Burkhart does—then assign students to

find one example of each type for their own instrument, to be prepared for performance in the next class. Continuing to rely on aural examples (previously compiled on tape), the instructor might turn next to the terminology commonly associated with periodic structure: parallel interrupted period, etc. Each type of phrase structure would be illustrated with an aural example, and students given the opportunity to hear and discuss the differing aural expectations created by the different cadence and phrase types; notation of these examples might then be handed out to reinforce the aural analysis and give students concrete examples of each phrase or period type. An addendum to the homework might instruct students to identify which specific type of phrase structure is illustrated by their instrument's example of periodic phraseology.

Asking students to find examples from their own literature and to perform them as homework is probably not enough to spark intrinsic motivation, however. What is necessary is an explicit link made by teacher and student between phrase analysis and performance. The teacher might even pose a number of discussion questions to the class: What is the importance for performers of distinguishing between phrase types? Should periodic phrases be performed somehow differently from nonperiodic? Should the second of two parallel phrases be played exactly the same as the first or subtly varied? Why is the identification of cadences (or phrase beginnings and endings) important for performers? Is every note or harmony of a musical phrase equally important, and how can the answer to this question be conveyed in performance?

At this point in the lesson, the concept of hypermetric accentuation could easily be introduced for periodic music, with the analogy of strong and weak beats to strong and weak bars.[5] Since students are probably familiar with teachers' admonitions to play certain passages or pieces as though they are notated "one to the bar," this is an ideal opportunity to mesh studio and theory class instruction. A second addendum to the homework assignment might now

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[5]See Burkhart's warning about the terms "strong" and "weak" in his footnote 14. Among the authors who discuss hypermetric accentuation in relation to performance are Edward T. Cone (see Schachter, footnote 3) and William Rothstein (see Burkhart, footnote 2).

ask students to consider the questions listed above in connection with the literature excerpts they have been assigned to find, and to incorporate these performance issues—as well as their thoughts about hypermetric accentuation of the passages—into their interpretations. The instructor might ask students to come prepared to answer some of these questions orally after performing their excerpts, or to lead a class discussion, or to write two or three paragraphs of prose that respond to these questions and hand them in with the excerpts. Due to time limitations, probably only selected students would get the opportunity to play and speak during the following class; but if similar assignments were given occasionally throughout the semester, each student might get the chance to perform. These in-class performances, incidentally, could be used as additional ear training for the other students to determine meter type, whether a periodic or nonperiodic example had been played, and, if periodic, which type of period had been illustrated.

Several other classroom activities based on Burkhart's article might follow up on the initial day's work. A wonderful opportunity to tie musicology to theory to performance is afforded by Burkhart's Example 8: the facsimile score of the first version of J. S. Bach's A minor "three-part invention" from the *Clavier-Büchlein* (begun 1720). A number of students will never have seen a Bach manuscript before, and most will not know what kind of evidence can be gleaned from score study. To begin, students might hear part of the work and be asked whether it has periodic or nonperiodic phraseology. A discussion of the movement's basic compositional design might ensue, based just on listening and observing changes in motive and texture (without getting into a detailed discussion of contrapuntal procedures that might more appropriately be left to the sophomore year). Students might then be asked to consider such questions as: Can the 3/8 bars be grouped successfully into larger units? How might the performer's determination of a 6/8 hypermeter affect interpretive decisions? Are there any "clues" as to the composer's intent from the score's notation? Here the instructor could guide the class to discover the short and long bar lines and their possible implications for hypermetric accentuation. In fact, it might be interesting to perform the movement or play a recording of it while the students conduct in two and recite "1-2"

for each pair of bars (as per Burkhart's annotations). This activity is likely to point up the moments where the hypermetric downbeat is reinterpreted (as at the beginning of Episodes 1 and 2). The skillful teacher might here bring in a discussion of the way in which changes in formal section coincide with the hypermetric reinterpretation, and the class might experiment with ways of performing the passages in question to make the new hypermetric downbeats clear. Finally, students will appreciate and enjoy Bach's notational "mistake" (marked "N.B." by Burkhart) when they understand some of the possible music-theoretical reasons behind this error.

Once students have been brought this far, they will probably be ready to explore the mid-bar downbeat that is the focus of Burkhart's article. In particular, his first two examples—the Allemande from Bach's French Suite No. 6 and the "Little" Prelude No. 8—seem particularly well suited to classroom discussion. In the first case, the Allemande's melodic cadential formulae and the transferal of the initial right-hand motive into the left hand in m. 8 clearly signal (even to freshmen!) the beginning of a new phrase mid-bar. In the case of the little prelude, freshmen should be able to perceive in m. 8 the "tonal accent" of tonic arrival mid-bar, reinforced by the clear left-hand change of rhythmic motive. Further, the octave unfolding in the upper line of mm. 5-8 is not difficult to hear, and it gives the instructor an opportunity to talk about compound melody and its implications for performance. The instructor might also wish to follow up with an analytical assignment that focuses on the mid-bar downbeat, in which case the other works from Burkhart's article might be chosen for phrase analysis.[6] In such an analytical assignment, questions explicitly addressing the interpretive implications of the mid-bar downbeat will make the homework more interesting and relevant to young performers.

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[6]Burkhart also suggests (personal communication) that students be assigned portions of the G major Gigue and the A minor Three-Part Invention that are not analyzed in his article for homework. For example, students might be asked to "find the six other mid-bar downbeats" in the second half of the G major Gigue. To tie such a homework assignment to performance, the student might then be asked to choose one of these spots to discuss in detail from an interpretive angle.

The Chopin D major Prelude (Op. 28, no. 5) that is the subject of Carl Schachter's attention is more suited to the sophomore year of study, due to its pervasive chromaticism. This work seems particularly well suited to complement classroom instruction on applied chords (since it contains applied dominants to ii, III, V, and vi, as well as an applied diminished seventh chord to III); it would also work well during students' study of mixture (since tension between scale degrees 6 and ♭6 is a prominent motivic feature of the work and since tonicization of a mixture chord figures into the work's large-scale harmonic structure).[7] Let us begin by designing a homework assignment around the Prelude. Figure 1 presents a possible assignment. Although it asks for some Roman numeral analysis within specific bars, the assignment consists primarily of short essay questions that require the student to reflect on the structure of the whole and to focus on elements other than harmony alone. Further, it asks students to relate their analysis to possible interpretive decisions. This type of assignment assumes that students will begin with a Roman numeral analysis, but it challenges them beyond mere descriptive labelling of verticalities. For students whose intrinsic motivation grows out of their performance concerns, this type of assignment is much more likely to inspire than one that asks them simply to annotate the score with a complete Roman numeral analysis for grading.

During the class session at which the assignment is collected, the instructor can continue to explore deeper analytical points with the class, since much of the groundwork will have been covered by the assignment. For instance, the instructor could follow up on question six by describing the long slur as a indicator of "spianato" playing, as Schachter does, and discussing reasons why the per-

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[7]Terminology varies from text to text. The terms used here correspond to those used by Edward Aldwell and Carl Schachter in *Harmony and Voice Leading*, 2nd ed. (San Diego: Harcourt Brace Jovanovich, 1989). Applied dominants are frequently called secondary dominants in other texts. Mixture is known as "modal mixture" in some texts, while mixture chords are sometimes called "borrowed" chords in others. According to Aldwell and Schachter, use of the major III chord (their III#) in a major key is known as "secondary mixture" (363-364).

Figure 1. Analysis assignment: Chopin, Prelude Op. 28 No. 5

Analysis Assignment:
Chopin, Prelude, Op. 28/5 Name:_____

1. One way to view the design of this work is as a simple continuous binary form with coda (A = mm. 1-16, A′ = mm. 17-32, coda = 33-39).

a. Given the continuous sixteenth-note motion and the unchanging texture that characterize the movement, what elements work together to articulate this formal design?

b. Within the continuous sixteenths of the right hand, there are embedded melodic motives that the performer might wish to highlight. Identify two and discuss musical ways in which these might be brought out of the texture.

2. What harmony does the work's opening four measures prolong?

a. Might this harmonic analysis cause us to re-evaluate our initial formal divisions? In what way? (Be sure to consider the return of these opening bars as well.)

b. Might this harmonic analysis cause us to perform the initial bars somehow differently? How?

(cont. . . .)

Chopin, Op. 28/5 - page two

3. The opening bars set a precedent for the use of mixture between major and minor modes by their use of scale degrees 6 and ♭6. Cite by measure, beat, and Roman numeral two DIFFERENT mixture chords that occur between mm. 5 and 16.

4. This Prelude's harmony is characterized by a number of applied chords. Cite by measure, beat, and Roman numeral three DIFFERENT applied chords that occur between mm. 5 and 11.

5. The applied chord that appears in mm. 12 and 28 differs from the others in that it is an applied diminished seventh rather than dominant seventh.

a. Identify this chord by Roman numeral, with its chord of resolution, and comment on the difference between resolutions in mm. 12-13 and 28-29.

b. Comment on the difference between dominant and diminished seventh applied chords, considering their dissonance and their patterns of resolution. How might the performer treat them differently in performance?

6. Speculate briefly on some aspects of the composer's notation: What might the long slur above the right-hand part mean? Why are some of the right-hand pitches doubly beamed, upward as sixteenths and also downward as eighths? Does this have implications for performance? (Note the change in the doubly-beamed notes in the final bars of the work.)

former might embrace or reject this interpretation of Chopin's marking. While the assignment has "set up" the possibility that students might wish to interpret the opening four bars as an introduction, it leaves somewhat open the question of the formal "function" of bars 17-20. Here the instructor might very well introduce the distinction between structure and design, and might engage the students in a discussion of the dual role of these measures (per Schachter's convincing demonstration in his Example 2) and possible performance implications. Even the "hidden repetition" of the introduction's B♭-A motive, expanded in mm. 13-16 and respelled as A♯-A, is probably not beyond a sophomore class's ability to appreciate. In fact, they might appreciate it very much. Likewise, they may notice the A section's long bass line, D-E-F♯, which reappears in mm. 29-32, rhythmically contracted, as the right hand's uppermost line. By assigning a keyboard player to prepare the Prelude for performance in class, the students could experiment together with varying interpretive cues to articulate the work's formal and motivic design. Alternatively, a comparison of various recorded performances could be used and students asked, for example, to speculate on whether each performer views bars 1-4 as an introduction or as the beginning of the A section. Likewise, various performers' treatment of the work's primary motives could be compared.

Let us close by returning to the Ryan quotation cited at the outset: "I try to open up questions—questions that they can apply to themselves, so they're not just thinking of a set of facts that they need to learn for an exam, but rather they're learning something that has relevance to the here and now in their daily lives."[8] If we can remember with each lesson plan to make connections to the daily lives of our students *as performers*, surely they will begin to see the relation between what we do and what they do. More importantly, if Deci and Ryan are correct, the incorporation of performance issues into theory teaching will help our students learn music theory more effectively, with more enjoyment, and with the intrinsic motivation to learn more.

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[8]Kovnat, 5.

Theory Pedagogy: An Experiential Approach

Thomas Benjamin

In a theory pedagogy course I taught recently, one of my goals was to introduce, model, and have the class practice with, a variety of teaching and learning modes. Of course there also had to be what we cavalierly call "content" too (as if the message and the medium were somehow separable). One of our problems as teachers is that we assume the content of our lessons and classes is merely information about music. I suspect that the real content, for any given student, is more like: "Gosh, I hope this course won't require too much writing." Or, "I really screwed up in that last lesson." Or, "I didn't really understand that thing about unequal fifths, but I don't want to appear stupid and ask." So perhaps the principal message of my pedagogy course was: try to figure out where the students are at any given moment, and how to reach them, and how to make sure they are really solid on the material. Content, without a clear-eyed vision of how to communicate it, reinforce it and check it out, doesn't mean much. The reality is that focusing entirely on content makes it very difficult to observe process.

The secret goal of the course was simply to make the students individually aware of the multitude of hidden messages and agendas floating around any given classroom, and the many ways these can short-circuit learning. What I hoped to accomplish was to get everyone into the *present*, aware of these agendas and messages. Most students, in fact most people, have a hard time being and staying in the present; and you can't learn (or teach) unless you are in fact truly *there*. It seemed that the efficient way to begin to focus the class on this secret goal was to remove all the ostensible content. The best way to do this, I felt, was to just shut up. I share the subversive attitude that says, for God's sake stop talking and let them learn. So I just sat and read, Calvin Trillin I think it was. Very uncomfort-

able, for all of us. They, of course, came in expecting to be told what the course was about and what to do to get an "A". I hated this exercise, as my main bad habit as a teacher is trying to make it all happen, to take excessive responsibility for everyone's success, and as a consequence to talk too much rather than just stand back and let the learning take place. Anyway, they just sat nervously in their rows of chairs, which I had made no attempt to rearrange. And sat. And sat. It was Awful. Finally I broke down and wrote a few words and phrases on the board: "Expectations." "Assumptions." "Content." "What's going on?" And so on. Before the second class meeting I wrote on the board the instruction "Talk about it," and sat in the back of the room and listened. They gradually began making observations about how they had felt during the first class, about expectations, assumptions, what roles they usually played as individuals in a group, and how they felt about me, which I didn't necessarily like hearing.

This experience, uncomfortable as it was, worked to disrupt the usual set of attitudes and behaviors students bring into a classroom. It helped to focus their attention on *process*, not merely content. What this little exercise can do is to interrupt the usual passivity of students, to allow them to be aware of themselves as learners, and their power to influence the outcome of their learning. The bottom line, maybe, is that the less responsibility we as teachers take for the learning, the more the students will, if allowed to.

In the interests of full disclosure, I must admit that this particular group tended to be unusually passive, compared to most of our graduate classes at Peabody. It was not easy for them to stay in charge, and I had occasionally to remind them to observe what was going on *now*, and to stop generalizing about education, or about music. They tended to filter all observations through me, and to focus their attention on me, rather than on each other, even after they decided to meet in a circle. This power and authority stuff is very old and very powerful; it's seductive for both students and teachers, and hard to break out of. There's also a lot of gender and ethnic content in this, as you probably know. There was more seeking after my approval, at least early on, than I had expected, and more willingness to fall back on the "let the teacher do the work" model. But we worked on it, and improved at least our awareness of the issues.

Progress in this area is slow; what is being contradicted is many years of learned behavior. What do you learn in school? You learn studenting. You learn how to student. If you successfully student, you get little pieces of sheepskin that allow you to have a nice house and a VCR. This is all very attractive. It's easy to fall into the required patterns of uncritical passivity that are too often rewarded in our schools, and our society. So, when we as teachers try to change the entire model, it's scary, and probably seems unfair to the students. No one likes to have the rules changed mid-game.

Throughout the course we worked on developing the habit of making observations about group process, affect and so on, looking carefully at whatever might result in potential blocks to learning. This led, finally, to a lot more risk-taking behavior and a lot more frankness than one expects in a classroom. People became unusually open about what they wanted out of the course, and about what was and was not working for them. I didn't have to work hard to get useful feedback, making my job tremendously easier. Students then were able to decide on what they wanted from the course, and on exactly what activities and assignments would best accomplish that for them, with only a little prodding from me. They decided on circular seating, peer teaching, classroom teaching, videotaping, and the topics they wanted to be sure we covered. They came up with a list of what to look for in good teaching, and a teaching reporting form to be used in their observations of faculty theory teachers and of each other. They decided individually what theory material they wanted to peer-teach, whose classes they wanted to observe and for whom they wanted to do their actual classroom teaching. They all observed a variety of undergraduate courses and teachers, and reported with great insight on what they observed, not only in terms of theory content but of teaching technique, the learning process and group dynamics.

The peer teaching was videotaped, at their request, and was immediately critiqued by the class and by me, in a frank but kind way. Their classroom teaching, for a variety of theory faculty, was critiqued in writing and verbally by the faculty member. The students went over these critiques with me. They also shared with the class their observations of undergraduate theory classes. Also shared with the class, and with me, were their teaching and learning jour-

nals, which I asked them to keep. These consisted of informal observations about their own experiences in classroom or private instruction, either as students or as teachers. They often ended up using the journals to work out issues in their own lives, and to make observations about themselves and their own values and goals.

There were also a good many traditional theory pedagogy activities. We learned Mike Rogers's fine book, *Teaching Approaches in Music Theory*, writing detailed chapter-by-chapter outlines and discussing and critiquing everything. There were many handouts, including a variety of articles and chapters on learning and teaching, by Kenneth Eble, John White, Harvey Jackins and me. These were likewise outlined and critiqued, and discussed in class. I tried not to lead the discussions, which was hard for me with my usual teacher patterns of being too active and verbose. We assigned ourselves areas of theory for which to make up bibliographies, and annotated these in writing and verbally. We brought in the books and had a look at how they were organized.

Like content and procedure, course grading was handled democratically. We discussed the nature and problems of grading, the various grading systems, and ways of maximizing useful feedback to both students and teachers. They settled on a contractual system, in which any work which I felt was under a "B" level was redone. Pass-fail grading is not an option at Peabody, but I had no resistance to assigning grades on individual assignments. Students deserve to know exactly how they are doing. At the end of the semester they critiqued in writing their own work, and assigned themselves a course grade, based on their assessment. I retained editorial control over the grades, as I informed them, and ended up tweaking one grade up half a letter, and one down half a letter. Otherwise I found their self-grading remarkably accurate and insightful. The only acceptable reason for grading, after all, is improvement, and we had worked out a variety of ways of maximizing specific and helpful feedback on their teaching, writing and outlining. Grading always seems to me a somewhat hostile act, so I'm always looking for ways to humanize it and make it a more positive part of the learning process.

I am certainly far from ecstatic over the course. For instance, I found the theory preparation of several students inadequate, so had

to work at length with them on the content and organization of their peer and classroom teaching. Two students said they hoped the course would review undergraduate theory course content. I told them I felt that was not possible in a one-semester course, though we did discuss curricular design and content, and the design of syllabi and lesson plans. Probably I should have spent more time modeling the teaching of specific theoretical items, but I was very hesitant to impose my own views of both theory and its pedagogy on the class. Individuals have their own natural way of teaching, flowing from their values, personality and musicianship, and it's not our job to get in the way. The best way of learning to teach may well be (1) to observe carefully and intelligently a variety of good teachers, and (2) to teach, preferably in a setting that maximizes helpful feedback to you as a teacher.

Finally, teaching the course as I did made me far more aware of what was going on in my own theory classes. It made me, I hope, better able to diagnose quickly and deal with glitches in the learning process, and with students who were clearly not learning on their own highest level. It certainly made me much more self-critical and self-conscious in my own teaching, for better or worse. It helped me to lighten up, be in the present, be more conscious of group process and of students as individuals. It helped me to interrupt those nasty old teacher patterns: talking too much, not listening, taking too much responsibility for the learning process, not having enough fun in the classroom. The anonymous course critiques, which I always ask for, made me feel good. A couple of students said that they had been changed permanently as students, and as human beings. I think they meant for the better. That was nice to hear. We are after all not merely teachers, but mentors and models. It's good when someone notices.

RANDOM THOUGHTS ON TEACHING AND LEARNING[1]

General Ideas

Assumptions about people (how they are doing, feeling, thinking, etc.) are always wrong. Never assume—check it out!

Use your personality—anecdotes, real-life things bearing on music and music theory.

Only connect (the prose and the passion). E.M. Forster.

How do I know what I think until I see what I say? E.M. Forster. (Get students to talk about it—mirrors, dyads, questions, answers.)

Remember:

I hear and I forget
I see and I remember
I do and I understand

Visual, aural and kinesthetic reinforcement and experiences are crucial.

People are doing the best they can at the moment. Check out poor work right away.

Never confuse the person and the product.

Teaching is a performing art (Eble).

Teaching is a helping profession.

Remember the K.I.S.S. Rule (Keep it short and simple).

Don't just say it—play it, write it, check it out, make it into a question or an exercise, sing it, act it. Make it *vivid*.

Stay focused on process. Don't assume that the material is getting through just because *you* understand it.

Learn the piano. You can't teach optimally without it.

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[1] Many of these comments are discussed in my article, "The Learning Process and Teaching," *College Music Symposium* 22/2 (Fall 1982): 120-32.

Know the material—cold.

Teaching is not learning.

Talking is not teaching.

Be quiet and listen to your students. They'll tell you what they need, verbally or otherwise.

Teaching may be a sacred trust, but it's also a lot of fun. If it's not, figure why not and fix it.

Specific Teaching Strategies, Attitudes, and Techniques

Use tiny increments of new material, checked out immediately.

New material must be attached to previous material, in lots of ways.

Vary reinforcement modes.

Vary presentation modes (what does the *material* suggest?).

Contexts are crucial. Make them explicit (musical, historical, cultural, aesthetic, anthropological).

Practice the new material: listening, singing, analyzing, writing, talking, questioning.

Focus on one item at a time. Move on when it is thoroughly checked out.

Start from the music, not abstractions. Play it, sing it, then discuss it. Experiences first, concepts later.

Exercises—always as musical as possible; play it, hear it.

Ask specific, focused questions. Use listing questions, to avoid "wrong answers".

Model the open mind; don't know it all (even if you do). Model question-asking as a mode of thought. Model critical thinking. Insist on personality and thinking in assignments.

Focus your comments. Be precise as to measure number, exact voice, precisely what aspect of the music you are discussing.

Typical idioms first, exceptions later.

Separate out all aspects of new material. For instance: musical usage, meaning and function, spelling, resolution, doubling, part writing and contrapuntal aspects, atypical usages, history, literature, and so on.

When in doubt, check it out. Never assume a class understands anything.

Use the board a lot. Before class write assignment, menu for the day, examples, charts, maps, whatever. Beware handouts. Avoid using handouts when presenting new material (they won't be focusing).

Learn student names as soon as possible. Consider a Polaroid photo the first day.

Lesson plan—be aware of every step in the learning chain and go through entire chain.

Don't just say it—show it. Play, sing, write, analyze, perform.

Check out student backgrounds, expectations, wants, needs, fears on the first day of class, in writing or in discussion.

Assignments

You can insist on originality and musicality very early in the course, in most work. Watch out for the "technique vs. musicality" trap. If your comments in class focus on the music and what makes it work (the *principles*, not just the discrete technical details; matters of aesthetics and style and expression), that will encourage musicality in student writing and analyzing.

Be sure to explain each assignment clearly. If possible, model the working-out process together with the class at the board (using the piano and/or singing to check it out). Discuss process in terms of clear stages; you are modeling the compositional process.

Principles: In all work in class (analytic and written), focus on the basic musical principles: coherence, affect, style, confirmation of material, continuity vs. articulation, shape, drama, expression. Be sure to pay attention to student writing in these same terms, in addition to technical polish.

Be aware of how long assignments take. Ask students to write on each paper how long they took to do it; adjust future assignments as needed.

Return assignments as soon as possible. This provides feedback, and models promptness.

Check out with students how they are approaching the assignments, both analytical and writing. They may need more modeling of process in class, or individual attention from you if they are taking too long, or doing poor work.

Try not to take poor work personally. If there is a pattern from particular students, make time to consult with them on what's going on. There may be problems of concept or process, or just something going on in their life. You can usually diagnose these problems quickly and suggest solutions.

Be prepared to spend lots of time individually with students. The harder, more thought-requiring or creative the work is, the more they'll need extra attention.

Always play written assignments in class, at least those of a few students. Let the class hear and comment on work which is excellent in both musicality and technique, and also work which isn't (this is fine ear training, too). Identify the composers of the best papers only.

Assignments can be done in class, with you walking around to check the work. This is especially valuable with new materials, as a way of instantly checking on whether everyone understands it (and letting students know if there are any gaps in the learning process).

Assignments can be done in teams, either in class or outside. This can help in building a peerness among students, and an atmosphere of being helpful to each other, rather than competitive.

Good assignments elicit good work, and vice versa (Eble).

Check on work in progress, in stages. This applies to term papers, large analysis and composition projects.

Elicit real answers to real questions (Eble). Trivial assignments elicit trivial, unengaged, work.

"Think about it" is far better than "look it up" (Eble).

Always give prompt response to assignments. Students need this for improvement, and your promptness is a mark of respect for them.

Stress independence and honesty. Try to minimize busy work.

Early assignments on new materials will need to be relatively short, simple and objective, until you are sure the material is thoroughly learned. These preliminary assignments do not always need to be graded.

Use feedback on assignments to improve your teaching. The main point should not be to *evaluate;* it should be to *diagnose* (both your teaching and student understanding).

Vary assignment formats. In theory, consider using every possible format: various types of analytic work, every possible type of written work (melodic writing and harmonization, figured and unfigured bass, all types of counterpoint, chord-phrase formats, given formal outlines, free composition within a specific style and/or technique). Make use of instruments and voices available in class.

Composition projects are very valuable. They are fun, challenging and can help to pull scattered bits of learning together. Leave plenty of time for them. Give such assignments clearly, with plenty of time ahead. Have student work in stages on all longer projects, showing you each stage (this is crucial).

Insist on personality and individuality in work, where this is possible. This pays off in terms of students taking responsibility for their work, which is after all the point.

Grading

Objectify the grading as much as you can. If a points-off system of grading is appropriate for an assignment, use it. If various components (i.e., technique, musicality, quality of manuscript) go into a grade, separate those out and average them.

Explain clearly your grading criteria. Make sure your correction symbols are clearly understood and helpful. Don't hesitate to suggest specific solutions to a technical problem.

Strongly consider having all work below a certain grade-level made up. Correcting one's work is an excellent learning tool, and improved grades can be averaged with the original, improving one's GPA.

Overall grading policy needs to be discussed and explained early. The exact grading mix (balancing of the components of the final grade) needs to be clear from the start.

Make up your final grades with care. It's best to use a simple arithmetical system in computing final grades.

Consider grading alternatives. If Pass/Fail is an option where you are teaching, that might fit some courses. In some classes, students can grade themselves, as long as you make it clear exactly what to base the grade on (and you may wish to retain editorial control over the grades, as long as they know this).

Grading should emphasize what students know, not only what they don't know. Grading should tell students how they are doing. People legitimately want to know this.

Always let students know what is good about their work. There is something good about almost all work, and you should specify what it is. Reinforce the good work. This will pay dividends.

Grade all work as specifically as possible. Be precise as to what the problems are, and what is particularly good, too.

Consider contracting for grades. There are many ways of doing this. This doesn't fit every kind of course, nor every class.

Students should think of grades as earned, not "given". They will need some help from you with this. Interesting, engaging assignments will help a lot, as will clear, detailed and helpful grading from you. Be as clear and consistent as you can about how a grade reflects a certain level of work, especially how excellent work is reflected in high grades. Be sure both individuals and the whole class are aware of this.

Many grades are much better than a few. Having many grades in a course minimizes the damage one poor assignment can do to a course grade. It also indicates that there is a variety of work being

done that is worth grading, and implies that students are getting a lot of feedback from you as to their work and their status in the course.

Try asking "How do you want to be graded?", either on a particular assignment or on the course as a whole. This may be very revealing as to student attitudes, needs, wants and expectations in a course.

Testing

Know why you are testing. Is it to help students think about and apply material; to provide you with feedback about them individually and as a class; to objectify your grading process?

Use both short-answer, objective questions, and larger, thought-provoking synthesizing questions, as the material and your objectives dictate.

Use lots of short quizzes. They work very well for feedback both to you and the students, and let you know instantly what needs work. They can be graded, or not, as seems appropriate.

To test only behavior can trivialize learning; test also the ability to synthesize, to abstract, to create, to think originally.

A good test can be fun to take!

Evaluation should work both ways. Be sure to work out an evaluation system for your teaching, via student written/verbal feedback.

Try having students make up tests.

Test to find out what they know, not just what they don't know.

Use what you find out in the test to improve your teaching. This may well be the main point of testing.

Grade tests promptly and carefully, and be specific as to both good work and problems. Return them to students as soon as possible.

Consider having students correct problems on tests and return the corrections to you. The point is to maximize the learning aspects of testing.

Not all tests need to be graded.

Trivial tests trivialize the material.

Be fair. Don't be tricky or too clever with questions or formats. Use familiar formats and familiar terminology.

Consider using practice tests, especially for final exams. Take-home exams are also possible. Let students know ahead of time about content, length and format. Practice for exams in class.

Be sure exams can be finished in available time. Err on the short side at first. Consider using extra-credit questions, too.

Pass/fail exams are good for simpler material (rudiments). Try competency-based barrier exams (with retakes as needed) for basic material.

Never teach only for the exam.

Creativity in Theory Courses

Assignments can call for creativity from the earliest stages. One doesn't need a lot of theoretical knowledge to be creative.

Creativity needs to be modeled by the teacher, by way of comments on the music being discussed, and on student written work.

Always emphasize the larger issues in addition to (often before) the narrower technical, detail-oriented ones. Think principles, not just operations. Some biggies are: affect, character, expression, style, idiom, genre; shape, flow, coherence, confirmation, concinnity, balance, logic.

Always put technical detail in a musical context. Not just "here's a German chord," but "how does this feel; why does it feel right *here;* what does it tell us about the historical or personal style of the piece; could it have worked equally well elsewhere; how is it set up in the preceding music; what is the linear and contrapuntal context for it" and so on.

Work out written exercises often in class, having students do most or all of the work, at the board. Be clear on the working-out process, and the *stages* in this process. Insist that the class play and sing all board-work, and critique it in terms of its musicality, not just "correctness".

In all corrections on written work, point out the musical issues, not just the "technique." Point out the musical problems, and praise specifically all good aspects of student writing.

Explore a variety of styles, textures, media, idioms, genres, and so on. Write for instruments and voices available in class. Try assignments in specific historical styles and/or genres.

Analysis can be approached creatively and open-mindedly, if you stress the larger principles involved, and are a model of flexibility and enthusiasm for the class. Analysis can be fun and engaging.

Try to do at least one composition project every semester. These are time-consuming but very much worthwhile. They excite students, and get them involved. Have them work in stages, and check out each stage. Insist on excellent manuscript and a fine performance in class. Tape the performances. Have students critique the results. Be positive and encouraging in your comments and grading.

Staying Fresh — Some Strategies

Vary your materials as often as possible. Use a different textbook or anthology every couple of years (if possible where you are teaching). If you are using the same book every year, try using different aspects of it, or different assignments from it. Better, develop your own materials from scratch. This is very time-consuming but makes you think freshly about the course materials and their best pedagogy.

Stay very aware of affect and process in class. This is not only crucial to good teaching anyway, but keeps you interested in what is happening *in the present*. Be aware of the roles students are playing, and of the nature of their interactions among each other, and with you. And be aware of how you are interacting with them one-to-one and as a group. Know your material so well you can keep your attention outside it and focused on what is happening with the students.

Vary the format of each class. Do activities in different orders, or in different ways. Vary the mode of presentation as much as possible (whatever seems appropriate to the material). Try various reinforcement strategies: each-one-teach-one, mirrors, students doing the teaching, students working at the board or performing. Get the focus off you and onto individual students. Kid around. Use humor to

make specific points. Tell stories, as they relate to the material (or sometimes just for fun). Try to keep it light but at the same time serious about learning the material. Model this attitude for the class.

Build a very fluid and informal atmosphere, if that is your style, where students feel free to jump in at any point with comments, questions, jokes (you may need to referee this). Student questions and comments are an immense help to you. They will tell you what's going on with the learning, will suggest new avenues of approach to a subject, will reveal gaps in the learning chain and so on. Create a model of questioning everything, and accepting nothing uncritically.

Enjoy yourself. Loosen up, lighten up. Nothing lasts, in the larger scheme of things. Have fun in the meantime!

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Recommendations for Atonal Music Pedagogy in General; Recognizing and Hearing Set-Classes in Particular

Robert D. Morris

Introduction

As its title indicates, this paper is directed to those who presently teach or are planning to teach atonal[1] music theory in any number of pedagogical settings: graduate composition, analysis, or theory classes and/or seminars; twentieth-century music literature classes; undergraduate theory sequences; workshop/seminars introducing compositional techniques and the like. My objective is first to raise several issues that address the role of atonal music theory in these highly different contexts, then to provide some suggestions regarding terminology and notation that will be useful in most educational occasions.

In the second part of the paper, I outline a methodology to teach the written and aural identification of set-classes and transformations. New and older concepts of set-class categorization and transformation are applied to this end. The final goal involves committing all or at least a large proportion of the hexachordal set-classes to memory and identification, in both visual and aural modalities. To this end, I introduce a simple and musically relevant generative method that doesn't rely on tedious calculation, table look-ups, or sheer rote memory.

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[1]I use the word "atonal" without bias simply to refer to twentieth-century music whose structure is based on relations of pitches and pitch-classes that are independent of tone centers and/or functional harmony.

The Field of Atonal Music Theory

Atonal music theory and analysis address the study of nontonal Western art music of the twentieth century. Included are the well-known topics of "set theory" and "classical" twelve-tone theory (and its extensions such as generalized combinatoriality), as well as more idiomatic approaches (such as George Perle's "Twelve-Tone Tonality") or those theories that do not isolate atonal and tonal issues in principle or practice (like those developed in David Lewin's *Generalized Intervals and Transformations*).[2] The field, like many other academic disciplines, has developed "top-down" from the sophisticated and advanced concerns of articulate composers and theorists to its recent incorporation in undergraduate music curricula. But for all its present day unification and generality, atonal music theory's development originated in a nonlinear manner, in a few minimally overlapping "schools" of highly contrasting concerns. A brief review of the history of the field will help pinpoint some of this characteristic diversity.

Research has confirmed that much of the important music of the twentieth century can be modeled (at least in part) with the tools of atonal music theory. The structure of music by Claude Debussy, Alexander Skryabin, Arnold Schoenberg, Alban Berg, Anton Webern, Ernst Krenek, Edgard Varèse, Igor Stravinsky, Béla Bartók, Olivier Messiaen, Elliott Carter, Pierre Boulez, Milton Babbitt, and a host of other composers has been illuminated by such tools, whether or not the composer consciously applied any kind of pitch/pitch-class theory to his or her works. Moreover, composers such as Messiaen, Schoenberg, Howard Hanson, Babbitt, Donald Martino, George Perle, Daniel Starr, and Robert Morris, to mention only a few, have published various compositional theories of pitch/pitch-class, many of which are general and flexible enough to be useful to other composers and to stimulate theorists and analysts who do not compose.[3]

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[2]See George Perle, *Twelve-Tone Tonality* (Berkeley: University of California Press, 1977); David Lewin, *Generalized Musical Intervals and Transformations* (New Haven and London: Yale University Press, 1987).

[3]See Olivier Messiaen, *Technique de mon langage musical* (Paris: Leduc, 1944); Arnold Schoenberg, "Composition with Twelve Tones" in *Style and*

But despite its general interest to scholars in all walks of music, the work of composer/theorists is often more oriented to making music than to analyzing it; indeed, some composers (such as John Cage, Karlheinz Stockhausen, or Iannis Xenakis[4]) have invented compositional methods that are meant to affect their music's character or flow only globally, or simply to provide new ways of making interesting music.[5] While such theories may be highly influential among composers, they do not provide much substance for analysts interested in producing descriptions of how pieces go.

The rise of music theory in the 1960s as an autonomous musical discipline distinct from musicology or composition is marked by important studies of the structure and analysis of nontonal music.[6]

Idea: Selected Writings of Arnold Schoenberg, ed. Leon Stein (New York: St. Martins Press, 1975); Howard Hanson, *Harmonic Materials of Modern Music* (New York: Appleton-Century-Crofts, 1960); Milton Babbitt, "Some Aspects of Twelve-Tone Composition," *The Score and IMA Magazine* 12 (1955): 53-61; Babbitt, "Twelve-tone Invariants as Compositional Determinants," *The Musical Quarterly* 46 (1960): 245-59; Babbitt, "Set Structure as a Compositional Determinant," *Journal of Music Theory* 5/1 (1961): 72-94; Babbitt, "Twelve-Tone Rhythmic Structure and the Electronic Medium," *Perspectives of New Music* 1/1 (1962): 49-79; Babbitt, "Since Schoenberg," *Perspectives of New Music* 12/1,2 (1973): 3-28; Donald Martino, "The Source Set and its Aggregate Formations," *Journal of Music Theory* 5/2 (1961): 224-73; George Perle, *Twelve-Tone Tonality*; Daniel V. Starr, "Derivation and Polyphony," *Perspectives of New Music* 23/1 (1984): 180-257; Robert D. Morris, *Composition with Pitch-Classes: A Theory of Compositional Design* (New Haven and London: Yale University Press: 1987).

[4]See for instance Karlheinz Stockhausen, "How Time Passes," *Die Riehe* 3 (1959): 10-40; John Cage, *Silence* (Middletown, CT: Wesleyan University Press, 1961); Iannis Xenakis, *Formalized Music: Thought and Mathematics in Composition* (Bloomington, IN: Indiana University Press, 1971).

[5]Of course, some composers' methods may be intended to be heard as such, but are not, due to flaws in compositional thinking or to the use of such methods in ways that do not engage basic aspects of human psychoacoustical cognition.

[6]This includes George Perle, *Serial Composition and Atonality: An Introduction to the Music of Schoenberg, Berg, and Webern* (Berkeley: University of California Press, 1962); Allen Forte, "A Theory of Set-Complexes for Music," *Journal of Music Theory* 8/2 (1966): 136-83; Forte, *The Structure of Atonal Music* (New Haven and London: Yale University

Numerous analytic articles and books provide a rich, insightful, and diverse set of "case studies." After a generation of composers and theorists worked on developing and understanding various models of structure in twentieth-century music, the field began to affect undergraduate theory curricula.[7] Nevertheless, that there is only one ear training manual based on current atonal music theory concepts, Friedmann's *Ear Training for Twentieth-Century Music* (1990),[8] indicates the field of atonal music pedagogy is still young.

Distinctions between types of theories that affect pedagogy.

1. *Theories of Composition versus Analysis*

The study of atonal music is modulated by compositional and analytic use. While these two avenues may seem allied, they are actually quite different. A composer is interested in making his or her music original, even unique, suggesting that compositional theory is speculative. The primary concern is for general, open-ended principles of composition, not simply descriptions of how existing pieces are structured. On the other side, the analyst is not necessarily interested in how pieces might be made, but in how existing pieces can be construed. In the analyst's quest for appreciation of music's structural detail and its contribution to the style and essence of a particular piece, the use of theory may become too specialized for generalization to other pieces, much less to pieces not

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Press, 1973); a long series of important articles by David Lewin leading up to *Generalized Musical Intervals...*, as well as other literature.

[7]Examples of this trend include Charles Wuorinen, *Simple Composition* (New York: Longman, 1979), a textbook in twelve-tone composition; John Rahn, *Basic Atonal Theory* (New York: Longman, 1980); Joseph N. Straus, *Introduction to Post-Tonal Theory* (Englewood Cliffs, NJ: Prentice Hall, 1990) and "A Primer for Atonal Set Theory," *College Music Symposium* 31 (1991): 1-26; Michael L. Friedmann, *Ear Training for Twentieth-Century Music* (New Haven and London: Yale University Press, 1990); Robert D. Morris, *Class Notes for Atonal Music Theory* (Hanover, NH: Frog Peak, 1991); and miscellaneous articles on pedagogy in *Journal of Music Theory Pedagogy*, *In Theory Only*, and other periodicals.

[8]Ibid.

yet composed. Of course, the analyst is also concerned with understanding and/or constructing the relations and categories among pieces in a given repertoire.

As an outcome of these differences, the composer's use of theoretic tools differs from the analyst's. The composer begins work with a general idea of the composition to be made. The idea will be eventually realized, if often altered, in the compositional process. At the onset, many different realizations of the idea will be possible; as work proceeds, some of these potential realizations will be dropped and others may present themselves. Thus the compositional flow can be modeled by a move from the basic idea to one of the potential realizations—a one-to-many relation. This kind of relation is not deterministic. In contrast, the analyst confronts completed compositions and studies both the unique, individual aspects of a work as well as its relation to other works of similar or contrasting types. A given piece may be included in a more general type or be cross-related to a different type. The analyst therefore proceeds from a diversity of pieces through types up to a repertoire as a whole. This process often involves many-to-one (inclusion) associations. Such associations are mappings and are deterministic.

Thus the pedagogy of compositional theory must be distinguished from that of analytic theory. Compositional theory must always respect the indeterminacy of compositional choice—choices that remain open until the composition is completed. Analytic theory addresses the way in which extant pieces are related in a repertoire, often to an ideal piece or an archetype. While this difference separates the teaching of "counterpoint" from "form and analysis," there has been a steady move from a compositional to an analytic orientation in theory pedagogy, especially in core courses. Many years ago, both basic and advanced theory were taught by composers. Students progressed by writing first exercises, then compositions in specific styles.[9] With the rise of professional music theory in the 1960s, non-composer theorists replaced composers, often teaching

[9]Because of this sequence, courses in theory were prerequisites for free or original composition.

students to analyze music rather than to compose it.[10] While written exercises are used at the beginning of study, later on the activities are analytic and critical. Even the role of counterpoint in the curriculum has changed; it is no longer there to provide a basis for composition but to study the underlying principles of voice leading as an adjunct to doing reductive analysis.[11]

These changes probably reflect the fact that music theory is presently taught to *all* students in a music department or school, most of whom are performance majors. As a result, theory is devoted primarily to developing critical musical skills that relate structure and analysis to musical performance. This move has often placed less emphasis on developing advanced skills in ear training, sight singing and keyboard. While the emphasis on analysis has provided a larger place for the study of twentieth-century music in the core theory curriculum, training of the ear, voice, and hand in comprehending atonal music is often omitted. As a result, many students are convinced that atonal music is completely cerebral and not based on practical and audible (read "natural") relations among pitches and pitch-classes. This attitude is exacerbated by the formal and mathematical appearance of atonal theory and the lack of importance it places on other salient features of twentieth-century music such as rhythm and timbre.

The last point about "other parameters" in twentieth-century music cannot be addressed at any great length here, but some response is appropriate. While it is true that what helps makes new music new is its exploration of all the possible dimensions of music, much of the fuss concerns not music theory—the study of musical structure—but musical style and repertoire. Atonal music theory needs to address how new conceptions of and roles for rhythm, texture, timbre, and spatial location help or hinder pitch and pitch-class relations and vice versa. For instance, in tonal music there is "tonal rhythm," but what about "nontonal rhythm?" Can there be

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[10]Consequently, young musicians have little understanding of what composition is about, resulting in a potentially unhealthy separation between composers and performers.

[11]In fact, counterpoint is often not in the core curriculum at all, except as an upper-division course.

general concepts of harmonic-rhythm, timbral-rhythm, x-rhythm (where x is any musical dimension)?[12] A good deal of research into the question of other parameters has yet to be done.[13] Until then, when we have moved beyond labeling to function, there can be no general pedagogy of all dimensions of musical structure, comparable to what we can impart about pitch/pc and, to a lesser extent, about rhythm in twentieth-century music. And there's plenty to teach about atonal structure, even if its relation to other musical features is unclear or solely contextual. The reader should not take my remarks as attempts to avoid the issue. In surveys and especially aural skills classes, considerable emphasis should be placed on appreciating and accurately identifying the music's rhythmic, articulative, textural, and timbral attributes.

2. *Entity versus Transformational Theories.*

The previous discussion talked about pieces as if they were primarily objects or entities. On the other hand, many conceptions of composition and analysis consider pieces as processes, often teleological in character. The former conception sees the piece as objectively "out there" in some kind of "reality," while the latter regards pieces as intersubjective experience, both useful points of view. The various dialects of atonal music theory can be divided somewhat similarly. Some theories consider musical entities primary—notes, time-points and their grouping into sets: ordered, partially ordered, and so on. Other theories consider the relation *between* entities as primary: the intervals between notes, durations between time-points, etc. The transformational approach suggests the generalization of

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[12]Clearly, in twelve-tone music there is *aggregate-rhythm*, the velocity at which twelve-tone units turn over. Moreover, composer/theorists such as Messiaen, Hindemith, Schoenberg, and Babbitt, to name just a few, developed or invented ways in which musical time relates to and influences pitch and pitch-class structure.

[13]Contour theory seems to be a promising entrée into such matters; for an introduction to this field see Friedmann, "A Methodology for the Discussion of Contour: Its Application to Schoenberg's Music," *Journal of Music Theory* 29/2 (1985): 223-248; Marvin and Laprade, "Relating Musical Contours: Extensions of a Theory for Contour," *Journal of Music Theory* 31/2 (1987): 225-267.

intervals to transformations from one entity (or interval or transformation) to another. While a strict mapping of objective conceptions to entity theories and intersubjective conceptions to transformational theory is perhaps a bit too rigid, it is clear that this alignment of the two pairs is not counterintuitive. Nevertheless, a given piece may be addressed with either type of theory, although textural quantization is a determining factor.[14] Obviously, when the role of analysis is to appreciate how pieces go, then a transformational approach is relevant. An entity approach might be well suited for composition studies.[15]

3. *Formal and Informal Theories.*

In a discipline where courses called "music theory" are usually devoted to developing skill or technical know-how, assuming a "theory" that is never addressed as such, there is naturally some misunderstanding about what a theory is. When these confusions are joined with a more general misunderstanding and mistrust of science and mathematics, even the very term *theory* develops a number of negative connotations. Perhaps as an attempt to make theory more palatable, teachers often assert that some kinds of theories, deemed "informal," are more "user friendly" than others.

Actually, a formal theory has to show that all of its statements are truly derivable by logical rules from its basic, consistent assumptions, its axioms. The amount of detailed reasoning to do this even in relatively simple cases in mathematics is really beyond human ability; thus, most sophisticated and complex theories are actually informal, especially the so-called elegant ones, since they leave out many of the smaller logical steps in order to present the theory in

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[14]Not considering how and how much a piece is broken into parts can lead to a dilemma. Even if each part of a piece A can be described as a transformation of another, A may be still be experienced as a series of states or events. And conversely, a piece B might be described as a series of states, but be heard as a continual flow from one state to the next.

[15]A theory that places entities in a transformational, especially a teleological, context may not stimulate original use of musical materials. For this reason, knowledge of one's materials independent of any preconceived actual or potential use can be an important adjunct to making original pieces.

the most succinct way for experts.[16] It is assumed that such omitted statements will be inferred and supplied by the professional.[17] Most so-called "formal" theories are in fact informal to one degree or another.

For a general audience (including musicians and music scholars) what is probably meant by "informal" is a theory without mathematics, or even better, without technical terms and concepts. Such theories can exist, but they soon collapse due to their own weight. Imagine how difficult it would be to explain adequately the notion of interval-class without the aid of terms such as unordered, set, pitch-class, mod-12, interval, absolute difference. Of course, one could point to and elaborate on symbols in a musical score or listen to and discuss certain sounds, but this presupposes an expertise in score reading and/or musical dictation determined by a working, if not definitive, knowledge of the terms just listed.

It is also commonly supposed that a theory is a closed field of discourse, as opposed to non-technical discourse whose openness is conducive to the imagination. Nevertheless, no theory is ever complete; there are always more questions that the theory can raise, some of which become celebrated problems in the field. It is also commonplace to find ways in which well-established parts of the theory can be altered so as to connect them with other theories or simply to make them more elegant and direct.

In any technical field—and given the years of training it takes to develop musical skill, music is such a field— some degree of formality is useful, indeed necessary to proceed. Clear definitions, symbology, and rules of inference make precision possible. Of course, one can easily go too far in this direction. After all, music is already technical with its own terms, concepts, and notations, even if these

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[16]Even experienced readers have difficulty in following the logic by which statements in a mathematical proof proceed. Sometimes the means of derivation are given simply by asserting that statement B follows from statement A "by algebra."

[17]This makes reading the advanced literature of a technical field almost impossible for the novice, no matter how strong his or her motivation and intelligence. What is obvious for the expert is a matter of lore, learned by practicing the field.

are not well defined. The problem is that, while the traditional terms are clear enough to the expert in tonal music theory, they are useful in atonal music only if they are considerably adapted, refined, and supplemented with newer concepts and notations. I address such issues in the next section. And while I understand that reducing the mathematical aspects of atonal music theory to the absolute minimum has its advantages, the precision and generality gained by using a little high-school math will be appreciated later, regardless of student opinions about "formality."

But can we do without the math? There is a trend to teach undergraduates atonal theory with the absolute minimum of formal means; pcsets become chords, set-classes become harmonies, and so forth. To this end a lore of specific strategies has been developed[18] over recent years; I applaud this development in as much as it reduces gratuitous pretension and any attendant intimidation.[19] Nevertheless, the attempt to "introduce" a subject without technical fanfare will not help later when the student studies it in detail. Shouldn't any introduction to a field of inquiry, especially at the college level, be just that, not merely a simplification? Certainly theorists who teach tonal music do not simplify or avoid concepts such as "neighbor chord," "exchange of voices," "prolongation," and the like when they introduce tonal theory to undergraduates. (And there was a time when such concepts were controversial or deemed too difficult to teach in the core.) Still it will be argued that the formal/mathematical aspects of atonal music theory are simply too much for the average undergraduate, especially a music student, to learn. Aside from the patronizing flavor of such views, the

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[18]For instance, set-classes are learned by association with particular pieces ([014] is the opening of Béla Bartók's *Music for Strings, Percussion and Celesta*; [026] is the beginning of the same composer's *Concerto for Orchestra*, fourth movement). Or to find the ic of a pitch-dyad, just reduce the size of the dyad by any number of octaves until the dyad is as small as possible and count the semitones.

[19]Joseph Straus's pedagogically oriented article "A Primer" probably goes as far as one can in reducing intimidating detail while preserving intelligible discourse. While the article is "adapted" from Straus's textbook, *Introduction to Post-Tonal Theory*, it succinctly describes the history and state of reseach in "set theory" and provides many useful citations to the technical literature.

most cursory examination of the textbooks for "average students" in other fields—in sociology, psychology, economics, foreign language, for instance—will make it plain that such disciplines are not loath to carefully define symbols and formulas, and demand that students follow complex chains of reasoning and memorize key terms and their applications as part of the *introduction* to their subject.[20] Even so, some will still object to "formalism" in music study as a necessary evil at best, and perhaps they are right in the largest scheme of things. For success in teaching is achieved when the student has gone far beyond cognitive competence and the subject has become "second nature." Such transparent mastery does not come easily; it is nurtured by clarity of presentation and purpose, supported by diligent practice and drill. In the end, there are no shortcuts.

Specific Recommendations

Up to now, I have been interested in differentiating types of theories and their applications. The following recommendations are designed to facilitate the teaching of atonal theory in composition classes and tutorials, and in analysis classes. I also consider them suitable for use in musicianship programs and workshops, and in undergraduate core music theory curricula. Exactly how these suggestions will be used depends on the instructor, the level of the students, the nature of the course, and the music speciality addressed. But no matter what the pedagogical intention, a balance of calisthenic exercises, readings and practice in analysis, and some composition and improvisation will help imbue the student with a healthy attitude toward atonal music and its literature.

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[20]My own experience teaching elements of atonal theory to high school students (at the Governors' School of Pennsylvania, summers of 1976-9) and music undergraduates (at the University of Pittsburgh and The Philadelphia University of the Arts) has been most encouraging. Most of the students found the field challenging but not overwhelming; many of them enjoyed learning about pitch-class structure in new music.

Terminology and Notation

Several different notations for what are essentially the same concepts have arisen in the literature. Amidst this surfeit, two approaches are readily identified: those associated with work accomplished in the 1950s and 60s at Princeton and at Yale Universities. The Princeton contribution was slightly earlier, somewhat composer-oriented, and found its focus in the study of the twelve-tone system. The Yale "school" was primarily analytic in orientation, originally concerned with the pre-twelve-tone but post-tonal music of Schoenberg, Berg, and Webern and other contemporaneous composers such as Stravinsky.[21] There were also a few individuals working outside of these two factions, such as George Perle and Howard Hanson.

Although the field is much more homogeneous now, three strains of terminology have persisted: from Princeton, Yale, and beyond. Table 1 lists some of the correspondences in terminology among the Princeton, Yale and "other" orientations. As the reader can see, terms that are equivalent in mathematics and/or logic are differentiated ("set" versus "collection"); other terms are conflated ("set-class"); one basic term overlaps ("set"). With only a few exceptions, I take the view that students should be familiar with all generally used terms, even if they are redundant. This familiarity helps promote better communication among theorists working within different traditions of research. A certain degree of flexibility of terminology is also useful to prevent rigidity from creeping into discourse. Even so, it is better to teach using the terminology of one approach as primary so that the terms will be properly associated within the orientations of older research.

[21]While Rahn's *Basic Atonal Theory* of 1980 and Straus's *Introduction to Post-Tonal Theory* of 1990 present a somewhat hybrid approach to atonal theory, the two still reflect their respective origins in the Princeton and Yale orientations.

Table 1. Correspondences in terminology

Princeton	*Yale*	*"other"*
ordered interval	interval	
unordered interval	interval-class (ic)	
collection	set	pcset, cell
collection-class, set-type	set-class	
normal-form representative	prime-form	
set	row	series
set-class		row-class
symmetry	invariance	

Below I make various recommendations on terminology and notation.[22]

Names of pcs: The convention is to use integers (mod-12) for pcs. If 10 and 11 are used for A-sharp/B-flat and B-natural, lists of pcs need to be separated by commas to distinguish 10 (ten) from 1 0 (one, zero), for instance. To avoid the commas, letters for numerals have been proposed: ten is denoted by A, a, t, or T; and eleven is denoted by B, b, e, or E.[23] Although I introduced the A, B notation (in 1974 with Daniel Starr)[24], the t and e are easy to remember, and

[22]My suggestions that certain symbols, terms, and notations be employed in atonal theory pedagogy does *not* spill over into original research in the theory and analysis of twentieth-century music. Far be it for me to assert in advance how my colleagues should conduct their research!

[23]a and b are used only in certain computer programs. T and E are used solely by Straus in *Introduction*. X and Y have also been used as pc constants, but I discourage this since X and Y are so frequently used as variables.

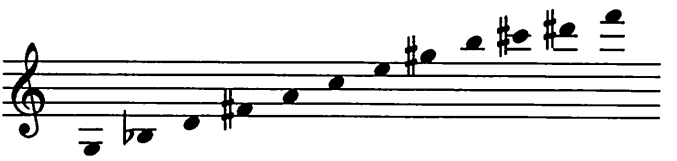
[24]See Morris and Starr, "The Structure of All-Interval Series," *Journal of Music Theory* 18/2 (1974): 364-388.

do not get confused with A and B as pitch-class letter names or with names of sets.

Some theorists have used letter names (such as A#, D♭, and the like) for pcs. This convention is used not only to reach out to those in other musical disciplines by avoiding a mathematical appearance, but also has a useful function in transformational theories. It indicates that the pcs are not the members of (or isomorphic to) a mathematical group, but are musical things that get transformed under musical transformations. While I am in great sympathy with transformational theories, the problems of enharmonic equivalence and the difficulty in reading longer strings of these symbols weighted against the facility of pc integers in more advanced contexts (such as the construction and use of *invariance matrices*) argue against letter names for pcs.

I generally discourage the use of staff notation for pcs, even though it is sometimes employed by major theorists and/or composers such as Babbitt and Wuorinen. Notes on a staff can easily lead students to confuse pcs with their realizations. For instance, I often begin the discussion of the pitch/pc distinction for composers with Example 1 written on the blackboard. I ask what is written on the board. The correct answer is not "the row" of Berg's *Violin Concerto*, but "a (pitch) realization" of Berg's row.[25]

Example 1. A realization of the row of Berg's *Violin Concerto*



[25]While on the subject of teaching the pitch/pc distinction, it is very important to show that every melodic presentation of a pcset is ordered in not just one, but in at least two dimensions, usually pitch and time. This observation leads directly into the discussion of musical contour, since a contour is the ordering of elements according to two or more dimensions.

Variables and constants: Capital letters, with or without subscripts or superscripts, are used to denote both sets and operations. Set and operator variables should avoid the following letters which are constants: A (a pc), B (a pc), I (inversion operator), M (multiplicative operator), O and P (classical row names), R (retrograde operator), S (classical row name or set), T (transposition operator), e (a pc), t (a pc). Be aware that: r (with subscript) has been used as the rotation operator; E (with subscripts) is often used as the name of an array or matrix; F, G, H, K are often used as operator variables.

Set and operator (transformation) names: These should be notationally differentiated. The standard is left autography: the notation of a set and its transformations is written so the name of the set is on the right and the series of transformations on the set is listed from right to left.[26] For example, T_5IRX indicates that the set X is first retrograded, then inverted, then transposed by 5. The reasons for adhering to this convention are many. For instance, while a subscript n on a set name locates the nth element of the set[27], a subscript on a operator name designates specifics of the operation. Thus we avoid the standard but unfortunate row labels such as P_5,[28] R_4,[29] I_7,[30] RI_3 to indicate what is properly notated as T_5P, RT_4P, T_7IP, RT_3IP.[31]

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[26]In general usage, T_n stands for pitch-class transposition and T_nI for pc inversion followed by pc transposition. In specific cases, the subscript in the transposition operator stands for the interval of transformation (as in T_3, for instance). Sometimes, in more formal discourse, the subscript can be a mathematical expression (as in $T_{(5+b)}$ or T_{-n}, where b and n are variables).

[27]Elements of a set can be notated with subscripts starting from 0 or from 1; the convention employed should be announced up front.

[28]P_5 would stand for the fifth element of P.

[29]The R operation doesn't take a subscript. In addition R_4 is ambiguous. In the literature, R_n might mean either the retrograde of T_nP or the transposition of RP that begins on pc n.

[30]I_7 has been used as an operator label equivalent to our T_7I. This has merit in more advanced contexts where I_7 is a member of the mathematical group of pc operators since, in general with the notation T_nI, a single operator in the group has to be notated as a concatenation of two operators. On the other hand, there are analytic contexts where it is preferable to use IT_n rather than its equivalent, $T_{-n}I$; operators of the form I_n will not allow this option.

[31]The separation of the operator from the name of the row P also allows us to identify more than one row-class (a row and its 48 transforms)

Set-theoretic Notations: The following concepts and notations should be introduced at an early stage.

∪ union	∩ intersection
⊂ set inclusion	∈ membership

' complementation (i.e. A' is the complement of A)

Brackets: Another useful convention involves the use of different kinds of brackets for different functions.

{ and } surround unordered sets.
< and > surround ordered sets.
[and] are used in special cases such as interval-vectors or set-class names.
(and) are used in mathematical (set-theoretic) expressions and functions.

Brackets can help show certain kinds of pc constructs.
A partition of the aggregate into major or minor chords:

{ {047} {259} {6t1} {8e3} }

The set-class 4-9[0167]:

{ {0167} {1278} {2389} {349t} {45te} {056e} }

Partially ordered sets (posets) can be also be notated readily. Below we have the poset Z consisting of an ordered set starting with an unordered set (pcs 0 3 and 5), followed by an unordered set comprised of two ordered sets (5 followed by 4; 2 followed by 1), finishing up with the ordered set t e.

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in a given analytic context. So if a piece uses, say, two independent twelve-tone rows, we can refer to these as P and Q and distinguish RT_5P from RT_5Q.

Z = < {035} { < 54> <21> } < te> >

Some sequences of pcs that satisfy Z follow:

3055214te 5035421te 0532514te 0355241te

Set-classes: The concept of a set-class (set-type, or collection class) can take at least three forms. A set-class is: (1) the set of all pcsets that are related by T_n and/or I; (2) a type (of pcset) having tokens related by T_n and/or I; (3) any member of a group of sets related by T_n and/or I. The first interpretation—a set-class is a set of pcsets—is preferred for the following reasons. First, the normal-form representative (prime-form) is shown to be only an arbitrary member of the set-class, fixed by an algorithm which, operating on any pcset in the set-class, returns the representative.[32] Second, the nominal nature of the definition avoids considering the set-class as a Platonic object. Third, such confusions as T_5(3-5) (or alternatively T_5[016]) are avoided. Fourth, the definitions of abstract inclusion and complementation are easily defined. Fifth, the definition implies that hearing set-classes is not a matter of identifying a particular collection of pitch-classes, but of identifying intervals (and their configurations) in the realizations of pcsets in pitch and time.[33]

A clear distinction between pcset and set-class allows one to separate pcset inclusion and complementation from set-class inclusion and complementation. I have called the former *literal* and the latter *abstract*. I provide the definitions below:[34]

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[32]One typical problem one often sees in the work of novices is exemplified by the statement "The pcset {567} found in m.5 is the T_5 of the prime-form of set-class 3-1[012]." It is irrelevant to note such a relation, especially when the pcset {012} never appears in the composition analyzed.

[33]In class, I encourage locutions such as "{129} in m.5 is a member of set-class 3-4[015]," as opposed to "set-class 3-4[015] occurs in m.5."

[34]Note that these definitions apply for all kinds of set-classes (see below).

Let X and Y be pcsets. XX and YY are set-classes. U is the set of all pcs, the aggregate, and {} is the empty set.

(1) X is *literally included* in Y if every pc in X is also in Y ($X \subset Y$).

(2) XX is *abstractly included* in YY if $X \in XX$, $Y \in YY$, and $X \subset Y$.

(3) X is the *literal complement* of Y if $U = X \cup Y$ and $\{\} = X \cap Y$.

(4) XX is the *abstract complement* of YY if $X \in XX$, $Y \in YY$, and $Y = X'$.

Literal and abstract relations can be extended to similarity relations.

The name of a set-class takes two forms. The Rahn (Princeton) name is a set-class's normal-form representative, while the Forte (Yale) name is more arbitrary, derived from the position of the set-class on Forte's list.[35] I strongly suggest theorists use both names at once in identifying set-classes. For instance, rather than using [012367] or 6-5 alone, use 6-5[012367]. This will allow theorists from both the Princeton and Yale approaches to follow the theoretical argument.

Each of the two styles of set-class names has its advantages. The Rahn name provides the user with an example of a member of the set-class. This is very useful in the early stages of pedagogy and for this reason Rahn's names for the twelve trichordal set-classes probably should be the standard. Forte's names have different advantages. The name of a set-class is coordinated with the name of its abstract complement; thus the set-class 5-3 is the abstract complement of the set-class 7-3.[36] The Rahn names for these set-classes,

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[35]See Appendix 1, "Prime Forms and Vectors of Pitch-Class Sets," in Forte, *The Structure*, and Table II, "T_n/T_nI-Types of Sets," in Rahn, *Basic Atonal Theory*. Similar tables are available in Morris, *Composition* (Appendix One, 313-19) and *Class Notes* (Appendix 1: "Set-Class Table," 105-111) and in Straus, *Introduction* (Appendix 1 "List of Set Classes," 180-183). The latter reference has another set-class table (Appendix 2 "Simplified Set List," 184-214), which lists all pcsets from three to nine pcs in ascending order with their set-class affiliations. My worries about the use of computer software to look up the set-class of a pcset also apply to this list (see note 56).

[36]Unfortunately, since Z-related hexachords are mutually abstract complements, Forte's hexachordal names do not indicate abstract complementation. For instance, 6-6 and 6-38 are abstract complements.

[01245] and [0123458], do not easily indicate their abstract complementarity. And while Rahn's labels are useful for set-classes whose members have few pcs, they become cumbersome with set-classes containing pcsets with six or more pcs. For instance, the Rahn names [013468] and [013568] might easily be confused, where the corresponding Forte names, 6-24 and 6-25, are easy to distinguish.[37]

I also prefer to use Martino's labels, the letters A through F, to designate the six all-combinatorial hexachords; thus,

A = 6-1[012345]
B = 6-8[023457]
C = 6-32[024579]
D = 6-7[012678]
E = 6-20[014589]
F = 6-35[02468t]

While set-classes are based on T_n and I relations, other kinds of set-classes can be constructed for certain purposes and occasions.[38] The canonical group[39] need not be only the set of T_n and T_nI operations; it can be T_n alone, or T_n, I and M together, or other, non-distance-preserving operations such as Mead's O_z,[40] or even T_0 and T_6 alone.

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[37]Some theorists have objected that one has to memorize Forte's table of set-classes just to make use of his names. It is true that Forte's names provide no information to help identify the members of a set-class. On the other hand, his short names are easily communicated. The same reasoning explains the common use of Martino's designations A-F for the six all-combinatorial hexachordal set-classes.

[38]Hanson in *Harmonic Materials* and Forte in his article "A Theory of Set-Complexes" proposed the following definition of set-class: two pcsets A and B are in the same class if the interval vector of A is the same as the interval vector of B. This collects Z-related set-classes into one class. The intuitive appeal of this kind of equivalence is counterbalanced by certain problems that arise associated with abstract inclusion.

[39]*Canonical group* is Lewin's term for the mathematical group of operators that defines the relation among members of a set-class. See Lewin, *Generalized Musical Intervals*,104.

[40]See Andrew Mead, "Some Implications of the Pitch Class/Order Number Isomorphism Inherent in the Twelve-Tone System: Part One," *Perspectives of New Music* 26/2 (1988): 96-163.

Invariance: This term indicates the case where, given a pcset X and an operation H,

X = HX.

Rahn's function,[41] which I call *degree of invariance*, borrowed from group theory, is a valuable tool.[42] The degree of invariance of a pcset Y, written D_Y, is the number of operations that keep Y invariant. The number of pcsets in a set-class including pcset Y is D_Y divided by the number of operations in the canonical group.

I usually avoid the noun *invariant*, presumably meaning a pc that does not change under a particular operation, or the locution "operation so-and-so holds the pcs x, y, etc. invariant." While there are pcs that do not change under some T_nI operations (such as pcs 0 or 6 under T_0I), "invariant" is too often used to refer to pcs as in the following statement: "under T_6, pcs 1, 4, 7, and t are the invariants." Now, while it is true that the pc*set* {147t} is invariant under T_6, the individual pcs *do* change: 1 becomes 7, 4 becomes t, etc. So, strictly speaking, there are no "invariants." And the locution can be easily fixed: rather than saying "T_6 holds the pcs 1, 4, 7, t invariant," say "T_6 holds the pcset {147t} invariant."[43] Perhaps all of this sounds a bit pedantic, but if students are to go on to study the cyclic representation of operators, cyclic adjacencies, and/or Lewin's injection function, attention to these distinctions will help pave the way.

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[41]He calls the function *degree of symmetry*. See Rahn, *Basic Atonal Theory*, 90. I usually avoid the term "symmetry," although it is roughly equivalent to invariance in some group-theoretic contexts. One reason is that symmetry often implies mirror symmetry in pitch and there is a class of pcsets that cannot be realized in pitch with a one-to-one correspondence from pitch-class to pitch.

[42]For example let Y be {02468t}. Y is a member of the whole-tone scale, invariant under T_0, T_2, T_4, T_6, T_8, T_t, T_0I, T_2I, T_4I, T_6I, T_8I, T_tI. Since there are twelve operations that keep Y invariant, $D_Y = 12$.

[43]Another instance of this misconception occurs in twelve-tone theory, where students often talk about the "invariant pcsets" in a row. For instance, given P = <02354768t1e9> and T_5IP = <53201te97468>, the sets {0235}, {4678} and {19te} are called "the row's invariant sets," "row invariants," or some such because the pcsets are found contiguously in both rows. Rather, only {0235} is invariant under T_5I, the other two sets mapping onto each other under the operation. This explains why and how the relative positions of the three pcsets in P permute under T_5I.

Similarity Relations: These are various methods of comparing aspects of the sonic similitude between pcsets, usually of different set-classes. Beyond the following remarks, I refer the reader to articles by Rahn and Isaacson for material on the published similarity relations and their roles in composition and analysis.[44] The basic problems with the more refined measures of pcset similarity is that, even for just two pcsets, a fair degree of calculation is necessary to establish a specified degree of similarity. On the other hand, the simpler methods of determining similarity with a minimum of hand calculation have certain methodological problems. Nevertheless, the practicality of these easy methods makes them somewhat useful for at least pilot studies.[45]

When teaching similarity, the distinction between equivalence-relations (underlying the definition of set-class) and similarity-relations should be made clear.[46] Working out similarity networks among various set-classes provides interesting and useful projects.

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[44]See Rahn, "Relating Sets," *Perspectives of New Music* 18/2 (1980): 483-502 and Eric J. Isaacson, "Similarity of Interval-Class Content between Pitch-Class Sets: The IcVSIM Relation," *Journal of Music Theory* 34/1 (1990): 1-28 for reviews of other similarity measures. (I must point out two problems in Isaacson's otherwise useful paper: (1) My ASIM measure is SIM divided by the number of ics (not pcs) in the two pcsets compared (p.5); (2) The measures of Rahn and Lewin are properly performed using total abstract subset content rather than with only the ics of the pcsets compared (pp.8-13).)

[45]I am thinking of Forte's R_n and/or my SIM measures here. (See Forte, *Structure*, 46-60 and Morris, "A Similarity Index for Pitch-Class Sets," *Perspectives of New Music* 18/2 (1980): 445-60.) A combination of both pc and ic intersection as a criterion of similarity provides a decent gauge of pcset/set-class similarity. (Such a tack is taken in Forte's *Structure* in Appendix 2 "Similarity Relations," 182-99; he assigns similarity on the combination of his Rp with his R_1, R_2, and/or R_0 measures.) In any case, some similarity measures for ordered sets of pcs are given in Morris *Composition*.

[46]Equivalence and similarity relations are symmetric and reflexive, but only the former is transitive; in other words, X is not necessarily similar to Z even if X is similar to Y and Y is similar to Z. One could also introduce partial orderings as a third class of relation (reflexive, antisymmetric, and transitive). Partial ordering relations bridge the gap from (totally) ordered to unordered sets and model set/set-class inclusion and twelve-tone ordering among combinations of rows. Incidentally, genealogical relations make good examples for teaching these concepts. For instance

Notation of Ordered Sets and Order Relations: Although pcsegs are easily notated, in serial theory certain abstract relationships between and among rows and other ordered sets become awkward. For instance, if we wish to talk about the pcset formed by the pcs at order numbers 3, 5, and 7 in the row W we must write $\{W_3\ W_5\ W_7\}$—precise but awkward. Andrew Mead has defined a few conventions that are helpful in such cases.[47] Given a serial entity, S, we can identify the pcs at order numbers in S by listing the order numbers alone and writing them in boldface (or in written work, with underlines). Our example with row W would be written {**357**}. Order operations that are isomorphic to pc operations are noted in boldface as well so that, for instance, $\mathbf{T_n}W$ denotes order number transposition, the rotation of W starting with the pc in W's (12–n)th order position and wrapping around until we end with the pc in W's (12–n–1)th order position.[48] **TeI** is equivalent to the R (retrograde) operation, and so forth.

In general, Mead begins with Milton Babbitt's original definition of a row: a set of twelve couples (ordered sets) of discrete order numbers and pitch numbers.[49] The row of the Berg Violin Concerto would be written:

{ <**0**,0> <**1**,3> <**2**,7> <**3**,e> <**4**,2> <**5**,5> <**6**,9> <**7**,1> <**8**,4> <**9**,6> <**t**,8> <**e**,t> }

Mead then defines two aspects of a row: a *pitch-row* and an *order-number row*. A pitch-row is the traditional way of writing a row: the pcs are written according to their ascending order numbers; an order-number row writes the order numbers according to their pcs in ascending order. As an example, the preceding row is written in both aspects.

"Father of" is a partial ordering; while "In the same family of" is an equivalence relation, "Sibling of" is not, since it is symmetric and transitive but not reflexive, and so forth.

[47]See Andrew Mead, "Some Implications...:Part One."

[48]$\mathbf{T_n}$ is equivalent to the rotation operator r_n.

[49]While it is an historical accident that Schoenberg called his "Reihe" a "set," Babbitt's formalization *is* a set, since his definition as given above is a set (unordered) of ordered couples.

Pitch row: <037e2591468t>

Order-number row: **<07418592t6e3>**

Mead's notations are extremely useful in studying partitions of pc or order numbers. For instance, the following order-number partition applied to Berg's violin concerto row yields a corresponding pc partition and vice versa; this order-number partition is used at the opening of the piece (G-natural is pc 0).

{ **{0246}** **{1357}** **{89te}** } ↔ { {0729} {3e51} {468t} }

Hearing and identifying pcsets and set-classes

I now turn to the second part of this paper, a subject of utmost importance if atonal theory is going to have any real impact on the musical habits and sensibilities of its hearers. Certainly one can get used to the "sound" of atonal music and really develop a taste for it; the question is whether the relations among its pitches and pitch-classes can have a degree of correspondence comparable to the function that pitches and pitch-class relations hold in tonal music. If not, then perhaps atonal theory is only for specialists. Judging from the statements of composers committed to and experienced in atonal music composition, pitch and pitch-class relations are both hearable and essential to the understanding and appreciation of this music, in ways that resemble and/or contrast with older music. Based on my own teaching experience, students with good, but not outstanding musical ears, can learn to hear and respond to things atonal so as to follow an atonal composition's progress by ear to some extent.[50] But I am also concerned with the development and mastery of advanced hearing skills that are needed for those student composers, theorists, musicologists, and musicians who might special-

[50]Of course, listeners to any kind of music aurally pick up much more than what they can articulate with some sort of technical musical discourse. I believe that teaching musicians to be able to identify and name what they have already perceived but cannot yet discuss expands the scope and depth of what they can perceive.

ize in twentieth-century music. I am further convinced that those students who have evidenced superior aural skills in tonal music can achieve equivalent degrees of expertise with atonal music.[51] To this end, I will provide an outline of various grades of difficulty of aural and visual identification of set-classes.

Much of what follows is certainly influenced by Michael Friedmann's excellent textbook, *Ear Training for Twentieth-Century Music*, cited in note 7. I recommend this book highly to anyone who wishes to teach atonal ear training to undergraduates. I should also say that my present concern (identifying set-classes and transformations) is only a subset of what Friedmann sets out to accomplish and that my methods sometimes differ from his. Although I shall identify the most important differences as I proceed, I consider my recommendations to be supplements to, rather than replacements for, his ideas.

Perhaps the greatest stumbling block in learning to hear set-classes[52] derives from the way students are usually taught to identify to which set-class a given pcset belongs. For instance, when presented with the pcs {50t291}, the task is to determine its set-class.[53] There are two basic ways: use a "normal-form" algorithm,[54] or derive the interval-vector of the pcset and look it up on a table.[55] While the second method appeals to me more (since it involves profiling the interval-class spectrum that the pcset shares with other members of its set-class), with larger set-classes both methods involve

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[51]Nor do I believe that absolute pitch is a necessity in advanced atonal ear training. Since atonal pitch and pc relations are based on ordered and unordered intervals, a good sense of relative pitch is sufficient.

[52]Of course one cannot "hear" a set-class. A set-class is a set of pcsets. It should be clear that the skill I am after involves determining to which set-class a heard pcset belongs. One assumes that it is possible to tell that two heard pcsets are or are not members of the same set-class without naming the class.

[53]The answer is 6-14[013458].

[54]Using Forte labels alone, the normal-form (actually "best normal-order") transposed to begin on pc 0, the "prime form," is not the set-class name. One must look the prime form up on Forte's table to get the Forte name.

[55]This method is not altogether direct since the pcset might be a member of a Z-related set, so one has to choose between two entries on the table.

calculations that most of us find difficult to do in our heads. Such methods are better used in computer programs. Indeed, I rarely use either method.[56]

What other musically relevant ways are there to identify set-classes quickly? The answer is probably obvious; learn first to identify the six interval-classes (the set-classes whose members are pcsets of two pcs), then go on to memorize the trichords. Set-classes with pcsets including more than three pcs can then be identified by their abstract ic and trichord content. Two problems arise. (1) How to organize the move from smaller to larger pcsets and their set-classes? (2) How to identify a set-class in all of its manifold pitch and temporal realizations and environments? I shall take up (2) first.

The basic problem is hearing and identifying interval-classes in all manner of musical passages. Fortunately, the pedagogy of tonal ear training and sight singing provides some experience in identifying and producing intervals. Nevertheless, much time and energy should be allocated to aural identification of both ordered and unordered intervals as presented as pitch pairs (in time). Exercises[57] such as those in Example 2 will prove useful.[58] These can be done as aural or written exercises. Since timbre is so important in twentieth-century music, the instructor/auditor might aurally present the

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[56]There are of course a number of useful programming packages for automating various atonal music tasks such as the CMAP utilities by Alexander Brinkman and Craig Harris. And it is relatively easy to write a simple program that will identify the set-class of a pcset. Nevertheless, too early a reliance on such programs will indefinitely delay the internalization of set-class identification, contributing to a lack of confidence in the value of atonal pitch/pc relations in music.

[57]While the examples or exercises I have provided were composed for this occasion (primarily to avoid a plethora of permission notices), most of the music for these tasks can be culled from the literature. As I comment later, teachers of atonal theory need anthologies of twentieth-century music written by major composers selected and balanced for pedagogical goals.

[58]The reader will note that some of the examples have more than two pitches. Exercises involving pcsets of more than two pcs should also involve octaves and unison "doublings." Simultaneous pitch-class duplication is often employed even by composers such as Schoenberg and Webern despite prohibitions against octaves found in their writings and lectures.

exercises with a multi-timbral synthesizer ("keyboard") perhaps using sampled instrumental sounds. The student should be asked to sing and play (on any instrument) intervals and ics, at first freely, then with the instructor providing the first, last, top or bottom pitch of the ic to be realized.[59] Once mastery in ic identification is secured, one can go on to larger pcsets. Examination of their interval (class) vectors will become meaningful to the student who can hear ics.

Returning to problem (1) above, I will plot a series of five stages leading to the identification of *all* the hexachordal set-classes. The first two stages are basic, the next two intermediate, and the last advanced.

Stage 1. The identification of pc intervals and ics as just described.

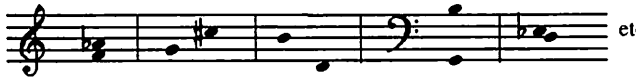
Stage 2. The aural and written identification of the twelve trichordal set-classes.

> Command of this stage provides the basis for competency with atonal materials. While the ability to detect ics in different pitch and temporal realizations will be of great help, the vast number of realizations of the pcsets from one set-class needs to be addressed. One might begin with trichords confined to small pitch ranges, then expand in width gradually to two octaves, a width which will accommodate the vertical ordering of the pcs in any trichordal pcset.
>
> To those students who have taken courses in tonal theory, several trichordal set-classes will be familiar: 3-10[036], the diminished triads; 3-11[037], the set of major and minor chords; and 3-12[048], the augmented triads. In addition, the chromatic trichord, 3-1[012] and the trichord 3-6[024], the first three notes of any major scale, will be easy to remember. Of course,

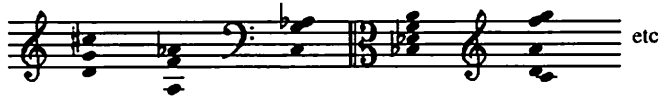
[59]Friedmann's Exercises 2.1 through 2.17 extensively drill visual and aural recognition of interval-class (called by him and Rahn, unordered pitch class interval), as well as the range of realizations of interval-class in pitch space (pp.9-21). My Examples 2a and 2d are in the style of his Exercises 2.12 and 2.17, respectively.

Example 2. Exercises in identification of interval classes

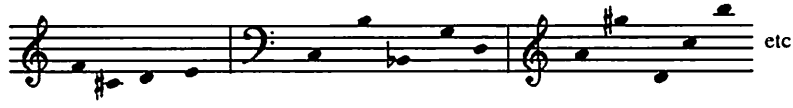
2a. Identify the ics. (Each example is played once.)



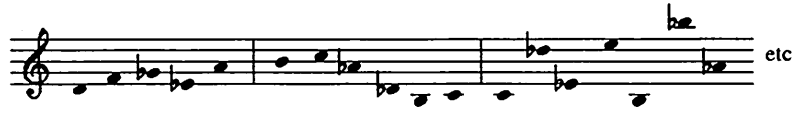
2b. Identify the ics between the top (bottom) two notes of each chord.
(Each example is played 3 times.)



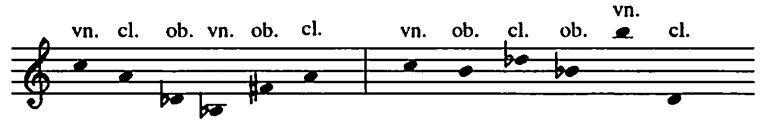
2c. Identify the last (first) ic of each melodic sequence.
(Each example is played once.)



2d. Write down the succession of ics in the melodic sequences.
(Each example is played 3 times.)



2e. Identify the ic in the violin (oboe, clarinet)
(Each example is played twice.)



"unorthodox" pitch spacings, doublings, and orderings of the pcset members of these set-classes will still present problems.

One way to further differentiate the trichords and their pitch and time realizations is to divide them into the nineteen T_n-type set-classes. 3-1[012], 3-6[024], 3-9[027], 3-10[036] and 3-12[048] remain the same, but the other seven trichordal set-classes divide into a pair of T_n-type set-classes each containing pcsets related only by transposition; thus, 3-2[013] divides into 3-2a[013] and 3-2b[023] and so forth. (3-11 divides into 3-11a[037] containing only minor chords and 3-11b[047] containing only major chords.)

Yet another way to differentiate trichords involves the construction of what we may call *twelve-tone figured bass*. For our present purpose, we define a *fb-class* of pitch-sets. Each trichordal fb-class includes sets of (at least) three pitches. Each pitch-set in a fb-class is defined by (at least) two intervals: the ordered pc-interval from the lowest pitch to the second lowest; and the ordered pc-interval from the lowest to the highest. All trichordal pitch-sets in a fb-class have the same two pc-intervals "above the bass."[60] The name of the class is the listing of the two defining intervals (in order);[61] thus, 45 is the name of the fb-class that has two pitches at any pitch realizations of pc-intervals 4 and 5 "above" the pc of lowest pitch (or bass). Some members of 45 are given in Example 3.[62]

It is easy to show that the pcsets in any trichordal set-class may be realized as m distinct fb-classes. In the following

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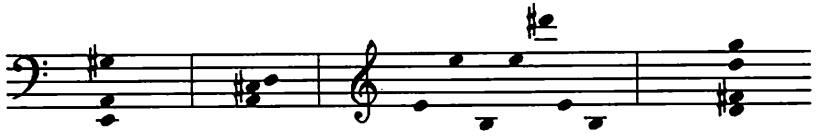
[60]Once the pc of the lowest pitch (the bass) is given, the pcs of the other two pitches have been determined.

[61]The name of one fb-class associated with the realizations of the pcsets in a set-class is the Rahn name of the set-class without the initial zero. For instance, 12 is a fb-class that can be realized by a pcset member of 3-1[012]. Of course, a zero in the fb-class indicates an obligatory (octave) doubling of the bass.

[62]Friedmann further differentiates trichordal realizations in pitch with his *rip* (registral pitch interval series) construct. A rip of a trichord is the set of its pitch realizations that are transpositionally equivalent in pitch. The underlying concept is equivalent to a pitch T_n-type set-class. Rip is the same as Morris's SP (spacing) of a pitch set. See *Composition*, 54-5.

Example 3. Members of the fb-class 45



formula for m, Y is any member of the set-class and D_Y is the degree of invariance of Y.[63]

$$m = 6 / D_Y$$

From the formula, seven of the trichordal set-classes can be realized as members of six fb-classes. For instance, 3-11 can be realized as the fb-classes: 37 49 58 47 38 59. These correspond to the traditional 53, 63, and 64 figured basses of minor and major chords respectively. Pcsets that have (only) T_nI-invariance have a degree of invariance of 2 so that there are only three fb-classes associated with them. This involves four trichordal set-classes. For example, the three fb-classes associated with 3-6[024] are 24, 2t, and 8t. Finally, 3-12[048] has a degree of invariance of 6, involving both T_n- and T_nI-invariance; thus it has only one fb-class, 48.

Aural and written drill can involve the fb-classes associated with a trichordal (or other) set-class. A few simple exercises are shown in Example 4.

Still another strategy for learning the trichords involves contrasting highly different set-classes and working up to more similar ones. For instance, one could start with 3-1[012] and 3-11[037] and then add 3-6[024]. A good set of contrasting set-classes (of pcsets of any cardinality) is the maxpoint sets.[64] For trichords these are: 3-1[012] maximizing ic 1, 3-6[024]

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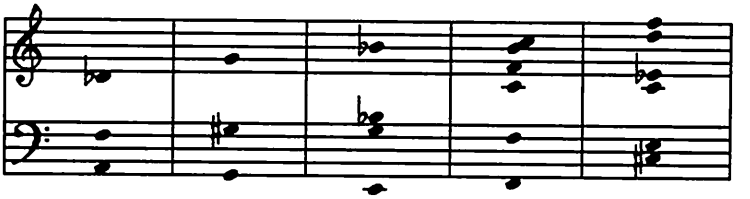
[63]The general formula for any set-class is 2 * #Y / D_Y. (Two times the cardinality of Y divided by the degree of invariance of Y.)

[64]A maxpoint set (pcset) is a set that maximizes a given interval class for its cardinality. See Tore Eriksson, "The IC Max Point Structure, MM Vectors and Regions," *Journal of Music Theory* 30/1 (1986): 95-111.

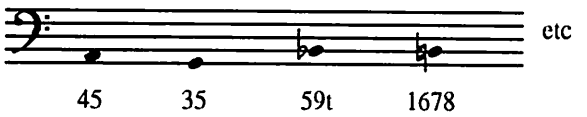
Example 4. Exercises in fb-classes

4a. Identify the fb-class of the following chords.



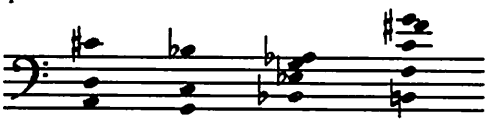
answers: 48, 01, 36, 67, 1234e

4b. Realize the fb-classes above the given notes.

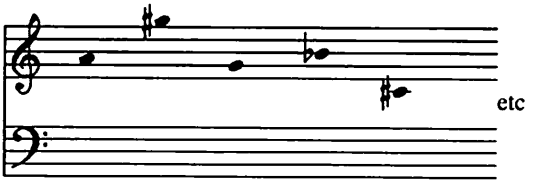


45 35 59t 1678

possible answers:

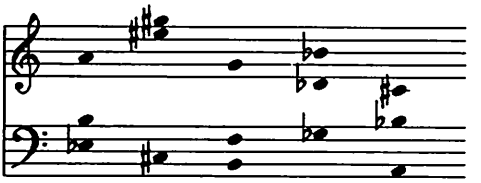


4c. "Harmonize" the following notes with the fb-classes given.



68 47 68 47 14

possible answers:



maximizing ic 2, 3-10[036] maximizing ic 3 and ic 6, 3-12[048] maximizing ic 4, and 3-9[027] maximizing ic 5.[65] Incidentally, these five set-classes are the ones whose pcsets have T_nI-invariance.[66] In essence, the student will have to learn to identify the trichords without relying on calculation, on their "sound" alone. Cognitive aids such as listening for the presence or absence of particular ics can help at initial stages, but in the end, the response should be as automatic as identifying ics.

Stage 3: Identifying relations among ics or trichords.

This stage marks the beginning of intermediate mastery of recognizing some of the more important features of pitch-class relations in atonal music. By now, pieces by Webern, Babbitt and others that employ relations among clearly segmented trichords will become aurally lucid.[67] The student will be able to begin to hear how pitch and pitch-class function on both local and formal levels. In general, the student will have learned that each set-class (and its incarnations in T_n-type set-classes and fb-classes) has its own set of sonorous signatures. Audition will gradually involve much less effort and pieces that might immediately seem messy or featureless will come into focus. The student will begin to appreciate the cogency of good analyses of new music. And the new-found discrimination will help refine tonal hearing as well. With the more gifted students, the achievements gained in the first two stages may stimulate a desire for further development in atonal audition and identification.

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[65]Of the three set-classes whose pcsets maximize ic 6, I choose 3-10 (which also maximizes ic 3). Note that there is no pcset that has more ic 6s than any other other ic except for the interval of a tritone (ic 6).

[66]Friedmann emphasizes recognition of the T_nI-invariant trichords (called by him inversionally symmetrical) in his Exercises 4.15 and 4.16 (pp. 53-54).

[67]I am thinking of pieces such as Webern's *Concerto for Nine Instruments*, Opus 24, or his *Piano Variations*, Opus 27 (first movement), Babbitt's song cycle *Du*, his Second String Quartet, or his piano piece *Partitions*.

Stage 3 develops the ability to identify precise relationships among atonal music entities. For instance, the student is asked to specify how members of the same or different set-classes are related. Exercises may start off with comparisons of (short) unordered or ordered sets of pcs (pcsets or pcsegs), first realized as pitch sets related by pitch transposition and inversion. First the student is asked to tell only if the sets are related by T_n or T_nI; the identifications first compare ordered pcsets (pcsegs), then unordered pcsets. Exercises such as those found in Example 5 can help develop these skills.[68]

The next degree of difficulty is to identify under which specific operation a first pcset relates to a second. Keeping the pc sets related under pitch transposition, the student will be asked to identify the n in the T_n operation by identifying the interval between the two sets. With pcsets related by T_nI the problem is more difficult, not only aurally, but conceptually as well. In order to explain these difficulties, I must digress for a few paragraphs.

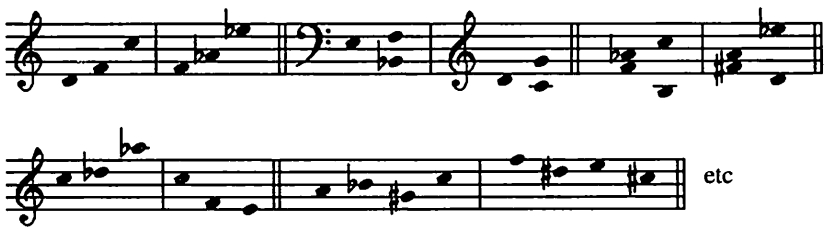
The conceptual cramps in pitch-class inversion are due to two factors. (1) Pitch-class inversion does not rely on contour—mirror inversion—in its realization in pitch. For example, consider the two chords in Example 6a. While the pcs of the first are related to the pcs of the second by T_3I, the pitch spacing of the chords disguises this relation. (2) Relation under a given T_nI operation does not imply a unique center-pitch. In Example 6b1, we have two pcsegments related by T_4I realized so that the resultant pitch sequences are also related by mirror inversion in pitch. The center pitch is D-natural. In Example 6b2, the same two pcsegments are used, but the upper one is realized an octave higher. Now the center of inversion is A-flat. Since the difference between the two examples is only in pitch, it is clear that the center pitch of inversion is not uniquely specified by T_4I. In fact, any two pc entities related by T_nI where n is even can be made to mirror around a center whose pitch-class is n/2 or (n/2)+6.

---

[68]In Exercises 4.7 and 4.27, Friedmann drills relations between multiple instances of pcsets.

Example 5. Exercises in comparing pcsets

How are the two note configurations related: under transposition or inversion or neither? (Each example is played twice)



Example 6c1 and 6c2 show the same thing but under T_5I. Here the lower pcsegment and its pitch realization is the same as before, but the upper pcsegment is the T_1 of the former. Example 6c also makes the point that the center of inversion for T_5I has to be a quarter-tone. Since quarter-tones are not defined as pcs, there is no "center" of inversion from a pitch-class point of view, if by center we mean a single pitch.[69] In sum, this example shows that trying to teach, much less understand pc inversion, from a contour or center of inversion point of view is incoherent.

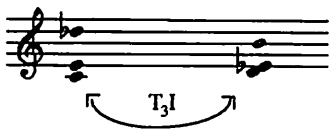
In my view, the best antidote to these problems is to specify pc inversion by its index number, the n in T_nI. This gives us twelve different inversion operators: T_0I, T_1I, T_2I, etc. The operation of inversion is then studied by considering what happens to the twelve pcs under each of these operations. For instance, under T_4I: pc 0 goes to pc 4, pc 1 goes to 3, pc 2 goes to itself, pc 3 goes to 1, pc 4 goes to 0, pc 5 goes to pc e, etc. We can write these associations as follows, first on pcs with mapping arrows, then as pcs related by double-headed arrows, and finally as cycles.

---

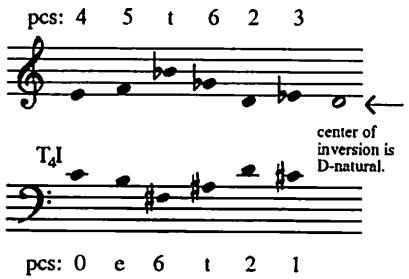
[69]We can say that the pcs related by T_5I have a pc center of the pc pair <2,3>, but <0,5>, <6,e>, and three other pairs will serve just as well.

Example 6. Pitch-class inversion.

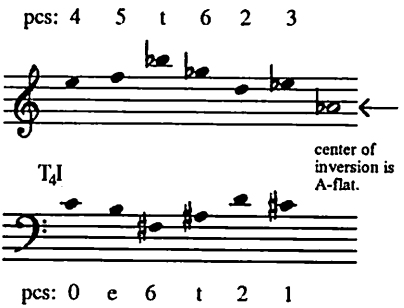
6a.



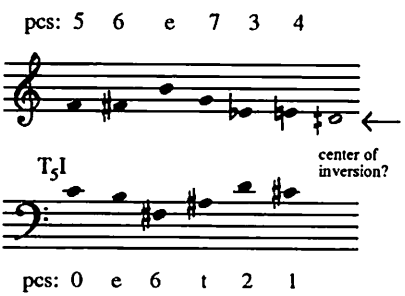
6b1.



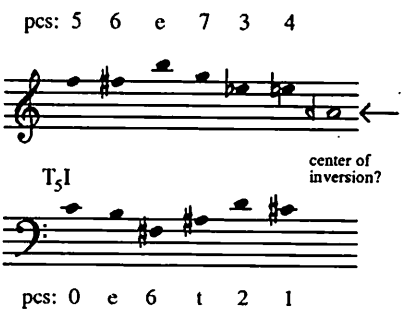
6b2.



6c1.



6c2.



0→4 1→3 2→2 3→1 4→0 5→e
6→t 7→9 8→8 9→7 t→6 e→5

0↔4 1↔3 2↔2 5↔e 6↔t 7↔9 8↔8

(0,4) (1,3) (2) (5, e) (6,t) (7,9) (8)

The cycles of the T_4I operation tell us what happens to a pc under the operation: just find the pc in one of the cycles and look to its right, wrapping around to the first pc in the cycle, if necessary. These cycles are the verticalities of note-against-note inversion under T_4I as in example 6b1. Note that all the cycles if considered as intervals are even, ics 0 2 4 6.

Now let's look at the cycles of T_5I:

(0,5) (1,4) (2,3) (6,e) (7,t) (8,9)

Here there are only six, not seven cycles, all of them having two pcs. If a passage has note-against-note inversion under T_5I, the cycles will form the verticalities, just as before; but the sound will be different, for all the intervals are odd, ics 1 3 5. (See examples 6c1 or 6c2 for verification.) I could go on to rehearse other well-known facts: that T_nI inversion comes in two flavors, odd and even; that the pcs in the cycles add up to the index number; and other important properties. Suffice it to say that once the students are aware of the cycles (intervals) that underlie pitch-class inversion, they will have something reliable and definite to identify and hear.

Identifying pitch-class inversion can be addressed by exercises that ask the student to tell if one pair of pcs is related under the same index number as another pair.[70] In other words, the student is asked to determine if the two pairs are both cycles of the same T_nI operator. Preparatory exercises could include distinguishing odd and even intervals and ics since index

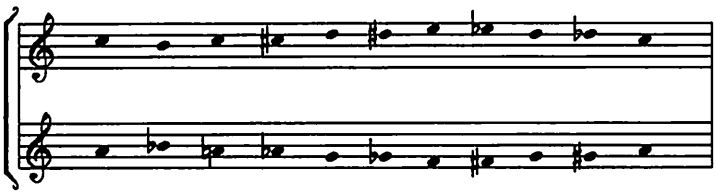
[70]One could ask if the two pcs have the same axis of pitch inversion when the pcs are also related by T_nI in pitch. If not, then only the index number is used.

numbers that are odd involve odd intervals between pcs related by T_nI (the cycles) and even index numbers involve even intervals. Singing exercises such as those given in Example 7 provide some needed practice.

Example 7. T_nI cycle singing exercises

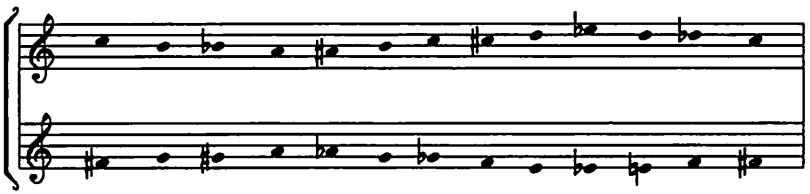
T_nI cycle singing exercise (n = odd = 9)

Divide into two groups; sing in any octave.



T_nI cycle singing exercise (n = even = 6)

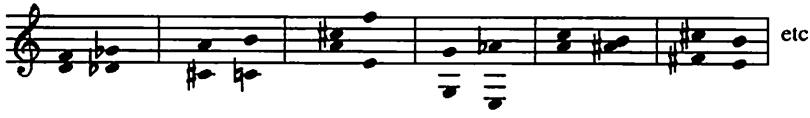
Divide into two groups; sing in any octave.



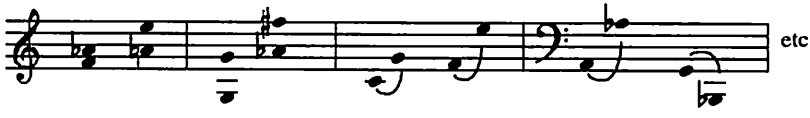
Example 8a provides two sets of examples: (8a1) if the pairs share the same index number in pc they also share the same pitch index number; (8a2) the two pairs of pcs are not related by pitch inversion. Ultimately, all of the examples in 8a have to do with identifying the content of the cycles of the twelve T_nI operations. The student can also practice producing and hearing pitch realizations of sets of pc pairs related by the same index of inversion. A last stage involves identifying the index number relating two pairs of pcsegs presented successively or overlapped.

Example 8. Exercises in identification of index numbers

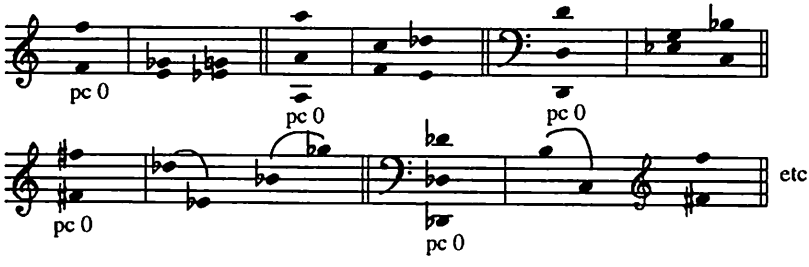
8a1. Do the following pairs of intervals share the same index number, or not? (Each example played 3 times.)



8a2. Do the following pairs of intervals share the same index number, or not? (Each example played 3 times.)



8b. Identify the index number of the pairs of intervals. (Each example played 3 times.)



Answers:

8a1: Y, N, N, N, Y, N

8a2: Y, Y, N, Y

8b: 0, e, 6, 4, 9

A final degree of finesse: to identify the transformation relating the pitch realizations of two pcsegs (ordered pcsets) without the benefit of contour relations produced by coordinating pitch and pitch-class transposition or inversions. Example 8b provides examples for identifying index numbers ranked by relative difficulty. These examples include an octave marked pc 0, which is played before the interval pairs to establish a basis for assessing the label for the index number.

Stage 4: Identifying some of the larger set-classes.

There are 29 tetrachordal set-classes. If we differentiate these further into their T_n-type set-classes and fb-classes the number of sets to learn to hear becomes too huge to manage in totality, at least in the span of one course alone. Fortunately, some of these set-classes will be familiar or easily memorized. In addition, a few of these tetrachords are found with great frequency in atonal music. A list of selected tetrachordal set-classes is given below.[71]

Common atonal set-classes:

4-1[0123]
4-9[0167]
4-19[0148]

All-interval tetrachords:

4-15[0146]
4-29[0137]

"Tonal" set-classes:

4-20[0158]	major-seventh-chord
4-25[0268]	french augmented-sixth-chord
4-26[0358]	minor-seventh-chord
4-27[0258]	half-diminished- or dominant-seventh-chord.
4-28[0369]	diminished-seventh-chord.

Combinatorial tetrachordal set-classes:

4-1[0123]	(also above)
4-6[0127]	
4-9[0167]	(also above)
4-10[0235]	
4-13[0136]	
4-23[0257]	
4-28[0369]	(also above)

[71]While Friedmann expects the student to be able eventually to identify all 29 tetrachordal set-classes, he drills a similar selection of these readily identifiable tetrachords in his Exercise 5.6 (pp. 80-81).

The all-interval tetrachords are Z-related, but their trichordal content (under abstract inclusion) differentiates them.[72] As we will see, they are easily constructed from the union of any ic 3 and ic 6 that do not intersect.

The pcsets members of the tetrachordal combinatorial set-classes can generate the aggregate in threes, mutually related by T_4 and T_8—hence their identification with combinatoriality. These seven set-classes also share other properties: (1) each of their members is invariant under T_nI except those of 4-13[0136]; (2) all of their pcset members omit ic 4. Once again, I stress the drill necessary to make tetrachordal identification direct and unpremeditated. As with trichords, exercises can be constructed based on contrasting tetrachordal set-classes to help secure immediate recognition.

In addition to the tetrachords, students are ready to learn to distinguish the six all-combinatorial hexachordal set-classes given earlier [see Martino's labels A through F] from each other and from the other 44 hexachordal set-classes. One might add nine more set-classes to the mix. These are given letters or nicknames for identification.[73] They are also accompanied by descriptions that help one to construct them without recourse to normal form or interval vector construction.

P	6-30[013679]	(The Petrushka chord and its inversion; two major or minor chords at the tritone.)
Q	6-14[013458]	(Any non-intersecting union of a member of 3-6[024] and a member of 3-12[048].)
S_1	6-44[012569]	(The Schoenberg "signature set;" two members of 3-3[014] related by T_5 or T_7.)

[72]Set-class 4-15[0146] abstractly includes 3-3[014] while 4-29[0137] abstractly includes 3-11[037].

[73]The names Q, S_1 and S_2 were inspired by Andrew Mead. He informally refers to S_1 and S_2 as the "twisted-sisters."

S_2	6-19[013478]	(The abstract complement of the Schoenberg signature; two members of 3-11[037] related by T_1 or T_e.)
m	5-12[01356]	("The Maverick sonority;" first five notes of the Locrian mode.)
d	7-35[013568t]	(The diatonic set; any of the "church modes.")
t	8-9[01236789]	(Messiaen's mode IV.)
O	8-28[0134679t]	(Octatonic scale; Messiaen's mode II; the abstract complement of 4-28[0369], the diminished-seventh-chord.)
N	9-12[01245689t]	(Nonotonic scale; Messiaen's mode III; the abstract complement of 3-12[048], the augmented chord.)

The P and Q hexachords are often found in aggregate formations (partitions) with the one or more of the six all-combinatorial hexachords.[74] S_1 and S_2 are Z-related. S_1 is the Schoenberg "signature set," i.e., the letters of Schoenberg's last name: S → Es → German for E-flat, C, H → German for B, B → German for B-flat, E, and G = {30et47} ∈ S_1. S_2 is the abstract complement (and M-correspondent[75]) of S_1.[76] With regard to set-class m, Howard Hanson referred to it as the "maverick sonority" because it is the only pentachordal set-class that is not abstractly included in its complement. m is also Z-related to 5-36[01247], but the two set-classes have pcsets with different degrees of symmetry. d is the diatonic scale and takes a lower

[74]See Morris and Alegant, "The Even Partitions in Twelve-Tone Music," *Music Theory Spectrum* 10 (1988): 74-101.

[75]That is, S_1's members are related to the members of S_2 by the M_5 or M_7 (multiplicative) operations.

[76]Schoenberg used S_1 and S_2 often in his early and middle periods. S_2 occurs at the opening of the second part of Stravinsky's *Rite of Spring*. An E-flat minor and C#-minor chord alternate over a low D minor chord. The combination of either of the oscillating chords and the D-minor chord comprises a S_2 sonority

case letter, not because the context is atonal music, but because capital D has been already reserved for an all-combinatorial hexachord. The name t is given to 8-9[01236789] since it contains pcsets rich in tritones. O and N, the octatonic and nonotonic scales, are found ubiquitously in the music of the late nineteenth and early twentieth century. Both were used extensively by Skryabin.[77]

Stage 5: Identifying the Hexachordal Set-classes

By now the student will be able to recognize at least ten hexachordal set-classes: A, B, C, D, E, F, P, Q, S_1, and S_2. Up to now I have not explicitly suggested any general method for memorizing set-classes; however, such methods easily fall out of the comments I have made about various set-classes in earlier stages, especially stage 4. The underlying strategies for learning set-classes are two—by construction from smaller set-classes that uniquely define the members of a given set-class and by grouping and associating set-classes and their members in families.[78]

1. Set-class construction: I use just two methods of definitively producing larger cardinalities of set-classes from a core of smaller ones: Transpositional Combination and Complement Union.

Transpositional Combination[79] (abbreviated *TC*) has been extensively studied by Richard Cohn.[80] In its simplest form, two

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[77]Friedmann's list of important larger sets includes the all-combinatorial hexachords, S_1, S_2 and the unique abstract supersets or subsets of the octatonic, E, and F set-classes.

[78]These strategies are based on the two most fundamental aspects of human cognition: "chunking"(hierarchy) and "association"(similarity).

[79]Transpositional combination was first defined in Hanson *Harmonic Materials* where it is called "projection." "Multiplication" is Boulez's term for what is essentially the same thing; see Pierre Boulez, *Boulez on Music Today*, trans. Susan Bradshaw and Richard Rodney Bennett (London: Faber and Faber, 1971).

[80]See Cohn, "Inversional Symmetry and Transpositional Combination in Bartók," *Music Theory Spectrum* 10 (1988): 19-42 and "Transpositional

transpositions of a smaller set construct a larger set.[81] The two smaller sets are related by the interval n so we can say the larger set is the transpositional combination of the smaller set at interval n.[82] The above comments about the set-class S_2 (6-19[013478]) employs TC: "two members of 3-11[037] related by T_1 or T_e". That is, if we take a major or minor chord and combine it with a copy of itself transposed by the interval 1 or e, we produce a member of S_2. Since we are concerned only with the set-class membership of the combination of the smaller sets, the smaller of the two intervals can stand in for both. For example, any member of S_2 is the TC of any member of 3-11 at interval 1.[83] We write this relation in a kind of shorthand as:

$$S_2 = 3\text{-}11[037]@1$$

To my knowledge, the *Complement Union Property (CUP)* was first defined and discussed in my article "Pitch-Class Complementation and its Generalizations."[84] A set-class ZZ has CUP if and only if any of its pcset members can be generated by the union of any member X of a set-class XX and any member Y of another set-class YY providing X and Y do not intersect. We say set-class ZZ is generated by set-classes XX and YY via CUP. The set-class Q (6-14[013458]) has members with this property. If one locates a 3-12[048] (augmented chord) in a member of Q, the remaining trichord is always a member of 3-6[024] as stated

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Combination in Twentieth-Century Music" (PhD diss., Eastman School of Music, University of Rochester, 1986).

[81]Friedmann emphasizes transpositional combination (called by him multiplication) in his presentation of melodies for all T_nI-invariant set-classes of four or more elements. See his Exercise 5.7 (p. 82) and his discussion of S_1 and S_2 on p.110.

[82]If the smaller set is X and the larger is Y, then TC can be defined as a function $Y = TC(X,n) = X \cap T_nX$.

[83]Let X and T_nX define TC. Then $T_{-n}X$ and $T_{-n}T_nX$ (= X) also produce TC defining $T_{-n}Y$, which is in the same set-class as Y. Thus the n in TC can always be substituted by -n when constructing members of the set-class of Y via TC.

[84]Morris, "Pitch-Class Complementation and its Generalizations," *Journal of Music Theory* 34/2 (1990): 175-246.

above. The "if and only if" part of the definition of CUP means that if we select any member of 3-12[048] and any member of 3-6[024] the union (provided the two members share no pcs) is always a member of Q. We notate this relation as follows:

$$Q = 3\text{-}6[024] \ \& \ 3\text{-}12[048]$$

Sometimes CUP connects two Z-related set-classes as in the following. Note the identifying "Z:" prefix.

$$Z{:}\ S_2 = 3\text{-}8[026] \ \& \ 3\text{-}12[048]$$

implies

$$Z{:}\ S_1 = 3\text{-}8[026] \ \& \ 3\text{-}12[048]$$

and vice versa. Here non-intersecting members of 3-8[026] and 3-12[048] in union will form hexachords that are members of either S_1 or S_2.

We can also write:

$$Z{:}\ 4\text{-}15[0146] \ / \ 4\text{-}29[0137] = \text{ic } 3 \ \& \ \text{ic } 6 \ (\text{or ic } 6 \ \& \ \text{ic } 3).$$

In sum, one can easily recall or identify set-classes by their TC and CUP relations. For instance: a member of set-class Q can be constructed by combining any non-intersecting augmented chord and a member of 3-6[024] (like {048} and {79e}); a member of P can be made by taking two members of the 3-11[037] set-classes a tritone apart (like {259} and {38e}); an all-interval tetrachord can be generated by the non-intersecting union of any tritone and any minor third (like {17} and {36}).

When attempting to determine the SC of a six-pc pcset using CUP, one should look in the pcset for the T_n-invariant pcset first. For instance, in the case of 6-17[012478], CUP is defined as 3-12 & 3-5. If one looks for the 3-5 first, one will readily find one of the four 3-5s that are included in each member of 6-17. The problem is that only one of these 3-5s has 3-12 as its CUP partner; thus, it is likely that the 3-5 found will not be the one that produces CUP with 3-12 and one might assume that the pcset is not a member of 6-17. On the other hand, if one looks for 3-12 first, then there is no ambiguity. Each 6-17 member has only one 3-12 whose

remaining three pcs are of 3-5. So by looking for the transpositional invariant member of CUP first such uncertainties are removed.

The Appendix includes TC and CUP relations for all hexachordal set-classes.

2. Set-class Association: This can take various forms. We can remember a set-class because one or more of its members is a "celebrated" music object. We can memorize set-class P by calling up the Petrushka chord (a C major triad "against" an F-sharp major triad). F is the set of whole-tone scales. Or the first six pcs of the row of Berg's Violin Concerto form a member of set-class 6-24[013468]. This form of association is known as "associated repertoire."

Sorting set-classes in groups can also stimulate memorization.[85] Above, I assumed sets that were important tonal entities would be easily memorized as atonal objects. Refining and generalizing this notion, set-classes can be related to each other by their abstract inclusion in a larger set-class. For instance, while none of the all-combinatorial hexachords is abstractly included in the octatonic set-class, P is so included. Other categories beside octatonic include "diatonic" (those set-classes abstractly included in the major scale (7-35[013568t]) "chromatic" (included in the A set-class or a larger set-class such

[85]Friedmann uses this strategy to group trichords and tetrachordal set-classes into categories. For tetrachords he has three categories. (1) Three "families": family 1 contains pcsets that include ic 1; family 2 has pcsets that include ic 2 but not ic 1; family 3 has pcsets without ic 1 or ic 2. This separates set-classes roughly into chromatic, whole-tone, and diatonic groups. Such categories are generalized by Eriksson; see "The Max Point." (2) Five groups: pcsets that are abstractly included in the diatonic scale, and/or octatonic, or whole-tone set-class, or abstractly include 3-1[012] and/or 3-12[048]. (3) By whole-tone-scale content: pcsets are members of the same group if they have n pcs in one member of set-class F, and m pcs in the other member of F, where m + n total the cardinality of the pcset. Friedmann states he has borrowed this idea from Andrew Mead, "Pedagogically Speaking: A Practical Method for Dealing with Unordered Pitch-Class Collections," *In Theory Only* 7/5-6(1984): 54-66. It can be developed further to register the number of pcs of a pcset in each cycle of the set of cycles of each T_n operator.

as 7-1[0123456] or 8-1[01234567]), "whole-tone" (included in F), and so forth. Other kinds of set-class families have pcsets that share special properties. The prime example is the set of all-combinatorial hexachords.[86]

Another special property is the all-x-chord attribute, shared by the following set-classes:

4-15[0146] and 4-29[0137] each abstractly contains every set-class of cardinality 2.

6-17[012478] abstractly contains every set-class of cardinality 3.

8-15[01234689] and 8-29[01235679] each abstractly contains every set-class of cardinality 4.

Still another family is composed of Z-related hexachord pairs. This family is called PZ3-12 in the Appendix. Let X be one member of each pair such that X is composed of a member of 3-12[048] and another non-intersecting trichord Y; the Z-related partner, the complement of X, is composed of the union of T_4Y and T_8Y. An example: X is a member of set-class 6-39[023458], X' is a member of 6-10[013457], the abstract complement and Z-correspondant of 6-39[023458], and Y is a member of 3-2[013].

{023} = Y, {467} = T_4Y, {8te} = T_8Y, {159} is a member of 3-12[048].

{023} $\cup$ {159} $\in$ 6-39[023458] and {467} $\cup$ {6te} $\in$ 6-10[013457].

These relations can be expressed in terms of TC and CUP:

6-10[012457] = 3-2[013] @ 4.

6-39[023458] = 3-2[013] & 3-12[048].

The Appendix contains "The Hexachordal Set-Class Table," a comprehensive list of the 50 hexachordal set-classes related by some of the methods given above and others. Study of the table

[86]A set-class can be easily remembered if it has striking and/or unique properties. For instance, Q is the only hexachordal set-class whose members can map onto their complements under transposition alone. P's members are the only hexachords that can map onto their complements by inversion alone and are invariant under T_0 and T_6. These facts will be well known to a twelve-tone composer.

makes it possible for one to teach and/or learn to identify any arbitrary set of six distinct pcs as to set-class, without the use of normal-forms, interval-class vectors or table look-ups. Every hexachordal set-class can be generated by TC or CUP. The Notes on the Appendix describe the table in detail.

Of course, one need not memorize the entire table at once; it can be used to keep a particular group of hexachords in mind for a limited period of time, during analysis or composition.[87] In fact, it may be a good idea to leave concerted study of the last columns of the table until one has grown accustomed to thinking of the hexachords in terms of TC and CUP. The Property Families group the hexachords by their CUP relations. It is quite remarkable that CUP can connect Z-related hexachords in various families.[88] And despite its elegance, CUP relations are not fully understood yet.[89] The "T inv", "I inv", "T comp map" and, "I comp map" columns are equivalent to abridged *invariance-vectors* (omitting invariances and complement mapping under the M and MI (M_5 and M_7) multiplicative operators).[90]

Final Remarks

It is an unfortunate fact that in many modern curricula the development of musicianship has been kept more or less separate from the study of analysis and composition. This can be remedied by the inclusion of more music literature and analysis in musicianship classes. Without doubt, there is a need for more anthologies of twentieth-century music especially for use in classes studying atonal music.[91] The transcriptions at the end of the Friedmann text are a

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[87]One can tackle the hexachords in groups, beginning with any of the inclusion or property families listed in the notes to the appendix.

[88]In contrast, when grouping hexachords according to inclusion families, the members of a Z-pair are not both obliged to be in the same family, even though their interval-class content is identical.

[89]See Morris, "Pitch-Class Complementation."

[90]Consult set-class tables in Morris, *Class Notes*, or *Composition* for complete invariance vectors.

[91]Among anthologies of twentieth-century music are: Thomas Delio and Stuart Saunders Smith, *Twentieth-Century Music Scores* (Englewood

good start. Perhaps a database will be established and keyed for pedagogical purposes. But beyond literature, students also need to see good and diverse examples of high-level atonal analysis.[92] Rahn and Straus furnish good introductions to analysis[93] while more difficult but quite satisfying work is exemplified by recent articles on Schoenberg's music by Andrew Mead and Allen Forte.[94]

I shall end with a quotation of John Cage: "Composing's one thing, performing's another, listening's a third. What can they have to do with one another?"[95] While Cage often answered his query in the negative, those of us who have chosen to live some of our musical lives in atonal music cannot agree. Sharing our responses to music puts us in touch with the question, but teaching and learning help answer it.[96]

Cliffs, NJ:Prentice Hall, 1989); Bryan R. Simms, *Music of The Twentieth Century: An Anthology* (New York: Schirmer Books, 1986); and Mary H. Wennerstrom, *Anthology of Twentieth-Century Music, 2nd ed.* (Englewood Cliffs, NJ:Prentice Hall, 1988). Such anthologies and those that include twentieth-century music in a larger time frame, as they should, produce samples from the vast diversity of contemporary music. Whereas at least half of this music can be addressed in part by atonal music theory tools, most of the pieces that are most amenable to atonal analysis are not found in these collections.

[92]A bibliography of theoretical and analytical literature was published in volume 11 of *Music Theory Spectrum*. See Martha Hyde, "Twentieth-Century Analysis during the Past Decade: Achievements and New Directions," *Music Theory Spectrum* 11 (1989): 35-39 and Andrew Mead, "The State of Research in Twelve-Tone and Atonal Music Theory," *Music Theory Spectrum* 11 (1989): 40-48.

[93]See Rahn, *Basic Atonal Theory* (4-18, 59-73); Straus, *Introduction* (16-25, 47-58, 79-89, 110-117, 136-146, 169-179.)

[94]Andrew Mead, "Large-Scale Strategy in Arnold Schoenberg's Twelve-Tone Music," *Perspectives of New Music* 24/1 (1985): 120-157 and Allen Forte, "Concepts of Linearity in Schoenberg's Atonal Music: A Study of the Opus 15 Cycle," *Journal of Music Theory* 36/2(1992): 285-382.

[95]John Cage, *Silence*, 15.

[96]I would like to thank Dora Hanninen, Ellen Koskoff, Michael Friedmann, Robert Gauldin, and Elizabeth Marvin for reading various drafts of this article and offering suggestions for its improvement. Any mistakes are mine, of course.

Appendix

The Hexachordal Set-Class Table

Name	AKA (short name)	ic-vector	Z	TC (Transpos-itional Combination)	CUP (Complement Union Property)	Inclu-sion Family	Property Family	T_n inv	T_nI inv	T_n comp map	T_nI comp map
6-1[012345]	A, chromatic	[543210]		3-1[012] @ 3			All-comb	1	1	1	1
6-2[012346]		[443211]		3-3[014] @ 2	6 & 4-1[0123]		P2-6	1	0	0	1
6-3[012356]		[433221]	6-36[012347]	3-7[025] @ 1	Z: 6 & 4-2[0124]	m	PZZ2-6	1	0	0	0
6-4[012456]		[432321]	6-37[012348]	3-1[012] @ 4	Z: 6 & 4-3[0134]	N	PZZ2-6 PZ3-12	1	1	0	0
6-5[012367]		[422232]		3-8[026] @ 1		t		1	0	0	1
6-6[012567]		[421242]	6-38[012378]	3-1[102] @ 5	Z: 3 & 4-9[0167]	t	MZ PZZ4-9	1	1	0	0
6-7[012678]	D	[420243]		3-1[012] @ 6 3-4[015] @ 6 3-9[027] @ 6		t	All-comb	2	2	2	2
6-8[023457]	B	[343230]		3-6[024] @ 3			All-comb	1	1	1	1

6-9[012357]	[342231]		3-4[015] @ 2	6 & 4-10[0235]		P2-6	1	0	0	1
6-10[013457]	[333321]	6-39[023458]	3-2[013] @ 4	Z: 6 &4-4[0125]	N	PZ3-12 PZZ2-6	1	0	0	0
6-11[012457]	[333231]	6-40[012358]		Z: 6 & 4-11[0135]		MZ PZZ2-6	1	0	0	0
6-12[012467]	[332232]	6-41[012368]		2 & 4-9[0167]	m	PZ4-9	1	0	0	0
6-13[013467]	[324222]	6-42[012369]	3-10[036] @ 1		O	PZ4-28	1	1	0	0
6-14[013458] Q	[323430]		3-4[015] @ 3	3-6[024] & 3-12[048]	N		1	0	1	0
6-15[012458]	[323421]			6 & 4-7[0145]	N	P2-6	1	0	0	1
6-16[014568]	[322431]			6 & 4-17[0347]	N	P2-6	1	0	0	1
6-17[012478] All-trichord	[322332]	6-43[012568]		3-5[016] & 3-12[048] 4 & 4-9[0167]		PZ3-12 PZ4-9	1	0	0	0
6-18[012578]	[322242]		3-8[026] @ 5		t		1	0	0	1
6-19[013478] S_2	[313431]	6-44[012569]	3-11[037] @ 1	Z: 6 & 4-19[0148] Z: 3-8[026] & 3-12[048]	N	MZ PZZ2-6	1	0	0	0
6-20[014589] E, magic, hexatonic	[303630]		3-12[048] @ 1 3-12[048] @ 3 3-12[048] @ 5		N	All-comb	3	3	3	3

6-21[023468]	[242412]			1 & 4-25[0268]	N	P4-25	1	0	0	1
6-22[012468]	[421422]			3 & 4-25[0268]	N	P4-25	1	0	0	1
6-23[023568]	[234222]	6-45[023469]	3-10[036] @ 2		O	PZ4-28	1	1	0	0
6-24[013468]	[233331]	6-46[012469]		Z: 6 & 4-14[0237]		PZ3-12	1	0	0	0
				3-7[025] & 3-12[048]						
6-25[013568]	[233241]	6-47[012479]	3-2[013] @ 5	Z: 6 & 4-22[0247]	d m	PZZ2-6	1	0	0	0
6-26[013578]	[232341]	6-48[012579]	3-9[027] @ 4	Z: 6 & 4-26[0358]	d N	PZ3-12	1	1	0	0
						PZZ2-6				
6-27[013469]	[225222]		3-5[016] @ 3	3 & 4-28[0369]	O		1	0	0	1
			3-8[026] @ 3							
6-28[013569]	[224322]	6-49[013479]		4 & 4-28[0369]	m	PZ3-12	1	1	0	0
				3-10[036] & 3-12[048]		PZ4-28				
6-29[023679]	[224232]	6-50[014679]		5 & 4-28[0369]	t	PZ4-28	1	1	0	0
6-30[013679] P, Petrushka	[224223]		3-2[013] @ 6	6 & 4-28[0369]	O t		2	0	0	2
			3-3[014] @ 6							
			3-7[025] @ 6							
			3-11[037] @ 6							
6-31[014579]	[223431]			6 & 4-20[0158]	N	P2-6	1	0	0	1

6-32[024579] C, Guidonian	[143250]		3-6[024] @ 5		d	All-comb	1	1	1	1
			3-9[027] @ 3							
6-33[023579]	[143241]		3-11[037] @ 2	6 & 4-23[0257]	d	P2-6	1	0	0	1
6-34[013579]	[142422]			5 & 4-25[0268]	N	P4-25	1	0	0	1
6-35[02468t] F, whole-tone	[060603]		3-12[048] @ 2		N	All-comb	6	6	6	6
			3-12[048] @ 6							
6-36[012347]	[433221]	6-3[012356]		Z: 6 & 4-2[0124]		PZZ2-6	1	0	0	0
6-37[012348]	[432321]	6-4[012456]		Z: 6 & 4-3[0134]		PZ3-12	1	1	0	0
				3-1[012] & 3-12[048]		PZZ2-6				
6-38[012378]	[421242]	6-6[012567]	3-9[027] @ 1	Z 3 & 4-9[0167]	t	MZ	1	1	0	0
						PZZ4-9				
6-39[023458]	[333321]	6-10[013457]		Z: 6 & 4-4[0125]		PZ3-12	1	0	0	0
				3-2[013] & 3-12[048]		PZZ2-6				
6-40[012358]	[333231]	6-11[012457]		Z: 6 & 4-11[0135]		MZ	1	0	0	0
						PZZ2-6				
6-41[012368]	[332232]	6-12[012467]	3-5[016] @ 2		t	PZ4-9	1	0	0	0
6-42[012369]	[324222]	6-13[013467]		1 & 4-28[0369]	t	PZ4-28	1	1	0	0

6-43[012568]		[322332]	6-17[012478]	3-5[016] @ 4		N t	PZ3-12 PZ4-9	1	0	0	0
6-44[012569]	S_I, Schoenberg signature	[313431]	6-19[013478]	3-3[014] @ 5	Z: 6 & 4-19[0148] Z: 3-8[026] & 3-12[048]	N	MZ PZZ2-6	1	0	0	0
6-45[023469]		[234222]	6-23[023568]		2 & 4-28[0369]		PZ4-28	1	1	0	0
6-46[012469]		[233331]	6-24[013468]	3-7[025] @ 4	Z: 6 & 4-14[0237]	N	PZ3-12	1	0	0	0
6-47[012479]		[233241]	6-25[013568]		Z: 6 & 4-22[0247]		PZZ2-6	1	0	0	0
6-48[012579]		[232341]	6-26[013578]		Z: 6 & 4-26[0358] 3-9[027] & 3-12[048]		PZ3-12 PZZ2-6	1	1	0	0
6-49[013479]		[224322]	6-28[013569]	3-10[036] @ 4		N O	PZ4-28 PZ3-12	1	1	0	0
6-50[014679]		[224232]	6-29[023679]	3-10[036] @ 5		O	PZ4-28	1	1	0	0

Notes on the Hexachordal Set-Class Table

Name
(column 1)

The set-class name (first Forte, then Rahn names).

AKA
(column 2)

The letter or other name for the set-class, if any.

ic-vector
(column 3)

The interval-class vector for the members of the set-class.

Z
(column 4)

The name of the Z-related set-class, if any.

TC
(column 5)

Any Transpositional Combinations (TC) that generate the set-class. (Single numbers stand for ics; for instance, "1" stands for ic 1.) See main body of paper for more.

CUP
(column 6)

Indicates the set-class's Complement Union Properties (CUP), if any. (As above, single numbers stand for ics.) See main body of paper for more.

Inclusion Families
(column 7)

Indicates the inclusion families of the set-class, if any.

d Family

Includes Set-classes that are abstractly included in set-class d (diatonic family 7-35[013568t]).

d family members:

6-25[013568]
6-26[013578]
6-32[024579] (C)
6-33[023579]

t Family

Includes Set-classes that are abstractly included in set-class t (tritone family 8-9[01236789]).

t family members:

6-5[012367]
6-6[012567] / 6-38[012378]
6-7[012678] (D)
6-18[012578]
6-29[023679]
6-30[013679] (P)
6-41[012368]
6-42[012369]
6-43[012568]

O Family

Includes Set-classes that are abstractly included in set-class O (Octatonic family 8-28[0134679t]).

O family members:

6-13[013467]
6-23[023568]
6-27[013469]
6-30[013679] (P)
6-49[013479]
6-50[014679]

N Family

Includes Set-classes that are abstractly included in set-class N (Nonotonic family 9-12[01245689t]).

N family members:

6-4[012456]
6-10[013457]
6-14[013458] (Q)
6-15[012458]
6-16[014568]
6-19[013478] / 6-44[012569] (S_2/S_1)
6-20[014589] (E)
6-21[023468]
6-22[012468]
6-26[013578]
6-31[014579]
6-34[013579]
6-35[02468t] (F)
6-43[012568]
6-46[012469]
6-49[013479]

m Family

Includes Set-classes that abstractly include set-class m (maverick family 5-12[01356]).

m family members:

6-3[012356]
6-12[012467]
6-25[013568]
6-28[013569]

Property Families
(column 8)

Indicates the property families of the set-class, if any.

All-Comb Property Family

The all combinatorial hexachordal set-classes. Each member has invariance under T_nI, T_n complement mapping, T_nI complement mapping (for at least one n).

All-Comb family members:

Hexachords (AKA column:) A, B, C, D, E, and F.

MZ Property Family

Z-related hexachordal set-classes also abstractly related by M/MI (M_5/M_7) multiplicative operations.

MZ family members:

6-6[012567] / 6-38[012378]
6-11[012457] / 6-40[012358]
6-19[013478] / 6-44[012569] (S_2 / S_1)

PZ3-12 Property Family

Z-related Hexachordal set-classes also related by TC or CUP. Let A be any trichordal pcset without ic4; A is a member of the set-class AA.

AA @ 4 specifies half the set-classes in this family. The other half, Z-related to the members of the first half, are specified by AA & 3-12.

PZ3-12 family members (first TC member, slash, then CUP member):

6-4[012456] / 6-37[012348]	AA = 3-1
6-10[013457] / 6-39[023458]	AA = 3-2
6-26[013578] / 6-48[012579]	AA = 3-9
6-43[012568] / 6-17[012478]	AA = 3-5
6-46[012469] / 6-24[013468]	AA = 3-7
6-49[013479] / 6-28[013569]	AA = 3-10

PZ4-28 Property Family

Z-related Hexachordal set-classes also related by TC or CUP. Let A be any ic except ic3 or ic6;

A @ 3-10[036] specifies half the set-classes in this family. The other half, Z-related to the members of the first half, are specified by A & 4-28[0369].

PZ4-28 family members (first TC member, slash, then CUP member):

6-13[013467] / 6-42[012369]	A = ic 1
6-23[023568] / 6-45[023469]	A = ic 2
6-49[013479] / 6-28[013569]	A = ic 4
6-50[014679] / 6-29[023679]	A = ic 5

P2-6 and **PZZ2-6** Property Families

P2-6 and PZZ2-6 have members defined by CUP: A & 6, where A is a tetrachordal set-class whose members omit ic 6.

In P2-6, A's pcsets have T_nI invariance under an even index number (n=even).

P2-6 family members:

6-2[012346]	A = 4-1
6-9[012357]	A = 4-10
6-15[012458]	A = 4-7
6-16[014568]	A = 4-17
6-31[014579]	A = 4-20
6-33[023579]	A = 4-23

In PZZ2-6, A's pcsets do not have T_nI invariance under an even index number (n=even). A & 6 produces the members of (both) Z-related set-classes

PZZ2-6 family members

6-3[012356] / 6-36[012347]	A = 4-2
6-4[012456] / 6-37[012348]	A = 4-3
6-10[013457] / 6-39[023458]	A = 4-4
6-11[012457] / 6-40[012358]	A = 4-11
6-19[013478] / 6-44[012569] (S_2 / S_1)	A = 4-19
6-25[013568] / 6-47[012479]	A = 4-22
6-26[013578] / 6-48[012579]	A = 4-26

P4-25 Property Family

P4-25 have members defined by CUP: A & 4-25, where A is ic 1, 3, or 5.

P4-25 Members:

6-21[023468]	A = ic 1
6-22[012468]	A = ic 3
6-34[013579]	A = ic 5

PZ4-9 and **PZZ4-9** Property Families

PZ4-9 and PZZ4-9 have members defined by CUP: A & 4-9, where A is ic 2, 3, or 4.

PZ4-9 members are Z-related hexachords, but the CUP concerns only one of the two Z-correspondants. The other Z-correspondent has TC: 3-5 @ A.

PZ4-9 family members (First TC member, slash, then CUP member):

6-41[012368] / 6-12[012467]	A = ic 2
6-43[012568] / 6-17[012478]	A = ic 4

PZZ4-9 has only one Z-pair of members. A is ic 3 so CUP = 4-9 @ 3 which generates both members of the Z-pair.

PZZ4-9 family members:

6-6[012567] / 6-38[012378]	A = ic 3

NB: The is a logic to property family names. The P stands for Property; the last part of the name is the constant set-class. The name has: no "Z", if Z-relations are not involved; 1 "Z", if one member of a Z-relation pair is generated by CUP and the other by TC (with the same variable set-class (always named A above)); 2 "Z"s ("ZZ"), if both members of the Z-relation pairs are generated by the same CUP.

T inv I inv T comp map I comp map
(columns 9, 10 ,11 ,12)

These last columns spell out the invariances of the members of each set-class.

T inv (column 9): the number of distinct T_n invariances for each member of the set-class. (All pcsets have identity (T_0) invariance, so a 1 entry stands for identity invariance.)

I inv (column 10): the number of distinct T_nI invariances for each member of the set-class. (A blank entry stands for zero T_nI invariances.)

T comp map (column 11): the number of T_n operations that map each member of the set-class to its complement.

I comp map (column 12): the number of T_nI operations that map each member of the set-class to its complement.

Example: 6-1[012345] has in columns 9 to 12: 1 1 1 1. This means each of its members has invariance under 1 case each of T_0 (identity), and T_nI invariance and 1 case each of T_n and T_nI of complement mapping.

Another example: 6-30[013679] has in columns 9 to 2: 2 0 0 2. This means each of its members has invariance under 2 cases of T_n (one of which is identity T_n), and 2 cases of T_nI complement mapping.

The reader can use these last columns to determine a set-classes's hexachordal combinatorial properties in twelve-tone theory:

If column 9 is 2 or more, the hexachord can be used to generate non-trivial R-type combinatoriality.

If column 10 is 1 or more, the hexachord can be used to generate RI-type combinatoriality.

If column 11 is 1 or more, the hexachord can be used to generate T-type combinatoriality.

If column 12 is 1 or more, the hexachord can be used to generate I-type combinatoriality.

(The all-combinatorial hexachords have 1 or more in all four columns.)

Cooperative Learning In The Music Theory Classroom

Lawrence M. Zbikowski and Charles K. Long

Those who teach know that our understanding of a topic gains depth and clarity—becomes *truly* understanding rather than a pale collection of facts and half-remembered thoughts—only within a dynamic environment where we try to set out concepts for others and have them challenge and question us. For this, beyond the contractual obligations of a profession, is what teaching is all about: to teach is to learn, and to share that learning with others. It is odd, then, that the organization of our classrooms does not permit students to experience this same dynamic process. Typically, we talk, the students listen, a few ask questions, we talk some more, play a few examples, and then it's on to the next class. We assume that students will master and retain the material by taking notes, asking a question now and then, and studying on their own. But given our own experience this assumption seems dubious at best.

An alternative is to change the dynamic of the classroom by dividing a class up into small groups of typically four students and asking them to work on specific topics as a group. Students then have an opportunity to become teachers themselves as they explain problems and concepts to other students, discuss alternative solutions, and work together to develop an understanding of the topic. This, in essence, is cooperative learning at its best. The opportunity provided by placing students in small groups may also be lost: students may fail to participate actively in their groups, groups may employ ineffective strategies in their approach to tasks, tasks may be inappropriate for group work. For group exercises to be effec-

tive, cooperation between students *must* be built into each small-group lesson. The fostering of cooperation and interdependence through structured small-group exercises distinguishes cooperative learning from the simple practice of dividing up a large class into small groups. Understanding this point is central to the following discussion. Employing cooperative learning entails, for those of us who work at the post-secondary level, a reconsideration of what it means to teach: although dispensing information and providing inspiration remain important, guiding learning strategies becomes equally important.

Our discussion of cooperative learning in the music theory classroom, which draws on our experiences using these techniques to teach both education and music theory at the post- secondary level, is divided into three sections. In the first section we consider ways in which cooperation between students can be structured. In the second section we offer four sample lessons that use cooperative learning for the study of topics specific to music theory. In the third section we discuss the larger import of cooperative learning for the teaching of music theory and consider some of the challenges it presents.

Structuring Cooperative Learning at the Post-Secondary Level

Although cooperative learning has been used and studied extensively at the primary and secondary level,[1] it has not been implemented widely on the post-secondary level. A number of factors may contribute to this; perhaps the simplest is that methodologies of teaching have tended to be of less concern to teachers at the post-secondary level. In general, we teach as we were taught, changing our habits only in the face of unique or epochal circumstances. A recent study of ways to implement cooperative learning at the college level by David Johnson, Roger Johnson, and Karl Smith proposes to change this situation, building upon the extensive research

[1]For representative studies see those in Shlomo Sharan et al, eds., *Cooperation in Education* (Provo, UT: Brigham Young University Press, 1980) and Robert Slavin et al, eds., *Learning to Cooperate, Cooperating to Learn* (New York: Plenum Press, 1985).

on and experience with cooperative learning by Johnson and Johnson over the past two decades.[2] In the model Johnson, Johnson, and Smith present, cooperative learning involves five basic elements: positive interdependence, face-to-face promotive interaction, individual accountability, social skills, and group processing. We will consider the structuring of cooperation at the post-secondary level in terms of these five elements.

Positive interdependence. One of the basic premises of cooperative learning is that individuals working together can achieve things that are beyond the same individuals working alone. However, it is not simply strength in numbers that makes these unique achievements possible but the combination of individual capabilities represented within the group. The subtle boundary between simply working in groups and a truly cooperative experience is made manifest for musicians when a small ensemble moves from playing notes together to making music together: although the process may be elusive, the transformation, when it occurs, is unmistakable.[3] The

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[2]David W. Johnson, Roger T. Johnson, and Karl A. Smith, *Cooperative Learning: Increasing College Faculty Instructional Productivity,* ASHE-ERIC Higher Education Report No. 4. (Washington, DC: The George Washington University, School of Education and Human Development, 1991). Johnson, Johnson, and Smith's study is one of the few that deal with cooperative learning at the post-secondary level. See also James Bellanca and Robin Fogarty, *Blueprints For Thinking in the Cooperative Classroom* (Palatine, IL: Skylight Publishing, Inc., 1991); the journal *Cooperative Learning: The Magazine for Cooperation in Education;* and the newsletter *Cooperative Learning and College Teaching* (Stillwater, OK: New Forums Press, Inc.). College and university teachers may wish to consider compensating for the relative lack of material at this level by collaborating with colleagues who teach education and who use cooperative learning techniques.

[3]For one account of the way individual efforts combine in an ensemble consider the comments of Michael Tree, violist with the Guarneri Quartet:

> There's a widespread belief that string-quartet playing demands a constant unanimity of style and approach. Yet it should be remembered that a quartet is based on four individual voices. The fact that we have to coordinate and find a proper balance doesn't mean that any one of us should become faceless. On the contrary, the re-creation of a masterpiece needs the full, vital participation of each of us.

uniting of individual capabilities toward the achievement of some goal is called positive interdependence. This characteristic is at the heart of cooperative learning, and much of the success of a cooperative lesson is based on realizing some measure of positive interdependence within each group. This can be accomplished by structuring learning situations so that individuals have to work together to succeed, and all members of the group have to perform competently if mutual success is to be assured. Here are four ways to structure positive interdependence suggested by Johnson, Johnson and Smith:

1. The completion of two complementary tasks should be included in the goals of every cooperative lesson: first, students must learn and understand the assigned material, and second, students must make sure all members of the group learn and understand the material. Setting these tasks requires stating the object of an exercise and holding each group responsible for the performance of its constituent members. Performance can be checked by asking questions of individual group members chosen at random or can be built into the evaluation of the exercise. This sort of guidance (setting tasks, checking performance) is typical of the responsibilities of the teacher in a cooperative classroom; in general, the teacher should concentrate on planning the lesson so that an absolute minimum of intervention by the teacher takes place.

2. Joint rewards for achievement also encourage positive interdependence: short exercises completed within the group during class can be collected, graded, and the average grade assigned each member of the group as a bonus. Similar results can be achieved by assigning bonus points to all group members based on the grade given one paper chosen at random, or by asking each group to submit one solution which will then be used as the basis for mutual reward. Another alternative is to assign bonus points if each member of a group scores above 90% (or some similar benchmark) on a test. There is some disagreement, however, about using grades for promoting positive interdependence. Spencer Kagan argues that

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David Blum and the Guarneri Quartet, *The Art of Quartet Playing: The Guarneri Quartet in Conversation with David Blum* (New York: Alfred A. Knopf, 1986), 3.

every grade should reflect individual achievement and that cooperative learning should be viewed only as an instructional strategy, not an assessment strategy.[4] It has been our experience that college students often find that working together is its own reward and the use of group grades is unnecessary.

3. One of the simplest ways to emphasize cooperative relationships is by distributing only one copy of the materials for an exercise to each group: this requires that the students share the materials in order to solve the problem. Variations on this strategy include having each student work on a different part of a problem as a way of contributing to the solution of the problem as a whole,[5] and having an in-class exercise build upon a homework assignment completed by each student in advance.

4. Participation in group activities can be insured if roles are designated. For part-writing exercises requiring a single solution from the entire group, one group member can be chosen as the recorder (to write out the answer), another chosen to check the work for missing accidentals or forbidden parallels, yet another to check for any other violations of voice-leading rules.[6] The assignment of roles insures that each member of the group has an obvious responsibility in the completion of the task. Switching roles frequently, even within an assignment, encourages each member of the group to acquire all of the skills.

Face-to-face promotive interaction. As students work on a problem together they have an opportunity to help, assist, and encourage each other's efforts to learn. This is what Johnson, Johnson, and Smith call face-to-face promotive interaction.[7] However, since students can *obstruct* as well as facilitate each other's learning, this interaction needs to be structured and monitored. Choosing and

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[4]Spencer Kagan, *Cooperative Learning* (San Juan Capistrano, CA: Resources for Teachers, Inc., 1992).

[5]This approach has been formalized as the jigsaw strategy; see Elliot Aronson, N. Blaney, C. Stephan, J. Sikes, and M. Snapp, *The Jigsaw Classroom* (Beverly Hills, CA: Sage, 1978).

[6]Other options for roles to be assigned to group members are given in Johnson, Johnson, and Smith, *Cooperative Learning*, 63-64; for implementation see Sample Lesson 3 below.

[7]Ibid., 7, 30.

implementing an appropriate cooperative learning structure assure that the interaction among group members is about lesson content and not next weekend's social event. Even groups that work well together, however, sometimes wander off the task at hand. The teacher must be prepared to intervene if a group is unproductive; usually a few suggestions that emphasize the importance of working together to achieve results can serve as reminders to group members that they will be individually accountable for the material covered in the exercise. These interventions should be as unobtrusive as possible so that the group learns to monitor its own functions.

Individual accountability. In order for groups to be as effective as possible students must be individually responsible for learning the material. Emphasizing this accountability is one means of guarding against two of the most frequent problems that occur when students are asked to work on exercises in groups: less able members may leave it to other members of the group to complete the assigned task (the "free-rider effect"), or more able group members may simply solve the problem at hand without making sure others understand the solution. In this second case only the more able group member benefits from the exercise (the"rich-get-richer effect").[8] The most direct solution to these problems is to make the relationship between work done in groups and work done individually (on homework assignments and tests) very clear. Once students understand that they must each learn the material in order to receive rewards, they more readily participate in group exercises. Having said this, it should be emphasized that problems such as these arise with surprising infrequency in properly structured cooperative lessons. Students are almost always eager to become more actively involved in learning and to share what they know with others in the group. Here as elsewhere the teacher is important as a role model and guide.

Social skills. Because students are required to interact with each other in a cooperative lesson, social skills take on an importance not often observed in a college classroom: skills in leadership, making decisions, building trust, communicating effectively, and managing conflict are essential for completing exercises within a group.

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[8]For further discussion of these and related problems see Ibid., 15-16.

This emphasis on the development of social skills represents an important contribution to a student's education, since such skills will often be as important for success in a career as an understanding of the intricacies of music (for corroboration of this point see Richard Light's observations in the final section of this article). For students at the post-secondary level the opportunity to work together accompanied by encouragement from the teacher will go a long way toward developing these social skills. It is also important to consider specific social skills when designing a cooperative lesson so that these skills, once acquired or refined, can be used in further cooperative situations.

Group processing. One important means of improving the effectiveness of groups is to ask groups to evaluate how they function; Johnson, Johnson, and Smith call this sort of reflection group processing.[9] A straightforward way of accomplishing group processing is to ask groups to list one strength of their group and one thing that could be improved. The responses generated, combined with an exercise that emphasizes cooperation between group members, can dramatically improve the way groups function.

It should be apparent from the preceding that cooperation between students doesn't simply happen: it must be structured into each lesson by the teacher. Implementing cooperative learning requires anticipating the changed circumstances associated with effective group learning and planning accordingly. The sorts of lesson plans that result are the subject of the next section.

Four Sample Cooperative Lessons

Just as there are several ways of teaching music theory within a lecture format, cooperative learning may be used in a variety of ways to teach music theory. In the following section we offer four sample lessons as illustrations of the ways cooperative learning can be applied to the specific task of learning music theory. In these lessons the emphasis is not so much on unruly problems of music theory as it is on incorporating the five elements discussed above

[9]Ibid., 22-24.

into learning experiences, the overall goal of which is an improved understanding of musical structure. Opportunities presented by lesson plans structured around more general instructional goals, such as classroom discussions of readings or critical evaluations of written analyses, will not be considered in depth, although the sample lessons (in particular, Sample Lesson 4) suggest ways to address these opportunities as well.

Before taking up the lessons two important practical questions must be considered: what process should be used to divide the class into groups, and what sort of constituency is the goal of this process. In general, the teacher should assign students to groups rather than let students form groups on their own; assigned groups can be formed with a view toward achieving maximum heterogeneity within each group, putting all groups at the same approximate advantage or disadvantage. A group size of four is optimal; assuming a class size of twenty-four, the teacher would sort students into six groups, striving to have each group represent the diversity of the class as a whole (the use of cooperative learning techniques in large lectures is mentioned briefly in footnote 14 below). The process can be relatively informal; experience indicates, however, that a number of factors may play a part in making a group balanced or unbalanced, and more formal procedures that take into account actual academic performance may be desirable.[10] On occasion it may be necessary to depart from the goal of maximum heterogeneity. Two situations come to mind. First, if six members of a class of twenty-four are women it would be logical to assign each woman to one of the six groups; however, it may be desirable to *pair* women in at least some of the groups so that they are not always isolated within groups of men. Second, if the performance of student compositions is anticipated, groups may be formed with a view toward creating standard ensembles such as piano trios, string quartets, or brass quintets.

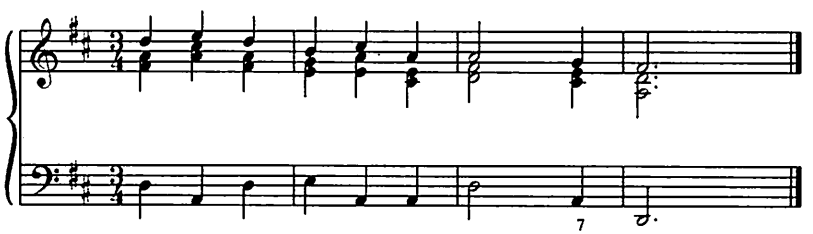
Sample lesson 1—using first-inversion harmonies. The music-theoretical goal of this lesson is to teach students how first-inversion

[10]One formal procedure for assigning students to groups based on academic performance is discussed in Robert E. Slavin, "Student Team Learning: A Manual for Teachers," in *Cooperation in Education*, ed. Shlomo Sharan et al. (Provo, UT: Brigham Young University Press, 1980), 97-100.

harmonies are used (with this as with all of the sample lessons the cooperative learning goals discussed above are assumed as well). The group exercise is the middle part of a three-part process that begins with an introduction to the topic, either through readings (to be done before class), a lecture, or some pairing of the two. The second part of the process is the group exercise discussed below. The third part of the process is a homework assignment, to be completed by each student individually; the assignment is similar to but somewhat more involved than the group exercise done in class. The group exercise thus serves as a reinforcement of the introduction and as preparation for the homework assignment.

The main points of the introductory part of the lesson are that first-inversion harmonies prolong a given harmony, provide a smoother bass line, or both.[11] The group exercise is a practical one that gives students an opportunity to put this understanding into action. Copies of the exercise (see Ex. 1a) are distributed to the class. Each student is instructed to analyze the passage and then rewrite the bass in order to achieve a more flowing bass line, changing the doublings in the lower two voices of the right-hand part to avoid forbidden parallels (the soprano voice is to remain unchanged). The students are then asked to form or join their groups, roles of recorder and checker are assigned, and the group is asked to combine

EXAMPLE 1a. Sample exercise for group work

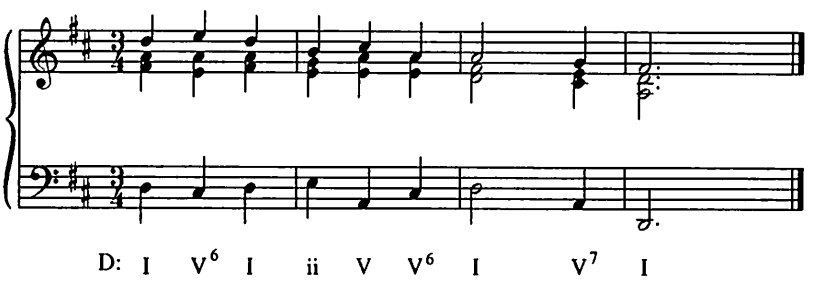


[11]This is essentially the same perspective used by Allen Forte in *Tonal Harmony in Concept and Practice*, 3rd ed. (New York: Holt, Rinehart and Winston, 1979) and Edward Aldwell and Carl Schachter in *Harmony and Voice Leading*, 2nd ed. (San Diego: Harcourt Brace Jovanovich, 1989).

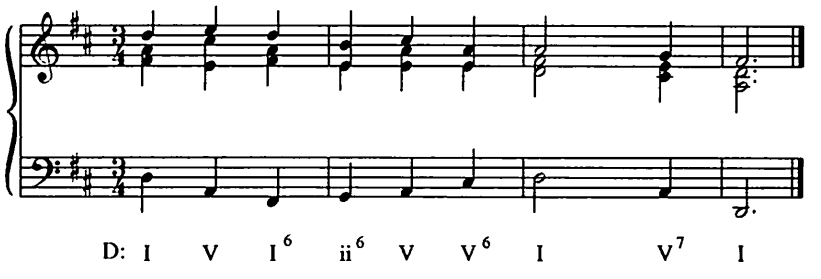
the individual efforts into a single result. The individual efforts are stapled to the group effort, and the resulting packets are collected by the instructor and evaluated. The entire procedure strikes a balance between individual accountability and mutual reward, and, given the brevity of the exercise, can be done in relatively little class time.

Several successful solutions to the exercise are possible, and students are encouraged to discuss the merits of each solution within their group. Two student solutions are given in Examples 1b and 1c.

EXAMPLE 1b. Student solution #1



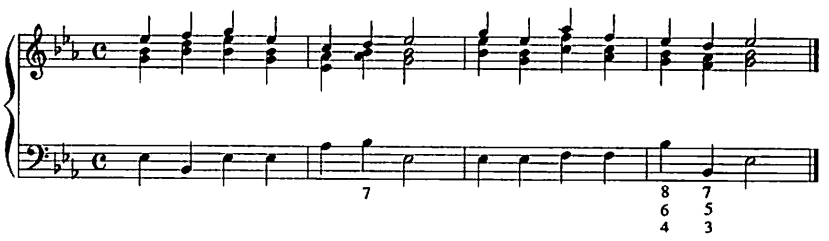
EXAMPLE 1c. Student solution #2



Group solutions can be shared in a couple of ways. After the completion of the lesson solutions can be solicited from each group, written on the board, and sung or played. This provides aural reinforcement and gives an opportunity for discussion *between* groups. A cooperative structure called three stay-one stray is an alternative, quick way to ensure discussion between groups and may be especially rewarding with more challenging or complicated exercises for which more solutions are possible.[12] In this sort of lesson the recorder in each group takes the group solution to another group and explains it to them. The group members can then comment on the differences between the two solutions and make suggestions. The recorder then returns to the home group and shares those suggestions. Further changes can be encouraged at this stage.

The homework assignment, which is the third part of the lesson, is itself in two parts. The first part simply duplicates the basic format of the group exercise, with changes in key, mode, and soprano line for variety, and includes three or four passages similar to the one given in Example 1a. The second part (given in Ex. 1d) is slightly more involved, offering students an opportunity to try their hand at writing bass lines for two consecutive phrases. This assignment provides both individual accountability and a reinforcement of the things learned in the cooperative lesson.

Example 1d. Exercise for the 2nd portion of the homework assignment



[12]Kagan, *Cooperative Learning*, 12.

Sample lesson 2—drill on fundamentals. The goal of this lesson is the reinforcement of fundamentals, accomplished through an oral drill that requires students to draw on a variety of aspects of their knowledge of music. The oral drill is then followed by a short written quiz on the same material. The sample exercise used here (which focuses on inversions of seventh chords) is somewhat complex and requires a developed knowledge of key signatures, relationships between keys, chord inversions, and intervals. It also requires that the student combine all these things rapidly and accurately. The exercise is intended more to emphasize fundamental ideas that may have grown fuzzy through disuse than to reinforce newly acquired concepts. This intent is in keeping with the spirit of Michael Rogers's well-reasoned argument for the importance of fundamentals; the exercise itself is a modified version of examples given by Rogers.[13]

In this exercise students are put into pairs; formal groups are not required, although the ready organization of formal groups may eliminate some dithering.[14] After an explanation of the sort of problem involved (and, if necessary, a description of the steps involved in solving the problem) two sets of question sheets are handed out to each pair of students (abbreviated versions are given in Fig. 1a and 1b). Each set has both questions and answers; students use the questions to quiz each other, and check each other's response against the answer provided on the question sheet.

FIGURE 1a. Sample question set #1

1. What is the V^4_2 of the supertonic of Eb major?	Bb, C, E, G
2. What is the V^6_5 of the mediant of f♯ minor?	G♯, B, D, E
3. What is the V^4_3 of the mediant in Eb major?	A, C, D, F♯

[13]Michael R. Rogers, *Teaching Approaches in Music Theory: An Overview of Pedagogical Philosophies* (Carbondale, IL: Southern Illinois University Press, 1984), chapter 3.

[14]Johnson, Johnson, and Smith discuss other ways informal groups can be used. For example, in large classes the teacher may interrupt the lecture to ask students to join with a few of their classmates to summarize the points just made (it always helps if the lecturer has actually *made* clear points). Although this sounds chaotic, it is actually quite effective, and has the additional benefit of rousing weary students from their slumbers. See Johnson, Johnson, and Smith, *Cooperative Learning*, 90-102.

FIGURE 1b. Sample question set #2

1. What is the V_3^4 of the dominant of a minor? F♯, A, B, D♯
2. What is the V_5^6 of the supertonic in D major? D♯, F♯, A, B
3. What is the V_2^4 of the subdominant in b minor? A, B, D♯, F♯

A sample drill might go something like this:

Stephanie: "1. What is the V_2^4 of the supertonic of E♭ major?"
Joan: Umm... B♭, C, E, G.
Stephanie: Right.
Joan: Okay; "1. What is the V_3^4 of the dominant of a minor?"
Stephanie: Easy: F, A, B, D♯.
Joan: Close, but not quite right; what's a perfect fifth above B?
Stephanie: Oh, yeah; it should be F♯, A, B, D♯.
Joan: Good job.
Stephanie: "2. What is the V_5^6 of the mediant of f♯ minor?"
and so on. . .

After completing all of the questions (between seven and ten on each sheet) students trade sheets and continue the exercise. If pairs of students finish both runs through the questions before the allotted time is up they can trade back once more and choose questions at random, or change the key specified in each question. The latter will require a little thinking on the part of the questioner to make sure the correct answer is given.

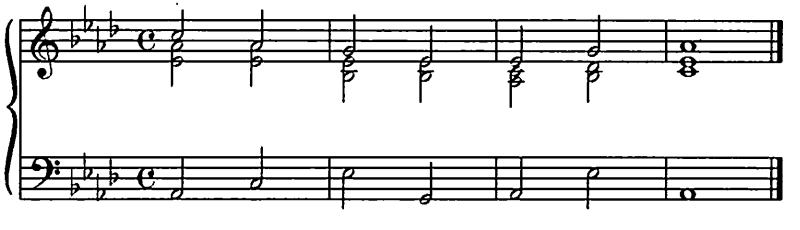
After the completion of the oral exercise the question sheets are collected and a short written quiz is administered. Where appropriate it may be useful to have the quiz timed as a way of stressing the need for facility with these sorts of fundamental concepts. The quiz is collected and graded by the instructor, with grades awarded on an individual basis. The procedure of following the oral exercise with a quiz encourages students to apply themselves to the exercise and should discourage partners from simply giving the answers away. Again, since the answer to each question involves a number of steps the process of solving the problem must be made clear by the teacher. Partners can then assist each other in retracing the steps to solving the problem should difficulties occur, perhaps

working on just one part of the solution to each problem until facility is gained.

Another approach to material at this level (which presupposes a slightly different exercise from the one given above) is a cooperative structure called "teammates consult."[15] Each student is given a worksheet. Pencils must remain down while the question is read and discussed by the group. When consensus is reached, the group members fill out the answer on their individual worksheets.

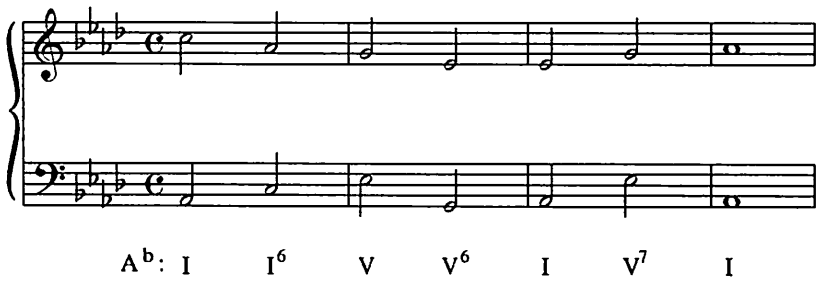
Sample lesson 3—harmonic dictation. The goal of this lesson is to make students aware of the different aspects of a harmonic texture, with the understanding that this awareness can contribute to fluency and accuracy in taking harmonic dictation. A group size of four is assumed, and each student is assigned a role: as a homophonic passage is played Student A listens for the soprano line, Student B listens for the bass line, and Student C tries to concentrate on the overall harmonic progression. Student D records the information from each of the three other students to construct an answer made up of a soprano line, bass line, and analytical symbols (typically, Roman numerals with inversions indicated). A sample exercise and response are given in Examples 2a and 2b.

EXAMPLE 2a. Sample harmonic dictation



[15]Kagan, *Cooperative Learning*, 11.

EXAMPLE 2b. Students' response



In total, four such dictation exercises are played, each repeated three or four times. With each successive exercise roles rotate; for the second exercise Student A is the recorder, Student B is responsible for the soprano line, Student C is responsible for the bass line, and Student D listens for the overall harmonic progression. A complete diagram of rotations is given in Figure 2. At the conclusion of each exercise the correct solution is given by the teacher, and any complications or problems discussed. After the discussion of the fourth dictation exercise a quiz is given, consisting of a passage similar to or slightly simpler than the preceding four. For the quiz the responses are individual, each student supplying the entire solution; these are then handed in to be graded by the teacher.

FIGURE 2. Rotation of roles

Exercise	1	2	3	4
Student A	soprano	recorder	harmonies	bass
Student B	bass	soprano	recorder	harmonies
Student C	harmonies	bass	soprano	recorder
Student D	recorder	harmonies	bass	soprano

In general, group exercises of this sort can be particularly useful in skills classes, since they offer an opportunity to break down complex and elusive tasks into component parts at the same time that the pressure of individual performance is momentarily eased. Designating rotating roles for group members insures a measure of accountability and participation within each group and facilitates the isolation of specific problems individual students may have. The group setting permits discussion of the solution to each exercise and encourages students to suggest strategies for listening. Finally, the sheer number of exercises played has its benefit: practice may not always make perfect, but it can surely contribute to facility.

This particular exercise also offers practice on the group skill of checking; part of the recorder's role should be to check for errors or lack of agreement in the information provided by the other students. The skill of checking must be taught and emphasized: it is critical to the learning process. It is not enough that the group confront the problem: the confrontation must result in correct answers. Students are sometimes reluctant to correct other students, fearful of hurting their feelings. It is incumbent upon the teacher to convince group members that permitting peers to accept incorrect answers is unethical and harmful.

Sample lesson 4—extended group project. This lesson is a more extensive foray into cooperative learning, one in which students are required to accomplish a number of tasks over a four-week period. The central task is to prepare, as a group, a presentation on one composition chosen from four or five works specified by the teacher. The basic requirements are that presentations last no longer than twelve minutes, involve every member of the group, and reflect what the group thinks is important about the composition. (The twelve-minute limit is simply an expedient that permits three presentations within a fifty-minute time period, with time after each presentation for questions and comments.) Provisions are made so that no more than two groups within the class are permitted to choose the same composition.

The first step in preparing the presentation is for group members to choose a composition. Sample compositions, all taken from

the fifth edition of Charles Burkhart's anthology of music,[16] are given in Figure 3a. The list should be given out ahead of time so that group members may look over the pieces; then five minutes are set aside after another group exercise or at the end of class for groups to choose the piece they will work on.

FIGURE 3a. Sample compositions from Burkhart's anthology

Ludwig van Beethoven, String Quartet No. 13 in B♭ major, Op. 130, Second movement

Franz Schubert, "Der Doppelgänger" from *Schwanengesang*

Felix Mendelssohn, *Song Without Words*, Op. 62, No. 1

Robert Schumann, "Vogel als Prophet" from *Waldszenen*, Op. 82

In a class session early in Week 1 group members decide what things about the composition must be researched and analyzed, and how to organize these things into an effective presentation. A checklist is given in Figure 3b. After the group has decided what must be covered responsibilities are delegated to individual group members, with the expectation that students will work on their individual assignments outside of class. Students should exchange telephone numbers (if they have not already done so), and one student should be chosen as a coordinator to insure that goals are met. All this activity is summarized in an initial report of group progress, given to the teacher either verbally or in written outline.

Toward the end of Week 2 groups meet with the teacher to report on the results of their research and analysis. At this point the strategy decided upon in earlier sessions can be fine-tuned and any other analytical or practical problems resolved.

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[16]Charles Burkhart, *Anthology for Musical Analysis*, 5th ed. (Fort Worth, TX: Harcourt Brace College Publishers, 1994)

FIGURE 3b. Suggestions for things to be researched, analyzed, and done in preparation for group presentation

a. harmonic analysis; plan to describe any chromatic harmonies in some detail
b. formal analysis
c. melodic analysis
d. text analysis (with songs)
e. programmatic analysis
f. information about other pieces in collection or other movements
g. historical information about the composer, origins of the work, circumstances for early performances of the work
h. recordings/performance
i. handouts
j. materials on board
k. other audio/visual aids

In Week 3 groups make their presentations to the class. At the conclusion of each presentation the class has the opportunity to ask questions of the presenting group or otherwise comment on the presentation, serving as a sort of informal evaluation of the presentation. The teacher provides a formal evaluation through a grade (where appropriate) and, more importantly, through written comments on the research and analysis imparted in the presentation. These comments are then at the disposal of each student for the final phase of the project, which consists of a two-to-three page paper on the composition presented by the group, due in Week 4. Each student summarizes the group presentation in this paper, following an outline of the sort given in Figure 3c. Because this information extends beyond any individual student's part of the presentation it requires a sharing of information among members of the group at the same time that it insures individual accountability for the material covered.

FIGURE 3c. Outline for paper summarizing group presentation

I. Identification of the work presented and historical information about the piece.

II. A brief description of the essential aspects of the form of the piece.

III. A brief discussion of one or two of the most important aspects of the compositional organization of the piece. Chances are these aspects coordinate with the form of the piece: important formal junctures often correspond with significant tonal developments. A few well-chosen examples from the work may be included, but these are not a substitute for a verbal account. Any examples should be included on a separate sheet of paper and keyed to the text, although there is no requirement for musical examples.

IV. A brief account of how any or all of this information might effect a performance of the work or an analytical interpretation of the work.

Cooperative Learning in the Music Theory Classroom

It is our belief that properly structured cooperative lessons can significantly enhance the way students learn, replicating in some measure the learning process we as teachers experience as we teach, listen to, and learn from others. The bulk of research indicates that cooperative learning can result in quantitative improvements in student achievement; at the very minimum, students in cooperative environments have at least the same level of achievement as students in more traditionally structured classrooms.[17] Perhaps more important than quantitative measures of achievement has been the

[17]For example, see Slavin, "Student Team Learning: A Manual for Teachers," 88; Sharan et al., "Cooperative Learning Effects on Ethnic Relations and Achievement in Israeli Junior-High-School Classrooms," in *Learning to Cooperate, Cooperating to Learn*, 313-40; and Johnson, Johnson, and Smith, *Cooperative Learning*, 38-42.

qualitative improvement that studies have shown: an improvement in students' attitude toward learning is a consistent result of introducing cooperative learning into the classroom. The most persuasive account of this change comes from a study devoted to the question of what makes for excellence in post-secondary education.

> Dividing students into small groups of between four and six, as they work on substantive topics, has a clear payoff. The payoff comes in a *modest* way for student achievement, as measured by test scores. It comes in a *far bigger* way on measures of students' involvement in courses, their enthusiasm, and their pursuit of topics to a more advanced level.[18]

This change in attitude is of signal importance for the study of music theory, for it helps students deal with competing demands made by other courses and by expectations of excellence in musical performance, demands that require students to learn as efficiently as possible. Efficient learning of the musical concepts dealt with at the post-secondary level has been undercut by the changing matrix of culture, reducing or eliminating much of the background knowledge that provides the necessary context for these concepts. A change of attitude alone cannot replace this context, but it can help students come to terms with the disparity between what they know and what they *need* to know to become effective students of music.

Although cooperative learning involves more interaction with students, almost all of this interaction takes place inside the classroom, which is the site of the cooperative learning experience. The increased teacher-student interaction associated with cooperative learning need not entail any huge increase in contact with students outside of class during office hours and appointments. Teachers *will* have to invest additional time in preparing lessons, an investment comparable to expanding into new portions of the repertoire, learning how a novel kind of computer software operates, or initiating the exploration of a new area of research. Of course, the issue

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[18]Richard J. Light, *The Harvard Assessment Seminars, First Report* (Cambridge, MA: Harvard University Graduate School of Education and Kennedy School of Government, 1990), 70.

of whether faculty should invest time in improving teaching through the adoption of innovative techniques is the subject of some debate, on a practical if not philosophical level: in post-secondary education, as elsewhere, the inertia of the status quo is a force to be reckoned with.

Introducing cooperative learning into an environment dominated by a lecture format may cause complications, although resistance from students is probably the least significant problem. Given clear guidance and a coherent learning structure most students readily adapt to working in small groups. A more significant problem may be the teacher's own training: the barriers created by years of passive absorption, highly competitive learning and work situations, and proscriptions against sharing information (a practice that many, regardless of circumstance, associate with cheating) are not easily overcome. The teacher interested in changing the dynamic of his or her classroom through cooperative lessons must recognize these barriers and have confidence that the rewards associated with becoming actively involved in the learning process will motivate students to overcome whatever reluctance they may have about working in groups.

Among the rewards students describe is the development of social skills. As Light notes in his review of studies of small- group learning,

> students overwhelmingly report one additional benefit of small group work. They point out that *the process of working in a group*, in a supervised setting, teaches them crucial skills. The skills they learn include how to move a group forward, how to disagree without being destructive or stifling new ideas, and how to include all members in a discussion. Few students, if any, have these skills when they arrive at college. Fewer still ever get formal training in them. Yet alumni from 35 liberal arts colleges report overwhelmingly that the best thing colleges could do for students in coming years would be to train them in how to engage in group efforts productively.[19]

The prospect of this reward carries its own challenge, for few if any teachers of music theory are trained in the development of social skills. Their training is, and should be, in music theory. To make

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[19]Ibid., 70-71.

the most effective use of cooperative learning the importance of social skills must be recognized and time, thought, and effort (along with a bit of humility about our own level of social skills) must be directed toward their cultivation.

As a final point, cooperative learning can, in a quiet and yet wholly persuasive way, open the classroom to viewpoints conditioned by combinations of gender, ethnicity, and experience different from those of the teacher. The importance of these viewpoints has been argued for elsewhere, and the arguments need not be rehearsed here. The possibility of allowing these viewpoints to emerge will, for many, be more than an even trade for the loss of that most central support to our ego, our role as the sole source of information within the classroom.

We believe cooperative learning has much to offer teachers at the post-secondary level. Beyond potential improvements in students' achievement, it offers the real promise for changing students' attitudes through actively engaging them in the learning process and giving them an opportunity to learn and refine social skills. Cooperative learning can also teach the teacher to think in new ways: previously silent or muted voices come to the fore; groups of students arrive at striking interpretations of a problematic work; a stilted explanation is given new life through a fresh interpretation from an eager and engaged student. But most importantly, cooperative learning can introduce our students to the thrill we ourselves have felt when, having learned, we share this learning with others.

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Three Introductory Miniatures for an Undergraduate Twentieth-Century Analysis Course

Craig Cummings

The undergraduate twentieth-century analysis course is difficult to teach: the vocabulary is expanded, at times the compositional techniques are new, and the course is usually compressed into a single semester. The teacher must determine precisely what the students should be expected to learn, since there are more possible pedagogical goals than there is time in such a course. This article assumes that the main objectives are helping the students develop the ability to analyze music that they encounter, familiarizing them with methodologies that may prove helpful in their analyses, and providing them with some knowledge of particular composers' styles. Given these goals and the time constraints, it is imperative to select works exemplary of their composers' styles and techniques. The commercially available anthologies cover the field well,[1] how-

[1]These anthologies include (among others): Mary I. Arlin et. al., *Music Sources*, 2nd ed. (Englewood Cliffs, NJ: Prentice Hall, 1989); Thomas Benjamin, Michael Horvit and Robert Nelson, *Music for Analysis*, 3rd ed. (Belmont, CA: Wadsworth, 1992); Charles Burkhart, *Anthology for Musical Analysis*, 5th ed. (Ft. Worth, TX: Harcourt Brace, 1994); Thomas DeLio and Stuart Saunders Smith, *Twentieth Century Music Scores* (Englewood Cliffs, NJ: Prentice Hall, 1989); Roger Kamien, *The Norton Scores*, 5th ed. (New York: Norton, 1990); Robert P. Morgan, *Anthology of Twentieth-Century Music* (New York: Norton, 1992); Claude V. Palisca, *Norton Anthology of Western Music*, 2nd ed. (New York: Norton, 1988); Bryan R. Simms, *Music of the Twentieth Century, An Anthology* (New York: Schirmer Books, 1986); Ralph Turek, *Analytical Anthology of Music*, 2nd ed. (New York: McGraw-Hill, 1992); and Mary H. Wennerstrom, *Anthology of Twentieth-century*

ever, lesser-known miniatures often are also effective. This article suggests content and ordering in presenting three brief pieces and addresses some issues of methodology. The compositions are:

1. "Jimbo's Lullaby" from *Children's Corner* suite by Claude Debussy;
2. *Tilimbom*, a song by Igor Stravinsky; and
3. "Dies ist ein Lied für dich allein," the first of *Fünf Lieder*, Op. 3, by Anton Webern.

Each of these brief works presents a clear stylistic example and establishes a foundation from which the students may advance into more complicated analytical work.[2]

Debussy composed his *Children's Corner* suite (1906-08) for his daughter. Several of the titles of the movements refer to her toys; "Jimbo's Lullaby," which refers to a toy elephant, is the second movement of six. This piece works well for introducing Impressionism in general as well as specific aspects of Debussy's style, and it is easily playable, thus creating a more musical atmosphere should the professor wish to present a live performance.[3] The following is a list of items for which the students might listen (many are possible without a score; some are more difficult): sections (no labels at first; simply find them), texture, tonal centers, pitch collections (scales) used and their relationships, harmony and chords, motivic structure (including rhythm and meter), and form.

The most important question concerning sections and tonal centers is not so much where they occur as why the students arrive at their conclusions. The students should be able to derive a plausible sectionalization, using a "bubble" or time-line diagram to summarize it. A temporary division into smaller units facilitates the analysis of other musical parameters. The discussion of how the sections are created should include factors such as texture, melodic material

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Music, 2nd ed. (Englewood Cliffs, NJ: Prentice Hall, 1988) and *Anthology of Musical Structure and Style* (Englewood Cliffs, NJ: Prentice Hall, 1983).

[2]The author is indebted to Mary I. Arlin for showing him the pedagogical value of the Debussy work and to Mary H. Wennerstrom for several ideas about the Webern composition.

[3]There is also a colorful orchestration of the entire suite by André Caplet.

and motives, and possibly the tonal centers and pitch collections used; these form-creating parameters are similar to those found in common-practice music of earlier eras. Since layered texture is typical of much Impressionistic music, one can point out the layering at such places as mm. 25-28, 39-40, and especially 63-70.

A discussion of the textural layers may lead into finding the various tonal centers and determining what makes them sound like tonics. While the tonal centers are ambiguous at times, they might be summarized as follows:

1-9	9-18	19-28	29-32	33-38	39-46	47-53	53-62	63-70	70-81
?	G? V/B♭?	B♭	A♭	---	A	D♭	G♭-E♭	B♭	---

The tonic of mm. 1-9 is best left open for later debate. The diagram shows G or V/B♭ as the tonic of mm. 9-18, and the situation is rather subtle: these measures provide an opportunity to discuss how the whole-tone scale obfuscates the prevailing tonic, since it has neither dominant nor leading tone and contains no half-steps. G may well be heard as tonic here, because the outer notes G5 and G1 of mm. 9-10 are reinforced by the F4-G4 pedal. One might just as readily hear F as the tonic (functioning as the dominant of B♭ on the larger scale). Measures 15-18, and most especially 17-18, serve as a transition to B♭, arriving on an implied V/B♭ in m. 18. After the relatively ambiguous opening (a connection to nineteenth-century practice), the remainder of the piece includes good examples of tonality by assertion or repetition. Although there are few spots where common-practice progressions and cadences establish the tonic, ostinati and pedals convincingly reinforce the tonics depicted on the diagram.

In addition to determining the tonics, the students might find those places that most nearly resemble traditional cadences. The most straightforward examples occur at mm. 18-19, 52-53, and 61-63, where the voice leading is largely by half- or whole-steps. Measures 52-53 feature the closest thing to an authentic cadence in the entire work: an altered dominant on D♭ resolving to G♭.

The tonic of mm. 1-9 may now be considered. Part of the beauty of the opening is its ambiguity, created by a relatively equal empha-

sis on all five pitch classes used and by their membership in an anhemitonic pentatonic collection. The returns of the opening material at mm. 21-28 and 63-70 have B♭ as tonic; might one then infer a B♭ tonic in the beginning as well? This question could be the subject for a discussion of implied notes, or even "implied tonics."

The relationships of the tonal centers and their placement within the overall tonal hierarchy are most efficiently depicted in a musical example (see Ex. 1).[4] After establishing that B♭ is the overall tonic, the students should discuss the relationships of the tonics; as is typical of much of Debussy's music, tonics related by second or third are more prominent than fifth-relations.

While it may appear conceptually backwards to find the tonics and then the pitch collections, students can more easily follow bass lines and hear ostinati and pedals as establishing tonic. Finding the complete pitch complement for a section is a more difficult task. In addition, determining the tonic sometimes facilitates the process of finding the scales used. Example 2 shows the pitch collections for the various sections of the work; the tonics are shown as whole notes while the other scale members are unstemmed quarter notes. Some of the scales, especially that of mm. 57-62, border on the total chromatic. Several of the sections contain "non-scale tones," which are omitted from the example.

"Jimbo's Lullaby" provides ample opportunity for presenting or reviewing scale types, including the pentatonic and whole-tone scales and the diatonic modes. The students might initially arrive at different conclusions, leading to a discussion of the potential ambiguity of the pentatonic and whole-tone scales and even the modes, if this has not already been considered. Connections among the pitch collections may be addressed by finding the common tones (see the circled notes in Ex. 2, which are the most obvious common-tone connections to address in a first class).

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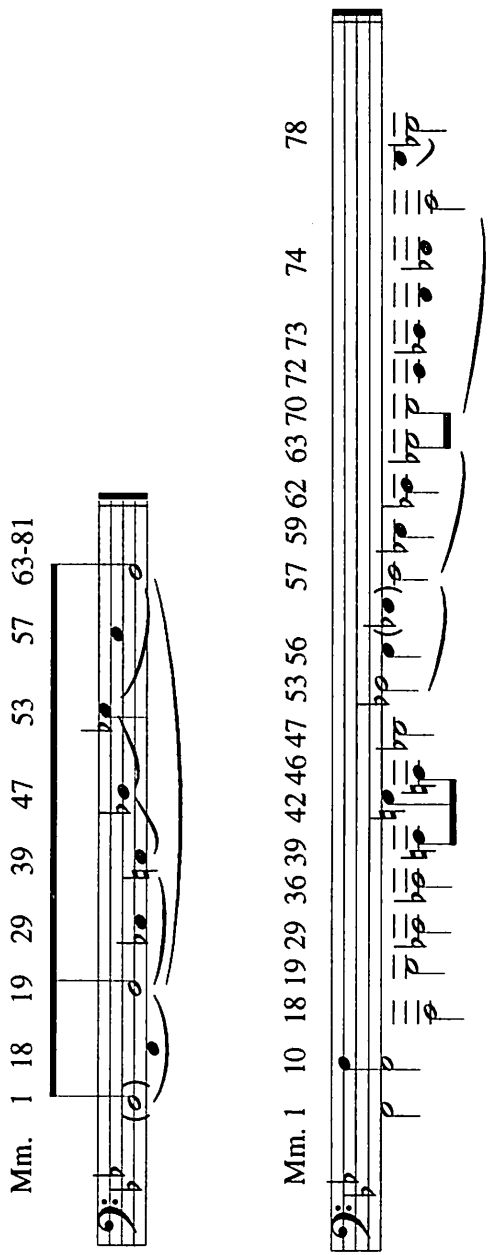
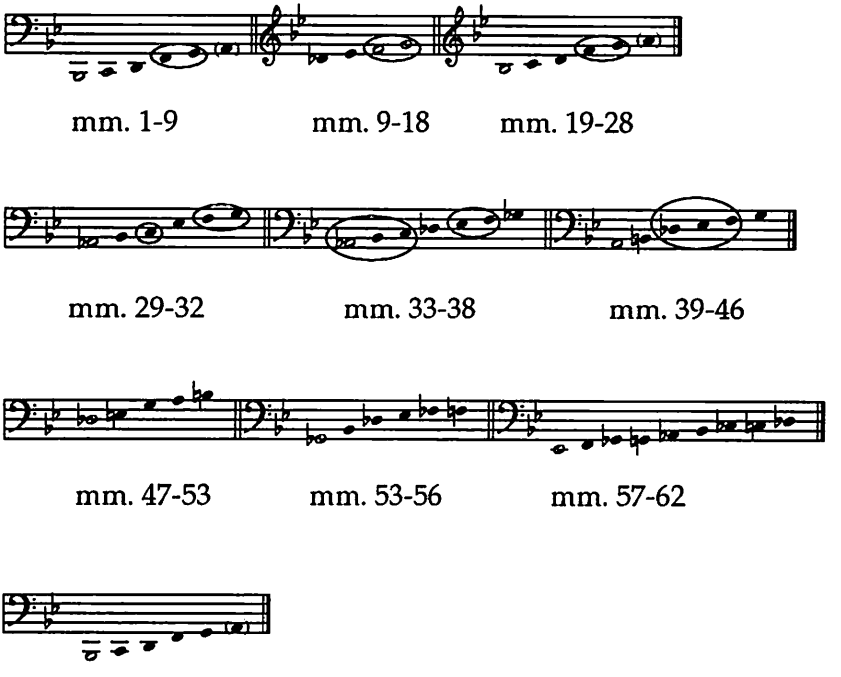
[4]In Example 1, my analysis is shown on the top, while the bottom reproduces that of Richard S. Parks in *The Music of Claude Debussy* (New Haven: Yale University Press, 1989), 69-70. While Parks discusses the pitch collections in this work by invoking pc set theory, and more specifically the notion of pc set genera, my analysis avoids this approach. The form diagram in this article is similar to that found on page 67 in the Parks book.

Example 1. Two readings of the tonal structure of "Jimbo's Lullaby": reading by Cummings on top, reading by Richard Parks underneath



Example 2. Pitch collections in "Jimbo's Lullaby"

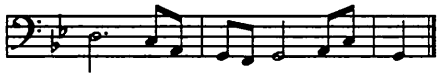


As is typical of many of Debussy's works, the chords generally are comprised of the pitch-collection members and contain few "non-scale tones." Measures 33-36 provide a brief example of harmonic parallelism or diatonic planing within the $A^{\flat}$ Mixolydian collection, while mm. 47-48 are a good negative example: one may successfully address the common student error of calling parallel intervals planing, and point out that planing must be parallel chords of some type.

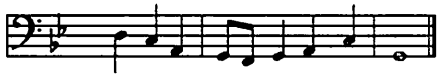
The motivic structure of "Jimbo's Lullaby," while not exceedingly complex, includes the varied repetition or recurrence of ideas, as is typical of Debussy's style. Example 3 shows two important melodic ideas along with some varied recurrences of each.

Example 3. Two prominent melodic ideas in "Jimbo's Lullaby" (registers altered for clarity)

A. Pentatonic motive

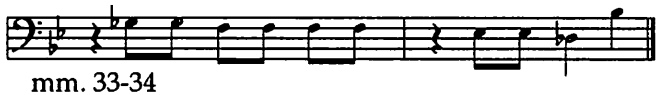


mm. 5-7

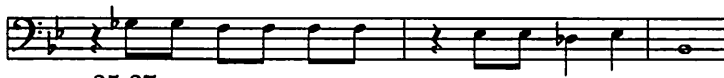


mm. 7-9

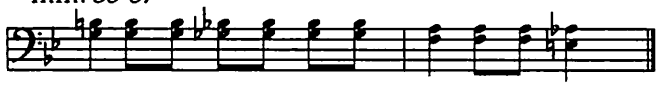
B. Descending-step-motive



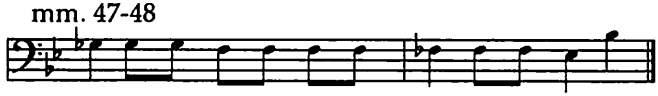
mm. 33-34



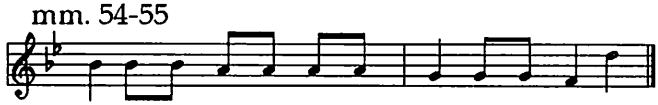
mm. 35-37



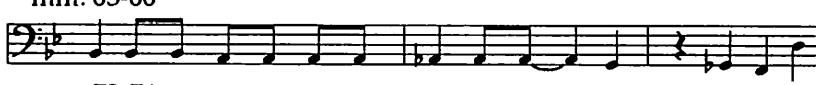
mm. 47-48



mm. 54-55



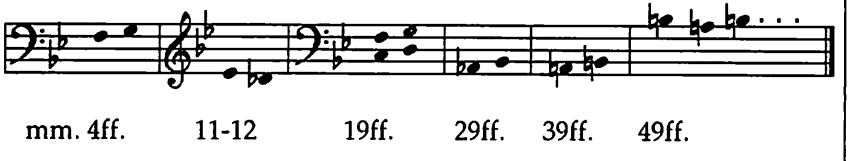
mm. 63-66



mm. 72-74

The material from mm. 5-7, which might be called the "pentatonic motive," recurs at mm. 7-9, 24-28, and 66-70. The "descending-step motive" is foreshadowed in mm. 29-30 and first clearly stated in mm. 33-34; it also returns in numerous guises. A final interesting detail is the major second, which is an integral part of all the pitch collections of the work and is used in a variety of ways (in particular, as part of pedals or ostinati; see Ex. 4).

Example 4. Prominent major seconds in "Jimbo's Lullaby"

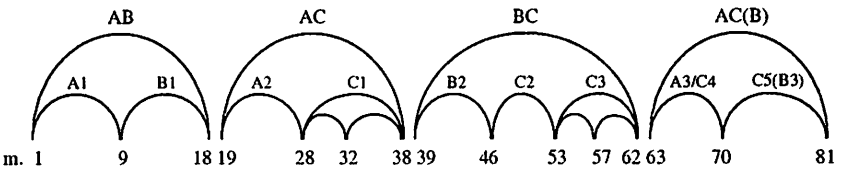


Rhythm and meter may be addressed in terms of the motives and the clarity of metric structure; however, "Jimbo's Lullaby" is not the most representative example of Debussy's rhythmic and metric subtlety.

The examination of detail may be summarized by an analysis of the form. "Jimbo's Lullaby" is a good example of Debussy's approach to form in that it exemplifies varied repetition and recurrence rather than development of ideas. A discussion can consider the reaction against Germanic developmental forms, the decreased emphasis on traditional phrase structure, and the replacement of it by immediate repetition and other techniques. If the students have already found the sections and why they are where they are, and have in addition covered pitch and rhythm in some detail, they will be able to discuss the relationships among sections and perhaps attach labels (see Fig. 1).

The students might approach the form by finding returns of the opening material (mm. 1-9) and labeling them with some form of 'A'. The material in mm. 9-18 appears to be transitional; however, it recurs in different surroundings in mm. 39-46, so it may be labelled

Figure 1. Formal diagram of "Jimbo's Lullaby"



'B'. If one interprets mm. 29-32 as transitional, then mm. 33-38—the descending-step motive—may well be labeled 'C', in part because this material recurs in mm. 47-48 and 54-59. The final large section, mm. 63-81, combines earlier materials in interesting ways: mm. 63-66 include the 'A' idea at the very top of the texture and a diatonic version of 'C' underneath it, followed by the recurrence of 'A' alone in mm. 67-70. Measures 70-81 form a coda, including 'C' (mm. 70-73, left hand) and a final allusion to 'B' (mm. 78-79, right hand). It is interesting to note that 'B' is first presented in an incomplete or fragmented way, almost like a foreshadowing (mm. 9-18), and that its final statement is even more fragmentary and allusive.

The students should also discover that one way in which Debussy recasts themes is by placing them in different registers. The final large section (mm. 63-81) includes all three themes in their highest registers except for theme C, which occurs in its highest then lowest register. This characteristic is common in many of Debussy's works.

"Jimbo's Lullaby," while a simple composition, exemplifies numerous Impressionistic techniques and stylistic features and illustrates a variety of pitch collections. The approach to the piece just discussed suggests a clear and fairly comprehensive introduction to Debussy's compositional practice. The teacher could follow this piece with any number of Debussy's works, including perhaps "Voiles" or "Des pas sur la neige" from the *Preludes*, Book I.

Just as "Jimbo's Lullaby" introduces Debussy's musical language and compositional techniques, so the song *Tilimbom* provides an initial exposure to Stravinsky. The discussion of this song may be as general and stylistic as that of the Debussy work, or the teacher can make it more methodology-specific by employing ideas about pc sets. *Tilimbom* was originally composed in 1917 as the first of the *Trois Histoires pour Enfants* for voice and piano. Stravinsky then rewrote it for voice and orchestra in 1923, lengthening it from 36 to the now-standard 64 measures. Finally, Stravinsky rescored it for voice, flute, harp, and guitar in 1954, making it the fourth of *Four Songs*. The song has a traditional Russian text.

The students could listen initially for texture. Generally, it is melody and accompaniment, but they will discover that the accompaniment is comprised of layered ostinati. The left-hand ostinato[5] is present throughout the piece; its pitch structure can be described in two different ways:

1. Stravinsky makes use of octave displacement, as exemplified by the F3-G4 leap on the second beat of each measure; and
2. The ostinato is a (0, 2, 7) pc set.

Regarding statement number two: it is sometimes a good idea to allude to integer notation and use it informally before formalizing it into full-blown pc set analysis. This may be as simple as saying: "let's eliminate the duplicated G and view the ostinato notes as F-G-C. If we call F zero and count up half steps, what would G and C be?" The students confirm that G is two and C is seven, and then one may say "Now we have a simple way to refer to the ostinato—we'll call it the (0,2,7) ostinato." Even a few initial lighthearted efforts at integer notation reduce anxiety later in the term.

After discussing the left hand, one would consider the right hand and the vocal line. This song has simple, clearly-delineated sections, yet there are numerous interesting points for discussion:

Are mm. 1-4 really bitonal (or at least examples of bichords)?
How are the vocal line and the right-hand ostinato related in

[5] All references are to the 64-measure piano-vocal score.

mm. 5-8? in mm. 28-32?
How are they related in mm. 53-57?
How are the ostinati in mm. 21-28 related to one another?

The final question provides an opportunity to discuss informally the transposition of pc sets: "G-A-D is also (0, 2, 7). Isn't it interesting that Stravinsky layers two ideas that are both (0, 2, 7)?" These patterns are similar to two different major triads: same interval structure, but different transpositions, and just as a triad may be placed in different inversions and registers, so has Stravinsky taken this (0,2,7) idea and used it in two different configurations.

In addition to the changing texture, the vocal line delineates sections in this work. The line sounds folk-like, covers a small range, and involves the (sometimes varied) repetition of a small collection of pitches: these are all stylistic traits of Stravinsky. The students may then find the different collections of mm. 1-32 (the remainder of the song repeats the collections):

measures:	1-4	5-16	21-32
pitches:	A,C,D	G,A,B,C	G,A,B,C,D
pc sets:	(0,2,5)	(0,1,3,5)	(0,2,3,5,7)

Having the students informally find the prime forms of each of the pc sets is more complicated here, since the students must "count down from the top" rather than up from the bottom (i.e., they are inverting the set); nevertheless, one can usually persuade the students to take a temporary leap of faith. On the other hand, if the teacher has already formalized pc set procedures, then these operations are easier.

Regardless of the degree of formalization, notions of sub- and supersets and invariance may be introduced at this point: mm. 1-4 and 5-16 hold the pitches A and C invariant, 5-16 and 21-32 hold the pitches G, A, B, and C invariant, and the pitches of both mm. 1-4 and 5-16 are contained in those of mm. 21-32. Therefore, the pitches of mm. 21-32 may be considered a superset, while those of mm. 1-4 and 5-16 are subsets. Working with the combined vocal line and accompaniment is also possible, although it may create greater pc set complexity than is desired in an introductory lecture.

In addition to the pc set structures, the students will find contextually emphasized pitches in the melody: for example, D5 alternating with C5 in mm. 1-4, A4 in mm. 5-16 (perhaps in alternation with B4 near the end of the section), and D5 and A4 in mm. 21-32.

By this point the students will have discovered recurring ideas throughout the song. One possible labeling of elements (a, b, c) reveals this formal diagram:

section:	a	b	a	c	a	b	a	c′	a
measures:	1-4	5-16	17-20	21-32	33-36	37-48	49-52	53-60	61-64

Further discussions might include proportion, the imbalance of section lengths, and the rondo-like quality (or, at least, refrain structure) of the overall composition. In addition, there are few transitions: Stravinsky chooses instead to juxtapose different ideas. The song is less useful as an illustration of Stravinsky's rhythmic and metric procedures.

One might also consider Stravinsky's harmony. The "chords" (or perhaps better, simultaneities) in the work may be analyzed using the pc set procedures suggested above. Just as important at this initial point of study are the following:

1. The harmony is static—there is little or even no sense of progression.
2. Stravinsky makes consistent use of dissonance—interval classes 1 and 2 or, if one has not introduced this concept yet, students can find many seconds and sevenths and some ninths.
3. As mentioned earlier, another approach considers bichords.

Tilimbom provides a clear introduction to Stravinsky's style, and yet it does so in a brief, uncomplicated context. The song may be followed by any number of more complicated Stravinsky works. The "Russian Dance" from *Petroushka* provides a particularly good continuation in that it contains the same basic stylistic characteristics in a more complicated work and in full orchestral score.

"Dies ist ein Lied für dich allein," the first of *Fünf Lieder*, Op. 3, by Anton Webern, was composed in 1908. The text is from *Der siebente Ring* by Stefan George. This song contains many connec-

tions to the nineteenth-century German *Lied*, and the typical negative reaction of many students to "dissonant" music may be mollified or even eliminated by emphasizing the ties that Schoenberg and his students felt with tradition. Although perhaps the break from tradition is more important than the connection to it, emphasizing this relationship is not artificial. Before working on this song, the teacher might play an even earlier one by Webern: for example, the 1899 song "Vorfrühling," one of *Three Poems* with texts by Ferdinand Avenarius. This song has fairly conventional rhythms, is quite tonal, and is directly tied into the Schubert/Schumann/Wolf tradition, thus providing a good point of departure.

After listening to and discussing "Dies ist ein Lied" without the score, the students can address the connections to tradition:

1. This is a *Lied* for voice and piano; the genre is traditional, and the piano part is an integral component of the composition in a way similar to a Schubert *Lied;*
2. The division into fairly clear-cut phrases is related to earlier compositional practice;
3. The tripartite form of the song, in which the third section is a varied return of the first, is traditional; and
4. The way in which both the vocal line and the piano make use of gesture and of motivic concentration is typical of much eighteenth- and nineteenth-century composition.

This final point is important: Webern and his Viennese contemporaries created a compositional problem for themselves by eliminating the stabilizing and form-producing force of tonality, and their initial solution was dense motivic concentration. The song is in three sections, the third of which is a varied recurrence of the first:[6]

section:	A	B	A′
measures:	1-5	6-7	8-12

[6]The form diagram and discussion of the Webern song bear some resemblance to those of Robert P. Morgan in both the anthology mentioned earlier and the accompanying text, *Twentieth-Century Music* (New York: Norton, 1991), 79-80. This article explores the set-theoretical aspects to a somewhat greater degree than do Morgan's anthology and text.

Aside from finding the sections, the more important issues of why they fall in these places, what creates cadences, and how the return is related to the opening should also be addressed. The structure of the motives themselves should be considered, arriving eventually at something like Example 5.

While the motives appear different on the surface, numbers 2-15 may all be seen as variants of number 1. The variety in numbers 1-4 is created through rhythmic alterations; numbers 2 and 6-10 may be seen as submotives (or subsets), varied through rhythmic changes and intervallic contraction or expansion. Finally, while numbers 11-15 look substantially different from number 1, the first four pcs of number 11 are identical to those of number 1.

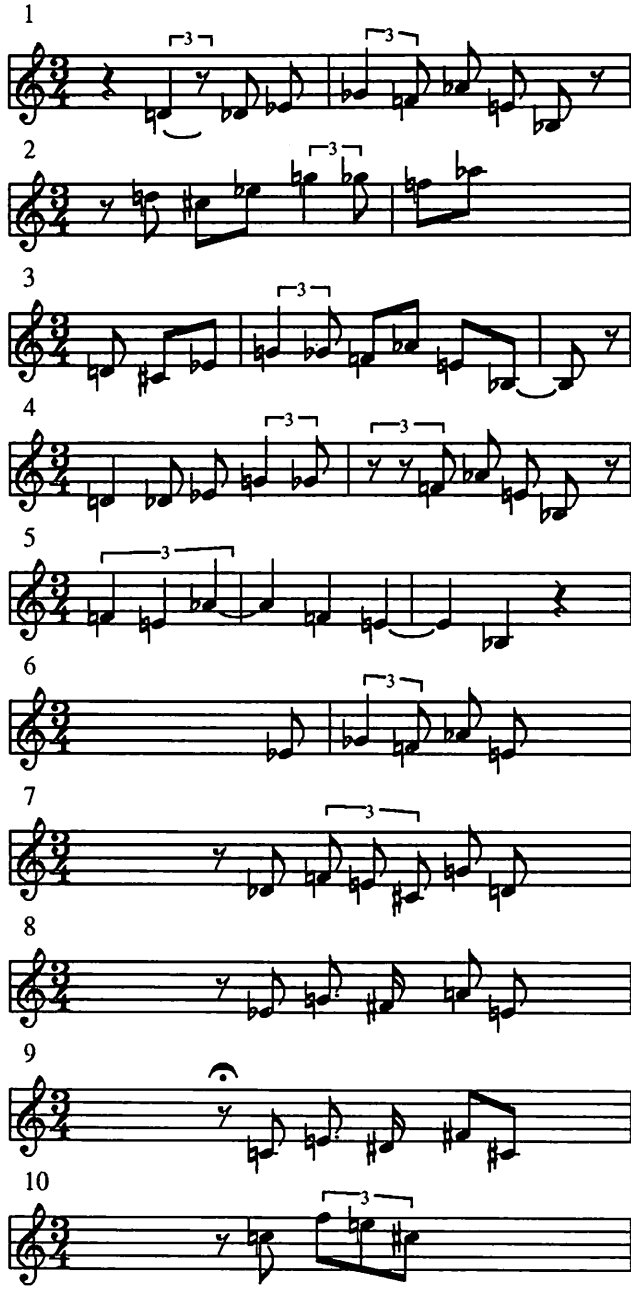
After trying to find and characterize the motivic connections, the students will probably agree that they need a system to classify collections of notes in order to show their pitch similarities as well as their intervallic content. Here one might begin a systematic approach to pc set analysis, if it has not already been presented.

The important initial premises are enharmonic and octave equivalence. Quicker students will object to the loss of the voice-leading implications of different spellings and also the loss of register. There is little to say to them, but generally they will accept that the intervallic construction of the motives is an issue worth investigation. The teacher can demonstrate that generalization to the twelve different pcs is similar to the consistent labeling of a C major triad, even though the triad may be presented in varied voicings, spellings, and registral contexts.

The next step is to find the normal order of the set; however, one need not call it that immediately. Rather, one might simply state that one classification system calls the pc C zero, and then relates all other pcs to it. The students may notice that this is analogous to fixed-do solfège. The students may then group the notes as closely together as possible—to compress them into a small space, or try to put them into the shortest scale possible. This process is analogous to taking any major triad and putting it into root position, closest spacing.

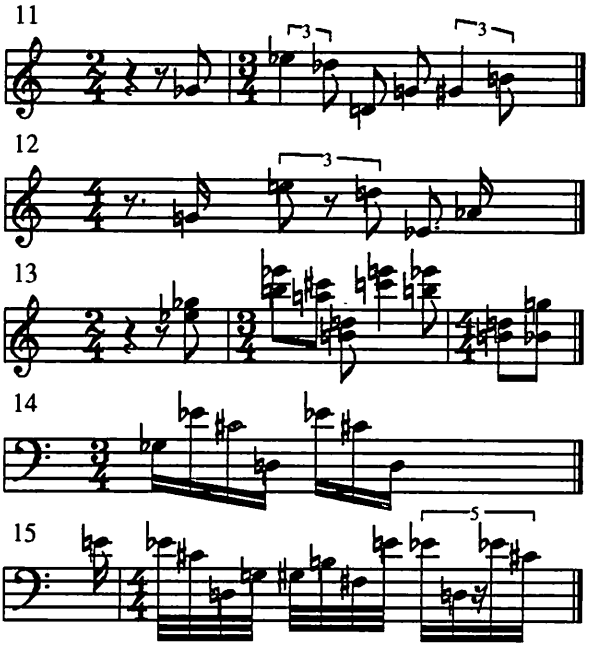
A word about the rigor of presenting normal order: while there is a time and place for introducing the notion of examining every rotation of a pc set to determine its normal order and for discussing

Example 5. Motivic structure in "Dies ist ein Lied für dich allein"



(cont.)

Example 5. (cont.)



Where they are from: #1: mm. 1-2, voice; #2: mm. 2-3, piano; #3: mm. 8-9, piano; #4: mm. 9-10, voice; #5: mm. 10-12, piano; #6: mm. 1-2 voice; #7: m. 3, voice; #8: m. 4, voice; #9: m. 8, voice; #10: m. 4, piano; #11: m. 6, voice; #12: m. 7, voice; #13: mm. 6-7, piano; #14: m. 6, piano; #15: m. 7, piano.

best normal order, these procedures may be temporarily postponed if one creates situations in which they are unnecessary. For many trichords and tetrachords the smallest span is visually quite obvious. One can eventually formalize the process by teaching how to determine normal order two different ways:

1. The rotation system, in which one rotates the bottom note to the top and systematically examines the rotations to find the smallest span (one could also present the successive interval array in this context);[7] and

[7] See David Mancini, "Teaching Set Theory in the Undergraduate Core Curriculum," *Journal of Music Theory Pedagogy* 5/1 (Spring 1991): 95-107 for additional information about the pedagogical value of the successive interval array.

2. A procedure which accomplishes much the same thing: intuitively try to find the normal order, then duplicate the bottom note on the top. Find the largest interval, and begin the normal order on the top note of the largest interval.

The first chord in the Webern song includes pcs 2, 3, 10, and 11. If it has not already been introduced, this is a good opportunity to present the idea of modulo 12 arithmetic. It may be as simple as pointing to a clock face and saying that we do not say "13 o'clock" (at least in the United States), but rather call it "1 o'clock." It is thus as if we subtract twelve from any hour larger than twelve. The only exception to the clock face analogy is that "12 o'clock" is referred to as zero in mod 12 terms—we subtract 12 from 12 as well as from anything larger than twelve.

Another way of getting at it is to present two side-by-side continua:

.	.	.	9	10	11	0	1	2	.	.	.
						12	13	14	.	.	.

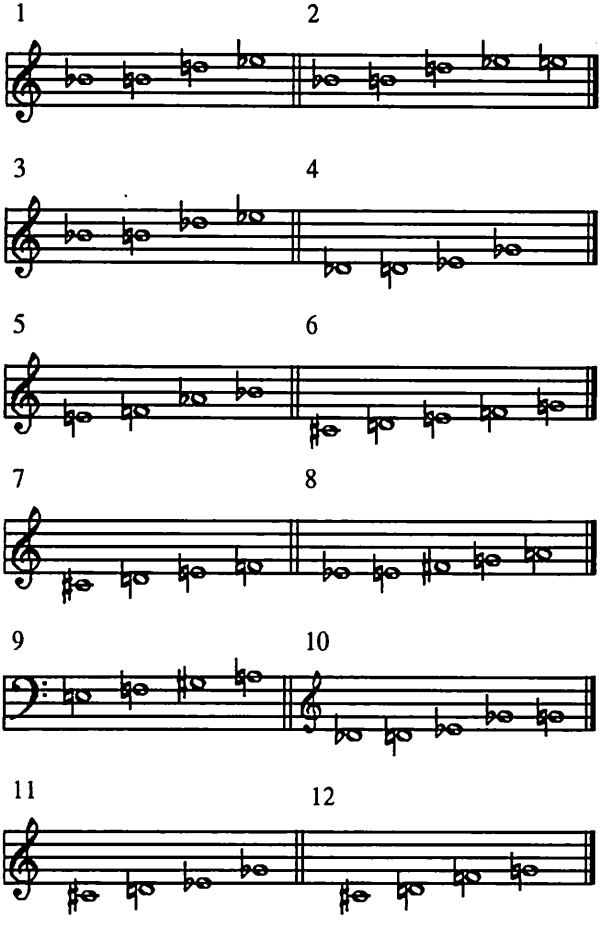
For the Webern chord, while [2,3,10,11] looks fairly compressed, it really has a span of nine semitones. The students will find that [10,11,2,3] has a span of only five semitones, the smallest span possible. The process of finding normal order thus involves:

1) assigning numbers (where C = 0);
2) eliminating duplications; and
3) finding the smallest span.

Normal order is useful for comparing chords and motives, particularly if one is looking for pcs in common between them. The normal orders of numerous other chords and motives throughout the song are given in Example 6. The issue of what to do when there is a "tie"—more than one rotation with the same interval span—might be addressed if the students are catching on quickly, but often it is best to leave it for a future class meeting.

An alternative to first creating a long list of normal orders and then converting them into prime forms (called set types in some texts) is immediately presenting the idea of prime form after find-

Example 6. Normal orders for several pc sets in "Dies ist ein Lied für dich allein"



Number	*Location*	*Normal order*
1	m. 1, piano, r.h., first chord	[10,11,2,3]
2	m. 1, piano, l.h. added	[10,11,2,3,4]
3	m. 1, piano, r.h., second chord	[10,11,1,3]
4	mm. 1-2[1], voice	[1,2,3,6]
5	m. 2, voice, all pitches but Gb4	[4,5,8,10]
6	m. 3, voice	[1,2,4,5,7]
7	m. 3, piano chord, beat 2.5	[1,2,4,5]
8	m. 4, voice	[3,4,6,7,9]
9	m. 5, piano	[4,5,8,9]
10	mm. 5-6[2], voice	[1,2,3,6,7]
11	m. 6, beat 2, piano	[1,2,3,6]
12	mm. 7-8, fermata chord	[1,2,5,7]

ing the very first normal order. Given the set with normal order [10, 11, 2, 3], the students might find it more efficient to begin the set on zero, analogous to transposition. The students may discover that this process is similar to taking several major triads with different roots and calling them all simply major triads; it is thus a general label. They may also discern the analogy with movable-do solfège—here, it is "movable zero." As the students figure out the prime forms, they will notice that several sets recur at different transpositions. They may then conclude that it is efficient to have one label which shows this similarity. Table 1 shows the prime forms and Forte designations[8] for each of the normal orders calculated in Example 6.

Table 1. Prime forms for several pc sets in "Dies ist ein Lied für dich allein"

Number	*Normal order*	*Prime form*	*Forte name*
1	[10,11,2,3]	(0,1,4,5)	4-7
2	[10,11,2,3,4]	(0,1,2,5,6)	5-6
3	[10,11,1,3]	(0,1,3,5)	4-11
4	[1,2,3,6]	(0,1,2,5)	4-4
5	[4,5,8,10]	(0,1,4,6)	4-Z15
6	[1,2,4,5,7]	(0,1,3,4,6)	5-10
7	[1,2,4,5]	(0,1,3,4)	4-3
8	[3,4,6,7,9]	(0,1,3,4,6)	5-10
9	[4,5,8,9]	(0,1,4,5)	4-7
10	[1,2,3,6,7]	(0,1,2,5,6)	5-6
11	[1,2,3,6]	(0,1,2,5)	4-4
12	[1,2,5,7]	(0,1,4,6)	4-Z15

If the class is particularly astute, one may even discuss the idea of subsets and supersets, using prime forms from the piece: (0,1,4,6) and (0,1,3,4,6); (0,1,2,5) and (0,1,2,5,6); and perhaps even (0,1,4,5) and (0,1,2,5,6). Finally, one may discuss Webern's notion of "the unity of musical space," citing the vertical and horizontal use of (0,1,2,5,6)

[8] See Allen Forte, *The Structure of Atonal Music* (New Haven: Yale University Press, 1973), 179-181.

and of (0,1,3,4) and (0,1,3,4,6). It is also worth mentioning that the sets (0,1,3), (0,1,4), and (0,1,4,5) were among Webern's favorites.

"Dies ist ein Lied für dich allein" provides a clear and practical introduction to atonal music and to pc set concepts; it may be followed by any number of compositions. Webern's Op. 5 or Op. 9 pieces work well, or if one prefers vocal music, Schoenberg's Op. 15 or Op. 21 are effective, as are Berg's Op. 2 songs. While it is chronologically more logical to begin with works which are on the edge between post-tonality and atonality, the students often find them more difficult to work with. It is sometimes easier to use clearly atonal, densely motivic, texturally transparent works first, and then address the more difficult post-tonal compositions such as Schoenberg's "Saget mir," number five from *Das Buch der hängenden Gärten*, Op. 15.

Undergraduate twentieth-century analysis courses are a joy to teach; however, the selection of compositions is critical to the students' understanding. The three miniatures discussed in this article provide concise introductions to their composers' styles and also to analytical approaches, and they may form a springboard into more detailed analytical investigation.

An ExSPRT Systems Approach to the Assessment of Students Needing Remediation in Music Theory

Timothy A. Smith

The typical freshman class in music theory is composed of students with formidable disparities in competence. It is not unusual for upwards of twenty percent of these people to withdraw or fail the first semester. Some failure is unavoidable, but excessive rates contribute to an inefficient use of faculty loads, student time, and money. It is possible to reduce the dropout rate if students with deficiencies are remediated.

It falls to schools of music to provide the instruments that will identify and advise unprepared students. No standardized test exists, however, for this particular diagnostic objective and age group. While the Aliferis-Stecklein Music Achievement Test does measure theory skills, its specifications also include history, literature, and performance. Further, both the Graduate Record Exam and the Aliferis Senior Comprehensive and Entering Graduate level test are too advanced to identify undergraduate students at risk. As a consequence, music schools often use instruments produced locally without an empirical basis for the interpretation of scores.

A systematic process of remediation requires that all students be tested, evaluated, and advised before registration. The logistical impediments of paper-and-pencil technology include scheduling appointments, proctoring and grading exams, and communicating results. By contrast, one might administer a computer test accessible on demand, with automated prognosis and recommendation available immediately upon completion. An *adaptive* computer test could accomplish the assessment even more efficiently and more

accurately. The computer could omit items that are too hard or too easy, compare student performance with statistical norms, and generate problems algorithmically.

This article documents a project undertaken by Ball State University to design and implement such a test. In late 1991 the project culminated in a computer adaptive test—called Ready or Not—that the School of Music has used since that date as part of its enrollment management program.[1] The article begins with a look at traditional methods of assessment, continues with a description of Ball State's pilot study of 1990-'91, and concludes with an explanation of the ExSPRT system now in use.

Related Research

The Harrison Study

Several researchers have compared student performance in the major with high school GPA, achievement tests such as the SAT, College BASE, or CAT, or music aptitude tests such as the College Music Aptitude Profile. Carole S. Harrison, for example, compared student performance in theory with three measures of achievement or aptitude (along with experiential measures such as the number of instruments played and years of private study).[2] She discovered the strongest correlations among theory grades and SAT math scores, high school GPA, and years of piano study. Surprisingly, Harrison found the music aptitude test to be a less than reliable measure when it came to predicting success in music theory. There is thus a need for a reliable theory-specific instrument that correlates with performance in the sequence.

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[1]Before being admitted into the program students are required to submit SAT scores, audition, interview, write a short essay, and take the Ready or Not test.

[2]Carole S. Harrison, "Predicting Music Theory Grades: The Relative Efficiency of Academic Ability, Music Experience, and Musical Aptitude," *Journal of Research in Music Education* 38/2 (1990): 124-137. See also Harrison, "Relationship Between Grades in the Components of Freshman Music Theory and Selected Background Variables," *J.R.M.E.* 38/3 (1990): 175-186.

The Colman Study

In 1988 Peter Colman attempted to construct such an instrument.[3] Colman did not assemble an objective standard for the interpretation of his test or for the advising of students, but limited his work to constructing and validating a prototype that could be administered by computer. Colman arranged preskills into a behavior and content matrix out of which his panel of experts developed a table of specifications and ninety multiple choice items in the following proportions: 25% scales, 20% pitch notation, 15% notes and rests, 15% intervals, 15% triads, 10% key signatures, 5% time notation.

Colman scripted his test into a Hypercard stack which he used to assess 59 students at Michigan State University during registration week of the fall semester, 1988. Students averaged 50 minutes to complete the assessment. Colman selected twenty individuals at random to retake the test one week later, enabling him to establish the reliability of the test with a strong correlation of 86% and a small number of negatively discriminating items. Colman's longitudinal comparisons correlated these entering test scores with three grades for each student (aural lab, final grade in percentage points, final grade in a four-point grade scale) over a three-term span.

Colman's pretest scores correlated most highly with the four-point scale as averaged over the three terms—a correlation of 51%. The lowest correlation was between the test and the ear-training lab grades—32%. Colman was not surprised with this result because his test included only eleven aural tasks. Colman concluded that the test contained no major design flaws and that it could accurately diagnose a student's preparedness to enter college level theory in universities like Michigan State.

Colman started the study with 59 students and concluded with 32. Unfortunately, his sample was insufficient to generalize results to a larger population. Item response theory dictates that item pa-

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[3]Peter Colman, "Development and Validation of a Computerized Diagnostic Test for the Prediction of Success in the First-Year Music Theory Sequence" (Ph.D. diss., Michigan State University, 1990).

rameter information be obtained from a pool of 200 to 1000 individuals.[4] Colman recognized this when he wrote: "An inherent problem . . . is the small size of the available sample and the great impact upon the study of students dropping out of the course" (p. 12).

The Ball State Pilot Study

In 1990, under joint auspices of Ball State University's Office of Research and Sponsored Programs and College of Fine Arts, I undertook to design an intelligent system for the purpose of assessing the skills of college freshmen beginning a course of study in music theory and identifying students at risk. The first phase of the research involved a Hypercard questionnaire, similar to Colman's, administered to volunteer freshmen at Ball State University, Indiana University, Biola University, Taylor University, and the University of Oregon[5] during the first week of the 1990 fall semester. From the nearly 200 students who took the pretest, I obtained complete linear data, including term grades, for 141. While this number is not sufficient to determine mastery on the basis of item response theory, it is more than enough to construct probabilities using Bayesian sequential probabilities ratios.

Besides gathering demographic, experiential, and attitudinal data, the questionnaire presented a series of aural, keyboard, and written tasks, recording the student's solutions and response times. The environmental data comprise the focus of ongoing analysis that may yet yield correlations of the type produced in the Harrison study. It is, however, the theoretical tasks that comprise the mathematical basis for the intelligent system described here.

The study began with an hypothesis that time spent on task would be a measure of fluency, that students who were masters would complete their tasks in less time than would nonmasters.

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[4]Theodore Frick, "A Comparison of an Expert Systems Approach to Computerized Adaptive Testing and an Item Response Theory Model," paper presented at the Annual Conference of the Association for Educational Communications and Technology, February 1991.

[5]Thanks for the collaboration of colleagues Allen Winold, Edwin Childs, Fred Schultz, and Robert Hurwitz at the latter four institutions.

While the data supported this theory somewhat, I discovered that students who perceived themselves to be nonmasters often spent less time on tasks than did masters. It soon became apparent that while speed is, for some students, a measure of fluency, it is, for others, a measure of having become frustrated, given up, and moved to a new problem. The conclusion of this line of inquiry was to abandon time on task as a variable to be used in the intelligent system.

The questionnaire of the 1990 study concluded with a tabulation of percentages correct for task performance sub-areas (written, aural, keyboard) and a composite of performance on all tasks. To determine if raw scores had correlated with semester grades, I calculated average pretest scores for individuals in each semester grade group (A, B, C, D, F). Table 1 represents these percentages in a comparison of term grades with performance on the test prototype.

Table 1. Comparison of term grades with average pretest scores

	Average Pretest Scores, Fall 1990			
Semester Grades, Fall 1990	Written Subscore	Aural Subscore	Keyboard Subscore	Composite Score
Individuals with written grade of F	.67	.31	.48	.58
Individuals with aural grade of F	.70	.27	.56	.61
Individuals with overall grade of F	.68	.28	.53	.59
Individuals with written grade of D	.73	.56	.58	.67
Individuals with aural grade of D	.81	.55	.79	.77
Individuals with overall grade of D	.76	.41	.71	.70
Individuals with written grade of C	.78	.49	.78	.73
Individuals with aural grade of C	.80	.57	.69	.74
Individuals with overall grade of C	.80	.58	.77	.76
Individuals with written grade of B	.83	.60	.78	.79
Individuals with aural grade of B	.83	.68	.69	.78
Individuals with overall grade of B	.81	.63	.71	.76
Individuals with written grade of A	.83	.70	.89	.82
Individuals with aural grade of A	.81	.74	.75	.79
Individuals with overall grade of A	.78	.64	.82	.77

The table shows that students who failed the course achieved an aggregate raw score of 25% less than students who passed the course with an A and 20% less than students who passed the course with a D or higher. Thus, student performance in the test prototype did reflect grade distributions at the conclusion of the semester.

I also grouped pretest subscores into quintiles and compared them to average semester grades for individuals falling within each quintile. This comparison showed that students whose subscores were in the lowest fifth earned semester grades of D or F in theory. Students who scored in the highest fifth earned an average grade of B. Table 2 represents these figures (average semester grades of D or F appear in bold type).

The questionnaire's statistics for scale showed a mean of 68.56% with a standard deviation of 20.89%. Roughly two-thirds of the subjects scored between 48% and 88% in the composite raw score, roughly one-sixth scored below 48% and one-sixth scored higher than 88%. Inter-item correlation yielded a positive mean of .2972 with a minimum correlation (negatively discriminating item) of –.529, a maximum correlation (positively discriminating item) of 1.0, and a range of 1.529.

The most compelling statistic of the pretest, quantified in a variable called Cronbach's Alpha, is a measure of reliability and internal consistency more powerful than a split-half reliability. Cronbach's Alpha represents the percentage of time students who missed an item missed all harder items and students who correctly solved an item solved all easier items. Cronbach's Alpha for this study was .9727, indicating not only that the test was consistent with itself but that learning objectives in music theory are strongly hierarchical. For the purposes of the Ball State project, this last finding would prove to be extremely useful.

This research showed, moreover, that the hierarchy involves a correlation of aural and written preskills with each other. The data show particularly compelling evidence for the importance of aural skills. Students who received a low semester grade in written theory earned low subscores in both the written and aural portions of the test. Not only were both subscores less than for those earning A's, but the aural subscores were substantially lower. Whereas students who failed written theory achieved written subscores an average of

Table 2. Comparison of pretest distributions by quintiles with term averages for the fall semester, 1990

	Semester Grades, Fall, 1990			
Pretest (1st week of fall, 1990) Raw Scores Grouped in Quintiles	Written Average	Aural Average	Kbd Average	Overall Average
individuals scoring in the lowest 5th				
written tasks: 37%-65%	.67	.71	.86	.72
aural tasks: 0%-29%	.71	.65	.82	.68
keyboard tasks: 0%-40%	.66	.73	.85	.69
composite score: 30%-59%	.63	.68	.83	.68
individuals scoring in the second 5th				
written tasks: 67%-78%	.79	.79	.88	.76
aural tasks: 31%-44%	.76	.74	.88	.75
keyboard tasks: 41%-75%	.83	.82	.91	.82
composite score: 60%-72%	.83	.78	.91	.79
individuals scoring in the third 5th				
written tasks: 79%-83%	.84	.80	.92	.83
aural tasks: 50%-62%	.84	.81	.93	.83
keyboard tasks: 76%-85%	.80	.78	.88	.79
composite score: 73%-80%	.81	.83	.90	.83
individuals scoring in the fourth 5th				
written tasks: 84%-88%	.86	.79	.93	.82
aural tasks: 54%-79%	.87	.84	.93	.86
keyboard tasks: 86%-94%	.86	.78	.91	.86
composite score: 81%-85%	.88	.80	.94	.83
individuals scoring in the highest 5th				
written tasks: 89%-95%	.90	.86	.91	.87
aural tasks: 81%-100%	.90	.90	.95	.90
keyboard tasks: 95%-100%	.89	.83	.96	.85
composite score: 86%-96%	.91	.89	.95	.91

sixteen percentage points lower than their counterparts who earned A's, the same students' aural subscores were thirty-nine percentage points lower. Similarly, students who failed aural theory averaged eleven percentage points lower on the written subscore, but forty-seven points lower on the aural subscore, than those who earned A's. Students whose pretest written subscores were in the lowest fifth earned semester grades twenty-three points lower in written

theory and fifteen points lower in aural theory. Individuals whose aural subscores were in the lowest fifth earned semester grades nineteen points lower in written theory and twenty-five points lower in aural theory.

Accordingly, the most significant finding of the 1990 research was that aural preskills comprise a stronger basis for the assessment of preparedness for college theory than do written preskills. This conclusion corroborates a 50-year old study in which Taylor showed that aural skills correlate more highly with success in the music professions than do written skills.[6] If these conclusions are valid, testing ought well to focus upon aural skills, as ought the remediation (if not the theory sequence itself).

An Expert System

Advantages

It took the students of the pilot study nearly an hour to complete the computerized questionnaire. Because the content matrix of the pilot study proved to be hierarchical, it appeared that a branching instrument could dramatically accelerate the assessment process. If a student showing mastery at a high level was not compelled to advance through items lower in the hierarchy and vice versa, fully half of the test items could be eliminated. But to determine which half—the high or low end of the hierarchy—it was necessary to devise an intelligent system.

An intelligent system—sometimes called "expert system"—is software that interacts with the user in a nonlinear fashion based upon responses as they are integrated with, and interpreted by, data.[7] By the end of 1990, I thought that an expert systems test might do

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[6]E. M. Taylor, "A Study in the Prognosis of Musical Talent," *Journal of Experimental Education* 10 ((1941): 1-28.

[7]Many computer-administered designs resemble paper-and-pencil tests mounted on a computer screen. Such was the case with Colman's, and, no doubt, similar instruments being engineered even now. While such adaptations do offer the advantage of automated administration and grading, they do little else to improve upon old technology, and use few of the unique capabilities of the new.

three things that a traditional test could not do: (1) generate problems algorithmically, (2) interact with the testee in real-time interpolation and analyses of data, and (3) progress in a nonlinear fashion to the most pertinent levels of the hierarchy, omitting the rest.

In addition, an intelligent system could accomplish at once two ordinarily separated diagnostic objectives: the ranking of students and the assessing of competence. One of the traditional imperatives of test design is to decide first if the purpose of the assessment is to rank students (norm-reference) or to identify competence (criterion-reference). This decision is necessary because each purpose requires a different type of problem. A norm-referenced test requires items of average difficulty and low (.25) to very high (1.0) discrimination. A criterion-referenced design intended to identify students at risk requires easy items and low discrimination (less than .25). Similarly, a criterion-referenced design intended to identify competence requires difficult items.

By contrast, an expert system could begin with norm-referenced items (do a preliminary ranking by sorting weak students from the strong), but conclude with criterion-referenced items (measure competence at both ends of the scale). By beginning with items of high discrimination the system would more quickly detect a trend toward mastery or nonmastery. After a trend had been established, substitution of criterion-referenced items would more efficiently and more accurately diagnose competence.

Three Learning Objectives and Competency Tests

Consider, for example, the following objectives and competency tasks related to theory assessment and how they might be ordered to yield information more efficiently and accurately.

Task One

The objective of Task One is for the student to demonstrate apprehension of the function of pitches in relation to a tonal center. Given a key signature and the first note of a seven-note diatonic melody (mostly steps and all whole notes), the student demonstrates competence by writing the remaining pitches correctly. The melody may be played an unlimited number of times.

This research showed that the percentage of students who could write any one pitch correctly, before having received instruction, averaged .83 for those who later passed the course but .33 for individuals who did not. For future reference, let us recall the probability that a master (Pm) would complete Task One correctly as .83, and the probability that a nonmaster (Pn) would complete the same task correctly as .33. As shown by the difference between Pm and Pn, Task One had high discrimination: D = .5. Accordingly, Task One would be appropriate at the beginning of a test where it might quickly sort weaker students from the stronger.

Task Two

The objective of Task Two is for the student to demonstrate apprehension of the aural structure of intervals of the second (major or minor). The computer generates a second, plays it starting on any pitch, and writes the first pitch in the student's favorite clef. The student is not required to name the interval but is instructed to represent the second pitch. Any diatonic or chromatic equivalent is recorded as a correct response. The student may play the interval an unlimited number of times. This study showed that Pm for this type of problem was .27 for students who later passed theory and .08 for students who did not. The discrimination variable was .19.

Because Task Two does not have high discrimination it is not appropriate at the beginning of the test (where we wish to distinguish between weaker and stronger students). But because Task Two is difficult, we shall save it for students whom we suspect belong to the latter group.

Task Three

The objective of the third task is for the student to name the symbols of notation. The computer names a symbol and displays four. The student is instructed to choose the display that represents the named item. This study showed that the probability of correctly selecting the symbol was .96 for students who later passed theory and .90 for students who did not: Pm = .96,

Pn = .9, and D = .06. Like Task Two, this task is unsuitable for the beginning of the test because it does not have high discrimination. But, because this task is easy, we shall save it for students whom we suspect are insufficiently prepared.

Discrimination and Item Difficulty as Parameters Controlling the Efficiency and Effectiveness of Assessment

The goal of a computer-adaptive test is to facilitate a more efficient and more accurate identification of students at risk. Efficiency is a measure of the time needed to accomplish that goal and accuracy is a measure of the validity of the assessment. The specified ratio of correct to incorrect responses may be adjusted depending upon how efficient and accurate one wishes the assessment to be. If one desires a faster but less accurate assessment, one might accept a lower ratio of successes to failures.

For example: if our subject correctly completes Task One one time we should begin to suspect mastery. However, because one-third of the nonmasters could also complete this particular task correctly, we should not be confident of our assessment until the student has replicated correct responses to a specified ratio, depending on how accurate we want the assessment to be. We must therefore continue to press the testee with different versions of Task One. Each new success, assuming there are no failures, will make us more confident of our assessment, but a mix of successes and failures might lead us to conclude that we dare make no conclusions on the basis of Task One by itself.

As mentioned before, specific success to failure ratios are not without inverse effects upon the efficiency and accuracy of the assessment. Generally, the faster the assessment, the less accurate, and vice versa. Equally significant, whatever success to failure ratio is specified, it must be calibrated with item discrimination. Items with higher discrimination require a lower proportion of successes; items with lower discrimination require a higher proportion. The following four paragraphs elaborate upon this principle.

With Task One, the number of successes that we might require depends upon the discrimination potential of the task, in this case already very high. If the discrimination for Task One had been still

higher—say, 1.0 (all of the masters, but none of the nonmasters, had solved it correctly)—then we might have concluded that our assessment was correct after one success. If the discrimination had been lower—say, .1 (masters solved the task correctly 10% more often than did nonmasters)—then our subject would need to accumulate roughly nine successes for every failure before we could be confident of an assessment of mastery.

Task Two is more difficult than Task One, but it has less potential to discriminate. If our student correctly completes Task Two one time we may be more confident that he is a master than if he solved Task One one time. Inversely, if our student misses Task Two one time, we must be less confident that he is a nonmaster than if he missed Task One one time. The second task is, after all, much more difficult. Because eight percent of nonmasters could also complete this second task correctly, we cannot presume mastery until we determine what kind of success to failure ratio our student can produce when given a series of problems like Task Two. Because Task Two has lower discrimination than Task One we will need a higher ratio of successes to failures to conclude mastery.

Task Three is easier than Task One, much easier than Task Two, and has the least potential to discriminate. This does not mean, however, that Task Three is of no value—quite to the contrary. Because the purpose of the test is to identify students at risk, Task Three is exactly the type we require. Of course, we will present tasks like number three only to students who we suspect are at risk, and to make this preliminary assessment we need tasks like number one.

Correctly completing Task Three one time says practically nothing about competence, as nearly all nonmasters could do the same. But, if our student misses Task Three one time, we should strongly suspect nonmastery. By missing Task Three we can be more sure that our subject is a nonmaster than if he or she had missed the more difficult first or second tasks. Because the discrimination index for Task Three is low, we must accumulate more than the usual number of failures to conclude nonmastery.

Five Variables

In an expert system we can envision, therefore, five variables governing the weight that we should ascribe to any given task. The first three of these are statistical functions and the last two are accumulated during the taking of the test itself: (1) Pm is the percentage of those in the pilot study who passed the course and who were able to solve the task correctly before having had instruction, (2) Pn is the percentage of those who failed the course who were able to solve the same task correctly before having had instruction, (3) D, the difference between Pm and Pn, is the discrimination variable, (4) S is the number of real-time successes at any given task that the test may present, and (5) F is the number of failures.

Besides these variables, the efficiency and accuracy of an expert system might be controlled by predetermined ratios—successes to failures that serve as error factors, a priori. The first of these variables, Alpha, shall represent the percentage of time we are willing to tolerate the misidentification of masters as nonmasters. The second, Beta, shall represent the percentage of time we are willing to tolerate the misidentification of nonmasters as masters. High Alpha and Beta result in a faster (but less accurate) assessment.

Probability, Decision, and Branching Structures and the Sequential Probabilities Ratio (S.P.R.)

If the expert system envisioned in 1990 were to exist, it required a mathematical rubric that could keep track of its variables, interpolating their significance in real time, and revising probability estimates with each success or failure. Such a rubric was found in Bayesian mathematics, a branch of statistics devoted to the continuous revision of probabilities until reliable estimates have been established. Developed originally for military applications, the equation used in this study was declassified and published after World War II. Since that time it has been used for quality control in manufacturing. Abraham Wald's equation has only recently come to the attention of educators thanks to the work of Indiana University's Theodore Frick. [8]

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[8]Theodore Frick, "A Comparison of Three Decision Models for Adapting the Length of Computer-Based Mastery Tests," *Journal of Educational Computing Research* 6 (1990): 483.

Because the formula is abbreviated S.P.R.—for Sequential Probabilities Ratio—Frick has coined the term, "ExSPRT system," for "Sequential Probabilities Ratio Test." The equation follows:

Figure 1. Equation for computing sequential probabilities ratios

$$PR = \frac{Pm^{S}(1-Pm)^{f}}{Pn^{S}(1-Pn)^{f}}$$

Following each completion of a task, the computer recalculates PR and compares it to three logical structures that determine if the subject is a master or nonmaster of the task in question. If **PR ≥ (1-ß)/a** then the student has demonstrated mastery of the objective. If **PR ≤ ß/(1- a)** then the student has demonstrated nonmastery of the objective. If **ß/(1-a) < PR < (1-ß)/a** then it is not possible to determine yet whether the student has or has not mastered the objective; generate another problem.

Ready or Not?

Table of Specifications

With the discovery of the S.P.R. Equation it was a relatively simple task to design the expert system envisioned at the conclusion of the pilot study. I began by selecting 22 learning objectives for which problems could be generated at random on a computer. These included a mix from difficult to easy and from high to low discrimination. Each was empirically quantifiable for its statistical significance in the longitudinal study of 1990-'91. Content specifications for the ExSPRT system are reproduced in Table 3 (arranged from highest to lowest discrimination). Notice that seven of the 22 objectives (asterisked items) assess aural acuity and that these seven comprise the objectives with the highest discrimination and/or difficulty.

Table 3. Ready or Not: Table of specifications

Twenty-two learning objectives (highest to lowest discrimination)	*Pm*	*Pn*	*D*
1 writes short diatonic melody*	.83	.33	.50
2 chooses aural option that correctly plays polyphonic notation*	.81	.47	.34
3 writes enharmonic equivalents	.85	.53	.32
4 writes pitches in treble, alto, and bass clefs	.85	.54	.31
5 plays pitches in treble and bass clefs on keyboard	.79	.48	.31
6 hears tonal fragment and writes last pitch in given key*	.69	.39	.30
7 knows the number of sharps and flats in key signatures	.50	.20	.30
8 identifies the root of a triad	.56	.26	.30
9 chooses aural option that correctly plays monophonic notation*	.74	.47	.27
10 completes a measure with missing durations	.74	.50	.24
11 identifies longest/shortest of four difficult rhythms	.80	.60	.20
12 identifies starting pitch of a song*	.50	.30	.20
13 writes M/m melodic seconds*	.27	.08	.19
14 names pitches in treble, alto, and bass clefs	.93	.75	.18
15 hears triad and ids type (M,m,+,d) congruent with notation*	.22	.05	.17
16 writes ♯s/♭s of key signature in correct order and position	.85	.68	.17
17 identifies nonequivalent rhythms	.86	.69	.17
18 identifies longest/shortest of four easy rhythms	.87	.72	.15
19 understands the function of sharps and flats	.82	.69	.13
20 identifies notes and rests that are correctly paired	.94	.86	.08
21 names basic symbols of notation	.96	.90	.06
22 identifies the number (but not the quality) of intervals	.93	.88	.05

As currently configured, Ready or Not (RON) begins by selecting one of the five most discriminating objectives and generating random problems within that objective. As each student demonstrates mastery or nonmastery of the objective RON advances to one of the top five remaining objectives. If RON is unable to determine mastery or nonmastery after an instructor-prescribed number of tasks within each objective, it advances to a new objective.[9]

When RON detects a trend toward mastery or nonmastery (as defined by a collective probability ratio for all tasks in the range of >.66 or <.33 respectively), it reorders the objectives remaining in its

[9]To prevent the assessment from becoming too long, the instructor may prescribe a maximum number of tasks in any one category (ordinarily a dozen). If RON is unable to make an inference after this maximum, it indicates, for the record, that it was unable to inform itself as to the student's aptitude on the basis of that objective.

matrix appropriately. If RON suspects, for example, that a student is a master it will begin to select items from the more difficult objectives remaining in its content matrix. Because of the high Cronbach's Alpha of the pilot study RON can assume, with confidence, that after a student demonstrates mastery of one or two difficult objectives the assessment can be discontinued. RON assumes, in such a case, that the student does not require remediation and should therefore be advised to register for the first course in the sequence.

Results

The School of Music at Ball State University has been using Ready or Not, with satisfactory results, for the past three years. Students are normally assessed during the senior year of high school at one of several audition dates. During the visits they also play their instruments before a jury of the faculty, write an essay, and are interviewed. A small stream of individuals is continuously assessed throughout the year on a walk-in basis. The computer administers the assessments, interprets the results, and advises its subjects in one sitting. The advice ranges from indicating that the subject may register for Music Theory 111, may register but should prepare during the summer by studying Harder and Steinke's *Basic Materials in Music Theory*, or should not begin the sequence without having taken the remedial course. Students in this last category are not restricted from enrolling in the regular sequence if they so choose. Approximately one-sixth of the applicants are advised to take the remedial course (roughly the failure rate before implementation of RON). Most students follow RON's advice. As a consequence, enrollment in the remedial course has more than doubled while the failure rate in the sequence has dropped.

During the first year of its use RON surprised even its author with the rapidity with which it completed its assessments (often in less than ten minutes and after having assessed only two or three objectives). Because I wished the students to have a more substantial engagement with the material, in the second year RON was constrained to withhold prognosis until after it had assessed a minimum of five objectives.

The S.P.R. structure dictates that students at the extremities of the curve—those who are either extremely deficient or well pre-

pared—will be identified more quickly than students who are average. In the case of the former, even after the minimum coverage of five objectives, RON often detects a need for remediation within fifteen minutes or less. But, in the case of average performance, some students continue through the entire table of specifications with RON being unable to formulate a prognosis. Consequently RON has been programmed to allow the student to work no longer than thirty minutes (or some other instructor-specified range). If it is unable to prognosticate the need for remediation within the half hour, RON advises the student to enroll in the first semester of the sequence.[10]

Case Studies

Robert[11]

RON assessed Robert in January of 1992, generating the report reproduced in Figure 2. In the fall of 1992 Robert enrolled in Music Theory 111 and passed it with an A. He recently completed the fourth semester of the sequence, having maintained an A average throughout.

Notice that RON tested Robert in but five areas. RON began by randomly selecting three of the more discriminating objectives (those from the top of Table 3). Robert was first asked to write certain pitches in specified clefs (objective 4 from Table 3). This particular objective had a discrimination factor of .31. This means that of the students in the pilot study who had mastered the objective before having had instruction, 31% more passed the course than failed it.

RON continued by notating pitches in various clefs and prompting Robert to play them on the keyboard—again a high discrimination factor of .31 (objective 5 from Table 3). For the third segment RON queried Robert about the number of sharps and flats in major

[10]The instructor may define this time limit and several others, including the controlling error factors Alpha and Beta.

[11]Individuals identified in this study are real students who were assessed by Ready or Not in the spring of 1992. Their names have been changed to protect confidentiality.

Figure 2. RON Report for Robert, January 25, 1992

Learning Objectives MASTERED:
1. writes specified pitches in treble, alto, and bass clefs
2. plays specified pitches in treble and bass clefs on keyboard
3. knows the number of sharps and flats in key signatures
4. writes M/m melodic seconds
5. matches sounding triad (Mm+o) with written triad

Learning Objectives NOT MASTERED: (none)

Learning Objectives INCONCLUSIVE: (none)

Prognosis:
Robert appears to have MASTERED the preskills that are necessary for success in the first year of music theory. The way this session was configured, there is a 16% chance that Robert might actually be UNPREPARED. Elapsed time for this session: 11 minutes.

Enrollment Management Ranking: 5
1 = DEFINITELY needs remediation
2 = probably needs remediation
3 = may not need remediation, but advised to brush up anyway
4 = prepared for MusTh 111
5 = EXCEPTIONALLY well prepared for MusTh 111

and minor key signatures—a discrimination factor of .30 (objective 7 from Table 3).

At this point RON had already prognosticated that Robert was ready for Music Theory 111. Because it had been constrained to cover a minimum of five content areas before delivering its prognosis, RON proceeded with the assessment, but with a different strategy. It selected its final two objectives from those that could most quickly confirm its prognosis of mastery—difficult items. For the fourth segment Robert was required to write the intervals that he

heard: major and minor melodic seconds (objective 13 from Table 3). Only 27% of those in the pilot study who passed theory were able to do this, and Robert was able to demonstrate mastery during his assessment.

Finally, RON displayed a series of triads and asked Robert to match the sounds (M, m, +, or o) with what he saw (objective 15 from Table 3). Only 22% of those in the pilot study who passed theory were able to do this, as was Robert. Clearly Robert was ready for the theory sequence, a conclusion substantiated by his subsequent performance in four semesters of study.

Notice that RON made its assessment of Robert—an unusually well-prepared student—in eleven minutes. Notice, too, that RON has informed us of the error factor, Alpha, that it used in its assessment. There was a 16% probability that Robert was actually not prepared. Because RON's purpose was to identify students at risk, the instructor was willing to tolerate a high Alpha in order that the test might not become too long.

Melissa

RON assessed student Melissa in March of 1992, generating the report reproduced in Figure 3. At the conclusion of the session RON advised Melissa that she should enroll in the fundamentals course before attempting the sequence. That fall Melissa enrolled in the remedial course and failed it. She has since dropped out of the major.

We note that Melissa had not mastered any of the objectives that RON presented. As in Robert's assessment, RON first engaged Melissa with tasks of high discrimination (objectives 1 and 3 from Table 3 with respective discrimination factors of .5 and .32).

When RON began to suspect that Melissa was not adequately prepared, it sought to confirm its prognosis by pressing her with easier tasks that she, likewise, had not mastered. Melissa could not negotiate objective 17, for example ("identifies nonequivalent rhythms" from Table 3). This is a skill that more than two-thirds of the individuals in the pilot study who failed the first semester of theory could do. Neither was Melissa able to name pitches in various clefs (objective 14), a skill that three-fourths of the unprepared students in the pilot study could do before having received instruc-

Figure 3. RON Report for Melissa, March 14, 1992

Learning Objectives MASTERED: (none)

Learning Objectives NOT MASTERED:
1. writes short diatonic melody
2. writes enharmonic equivalents
3. identifies nonequivalent rhythms
4. names pitches in treble, alto, and bass clefs

Learning Objectives INCONCLUSIVE:
1. understands the function of sharps and flats

Prognosis:
Melissa appears NOT to have mastered the preskills that are necessary for success in the first year of music theory. The way this session was configured, there is a 7% chance that Melissa might actually be PREPARED. Elapsed time for this session: 13 minutes.

Enrollment Management Ranking: 1
1 = DEFINITELY needs remediation
2 = probably needs remediation
3 = may not need remediation, but advised to brush up anyway
4 = prepared for MusTh 111
5 = EXCEPTIONALLY well prepared for MusTh 111

tion. It is clear that, when she was assessed in the spring of 1992, Melissa was not prepared to begin the theory sequence. She followed RON's advice and enrolled in the remedial course, which she failed.[12]

RON completed its assessment of Melissa in thirteen minutes. Notice that the error factor, in Melissa's assessment, was 7% as op-

[12]None of the teachers of our 25 theory classes and labs or remedial courses except myself has access to RON assessments of students coming into their courses. I do not teach the remedial course.

posed to Robert's error factor of 16%. There was a 7% probability that Melissa might actually have been prepared. Because the purpose of the assessment is to identify students at risk, Ball State uses a lower Beta than Alpha. This means that RON's estimates of nonmastery are more accurate than its estimates of mastery—exactly what we want.

Thirteen Students Identified as Needing Remediation in 1992

Including Melissa, RON had, by the middle of March, 1992, identified thirteen prospective students as either definitely or probably needing remediation. Three students ignored RON's advice and registered for the first course in the sequence without having been remediated. Two of these withdrew before the eighth week, and one failed the course. (Although I have no evidence that the two students who dropped were failing the course, students typically drop for this reason.)

Four of the thirteen did not matriculate in the major. They may have become discouraged by RON's prognosis, changed their majors, or they may not have enrolled in the University at all. The remaining six students who were advised to enroll in the remedial course followed the advice. Of these six, two students failed (Melissa was one), one withdrew, one received a D, and two passed the course with a B. Of the two B students, one continued into the regular sequence and passed the first semester with a grade of C; the other did not continue in the sequence (at least not at Ball State).

Where Do We Go From Here?

In the current instrument, Pm and Pn are static, representing a synchronous view of performance in the five institutions that participated in the 1990 study. It is postulated, however, that both variables are diachronically and environmentally sensitive. The proportion of masters and nonmasters who will pass or fail a course having mastered prescribed objectives before instruction surely depends upon institutional admissions policies, grading scales, and curricula, if not individual teaching styles. A test, therefore, that might be accurate at one site might be less or more accurate at another site, or at the same site years from now. I am continuing to

revise Ready or Not to devise a test that learns—a test that remembers the performance of its subjects, revises its own estimates and rewrites its own code to provide a dynamic assessment of institutional patterns in time.

As the Ball State School of Music continues to use Ready or Not into a fourth year, the effectiveness of the system is being studied for its accuracy as an aid to advising. I envision Ready or Not as a tool that could be used not only by departments of theory at the college or university levels, but also by private instructors and high school career counselors.

If the S.P.R. approach to theory assessment is a viable strategy for the identification of students at risk, further research is necessary. Many more preskills could be used for which I currently have no data (Pm and Pn) with which to incorporate them into Ready or Not. It is my hope that by presenting the results of this research others will be encouraged to conduct investigations leading to an expanded and more accurate assessment.

Reviews

Jazz Theory Texts: An Overview

Reviewed by Gary Potter

The arrival on the market of a new jazz theory text prompted this review of several recent publications with potential usefulness for theory teachers interested in jazz. *Jazz Theory and Practice* by Richard J. Lawn and Jeffrey L. Hellmer was published in 1993.[1] According to a publisher's spokesperson, it was intended to compete with *Jazz Improvisation in Theory and Practice* by Bruce Benward and Joan Wildman.[2] The many similarities in approach and content between the two similarly-titled texts suggested a comparative review, perhaps adding another jazz text, *Jazz Theory* by Andrew Jaffe,[3] for a three-way comparison. Unfortunately, both Benward/Wildman and Jaffe are in the process of going out of print, leaving Lawn/Hellmer without a direct competitor. Fortunately, however, Lawn/Hellmer is the best of the three, clearly building on and surpassing its predecessors in most (not all) respects.

This article concentrates on this newest entry into the dwindling jazz theory textbook area. Shorter sections then review several other recent books that, while not covering exactly the same material, can be compared usefully with Lawn/Hellmer and might provide additional resources for teachers. The article is aimed at theory teachers who: (1) want to incorporate some jazz theory into a traditional theory curriculum; (2) want to offer a separate jazz theory course, either as an elective for students who have completed the theory requirements or in place of one of the required courses; or (3) want to expand their own knowledge of jazz theory.

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[1]Richard J. Lawn and Jeffrey L. Hellmer, *Jazz Theory and Practice* (Belmont, CA: Wadsworth, 1993).

[2]Bruce Benward and Joan Wildman, *Jazz Improvisation in Theory and Practice* (Dubuque, IA: Wm. C. Brown, 1984).

[3]Andrew Jaffe, *Jazz Theory* (Dubuque, IA: Wm. C. Brown, 1983).

Jazz Theory and Practice (Lawn/Hellmer) is not intended only for improvising performers trying to learn the craft of jazz improvisation. Many books *are* so intended, and the range of coverage of these "how-to" books is usually narrower. Lawn/Hellmer is potentially useful for jazz performers, arrangers, and knowledgeable listeners alike. "This book is intended for use in the college classroom by students who have completed one year or more of traditional theory. . . . It can also be successfully used independently by individuals outside the classroom setting" (p. xiv). The first two chapters covering intervals, scales, and modes would be largely review for students with a year of traditional theory behind them, although the topics are presented with occasional references to jazz, thus laying the foundation for specific jazz applications of these fundamentals. A section on interval recognition, for example, includes a list of jazz tunes that begin with all the various ascending and descending intervals.

Beginning in chapter 3, in which virtually all jazz chords and associated jazz symbols are introduced, the book becomes more specifically a jazz theory text. The topics of chapters 4 and 5, "Symmetrical, Synthetic, and Hybrid Scales" and "Chord/Scale Relations and Applications," have been the primary focus of jazz improvisation methods for decades. Many books, in fact, never get past these topics, restricting the books' usefulness to only the budding improvisor trying to learn to choose the "right" pitches to play with given chord symbols.

There is, however, much more to jazz theory. After presenting the chord/scale correlation information concisely and well, Lawn/Hellmer follow it with chapter 6 entitled "Principles of Melodic Construction and Development," in which motivic development is presented as an important part of improvisation. The student quickly learns that there is more to improvising than hitting all the right notes. Also in chapter 6, non-harmonic tones are introduced using traditional theoretical terms, but illustrated by jazz melodies. Unfortunately, some of the definitions are misleading or poorly expressed. Also problematic is Lawn/Hellmer's arbitrary assumption that root, third, fifth, and seventh are chord tones while all others are non-harmonic tones of some variety; in some jazz styles where 9th, 11th, and 13th chords are the norm it seems awkward to view

these "upper extensions" as non-harmonic tones. In contrast, the section on melodic manipulation and development presents a valuable motivic approach to improvisation for both the improviser and the analyst. Two annotated transcriptions at the end of the chapter illustrate non-harmonic tones and motivic development in improvisation.

Chapters on harmonic progression (including cadential patterns, II-V-I's, and turnarounds) and on harmonic substitution and embellishment follow. Both jazz letter symbols and Roman numeral labels are used in appropriate contexts. These chapters are excellent; the explanation of chord substitution principles is particularly good and well illustrated.

Two chapters add considerably to the usefulness of Lawn/Hellmer for students of jazz theory. "Introduction to Jazz Keyboard Voicings" presents a concise summary of the keyboard's role in jazz and of basic techniques for simple but effective realizations of chord symbols in three to five voices. The basic voicings can and should be learned immediately and then applied in subsequent chapters. "Rhythm and Meter" presents a welcome departure from the pitch domain. Topics include African, Afro-Cuban, and Afro-Latin influences, meter, and the phenomenon of "swing," examined from the perspective of the rhythm section and the improvising soloist. A brief history of the swing eighth note is actually a concise overview of rhythmic evolution in jazz from the early days through recent styles.

Chapters 11 through 13 focus on common "forms": the blues, modal structures, and "rhythm changes." Based on musical examples, each is discussed historically, standard and elaborated versions are illustrated, and transcribed solos are analyzed using tools developed throughout the book. Chapter 14, similar in format, deals with the various topics of "contemporary jazz composition." Compositions by Ornette Coleman and Herbie Hancock are analyzed.

The final chapter, "Solving the Improvisation Myth," discusses issues of creativity in improvisation. Clichés, quotes, and patterns are presented as an integral part of most jazz improvisation, which is not "the result of some divine inspiration but rather a learned language"(p. 244). Four transcriptions and analyses comprise the bulk of the chapter and sum up very well the material presented

throughout the book. The four illustrate each of the four types of pieces presented in chapters 11 through 14. The transcribed solos, by Cannonball Adderley, Clark Terry, Don Byas, and Miles Davis, are excellent as are the analyses themselves.

The strengths of Lawn/Hellmer are numerous. The book goes farther than standard chord-scale correlation explanations of many jazz how-to texts, bringing in rhythmic issues, motivic development, jazz forms, and complete analyses. The analyses in turn go beyond simply relating chord symbols to pitches chosen by the improvisor. Keyboard voicings are presented early enough that the student can use the keyboard as a way of hearing the chord progressions presented later. Almost every chapter has "Suggested Exercises and Activities," including written exercises, suggestions for application to keyboard and/or the student's own instrument, and ear-training suggestions and drills. Adding greatly to the value for the theory student, software for ear-training tutorials and mastery tests is included with the book. The student needs a Macintosh computer with MIDI tone generator and Hypercard 1.2.5 or later to access a variety of exercises, ranging from simple interval recognition to identification of longer progressions.

However, Lawn/Hellmer is not problem-free by any means. Especially in the early chapters, some errors appear that careful editing should have eliminated and, worse, many written examples are (at best) inelegant or (at worst) incorrect. Particularly in sections reviewing basic theoretical topics, traditional theory teachers will squirm; the following are a few samples.

(1) Interval inversion is "explained" as follows: "Any interval may be inverted to achieve a similar consonant or dissonant sound. Whether the interval is expanded or contracted, it still represents the initial consonant or dissonant quality"(p. 4).

(2) "Tonality" loses its standard meaning in the following: "When played side by side, these two scales [Eb pentatonic and C Dorian] communicate a similar tonality or musical, aural identity" (p. 18).

(3) From the following, one might conclude that inverting diminished triads yields no aural difference: "A combination of two major 3rds completes the augmented triad which is, like the diminished triad, a symmetrical chord. Because of this symmetrical arrangement of intervals, there is no real difference achieved through

inversion" (p. 23).

(4) Consider the theory student's confusion at the following: "*Anticipation* (ANT.) is created when a change of harmony is actually foreshadowed by a melody note that creates a form of suspension" (p. 77).

(5) The term "inversion" already has too many confusing meanings in theory. Lawn/Hellmer adds yet another: two scales with the same pitches but starting and ending on different degrees are termed "inversions" of one another (p. 36). The topic is treated inconsistently, however; in a section on modal scales, D Dorian is referred to as the "reordered" modal scale of C-major (p. 13).

(6) There are also many relatively minor editorial lapses, such as referring to CDEF and GABC as the lower and upper tetrachords in Example 2.1 where an F-major scale appears (pp. 9-10).

Unfortunately, the ear-training software is similarly problematic. Like the text itself, it covers all the right territory; one wishes it could have done it a little better. For example, there is a great exercise in which the student is to choose from a list of chords the ones heard in a brief progression. Ideally, one could "click" on chords in the given list. Instead one must click once in the answer box and then type the multi-character chord symbols, along with slashes for repeated beats and dashes for barlines. Multiple-choice clicking would be faster, allowing less elapsed time between answering and rehearing the aural stimulus.

As in the text, occasional errors occur in the software as well. A dominant-seventh chord is incorrectly identified as a minor-seventh, for example. A more vexing problem, however, is inconsistency. In one valuable exercise, students both see and hear a complex chord which they are to identify. The basic seventh is to be typed first followed by any "upper extensions" in parentheses listed from highest to lowest. But just when students learn, for example, to respond "D7(13,#11,9)" for a D-F#-A-C-E-G#-B chor d, that chord appears and the "right" answer turns out to be D13(#11). Again, multiple-choice clicking would be easier. If typing out the answer is considered a valuable exercise, either the symbol usage must be consistent or multiple "right" answers must be accepted.

Lawn/Hellmer covers an impressive range of materials rather well. In spite of casual application of theoretical terms, a frequently

clumsy writing style, and ear-training exercises that are stimulating but frustrating, the book can be recommended. The information presented is usually accurate and comprehensive. Students who work through the exercises, listen through the software, and study (visually and aurally) the transcriptions with their analyses will have a thorough and broad-based understanding of jazz. I hope that theory teachers will all order this book, making it so successful that a REVISED edition can appear soon.

Other recent jazz books also deserve consideration. All are less comprehensive than Lawn/Hellmer and none could stand alone as *the* text for a jazz theory course as could Lawn/Hellmer. They have, however, potential applications for theory teachers in specific curricular situations.

The Jazz Theory Workbook by Mark E. Boling,[4] designed as a jazz theory primer leading to advanced work in improvisation, arrangement, and composition, is a smaller book (125 pp.) focusing exclusively on pitch materials. Four chapters present information on music theory fundamentals, jazz chord structures, chord/scale relationships, and jazz progressions. Chapter 5, "Sources of Chromaticism," is far too brief to be useful, "covering" chromatic non-harmonic tones, harmonic substitution, and playing "outside the changes" in fewer than five pages! A final chapter provides brief suggestions for further study.

The one strength of this book is its concise presentation (74 pages) of basic chords, scales, and progressions. Written exercises are included, the answers to which are found in the appendix, so interested students could work through important aspects of elementary jazz theory on their own. There are no transcriptions or analyses, and there is no ear-training component. "Playing Exercises" are included, but, as in many books, they consist merely of patterns that students are urged to practice in all twelve keys.

Creative Jazz Improvisation by Scott D. Reeves[5] is aimed at the improvising performer, and it deals almost exclusively with pitch. A four-page chapter pays lip service to rhythm, but the primary

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[4]Mark E. Boling, *The Jazz Theory Workbook* (Rottenburg, Germany: Advance Music, 1990).

[5]Scott D. Reeves, *Creative Jazz Improvisation* (Englewood Cliffs, NJ: Prentice Hall, 1989).

topic is scales and modes, typical of improvisation method books.[6] There are almost no written exercises or ear-training materials. The book's interest for theory students and teachers lies in the number and variety of transcribed solos. Almost every chapter ends with a transcription of a solo which more or less illustrates the chapter's topic—generally the use of a particular scale. Included are solos by Louis Armstrong, Miles Davis, Lester Young, Clifford Brown, Charlie Parker, John Coltrane, Wayne Shorter, Sonny Rollins, Thelonious Monk, Chick Corea, and others. Brief analytical comments accompany each transcription; while these comments focus on chord-scale correlation, other aspects of improvisation are sometimes mentioned. All of the transcriptions are written out four times: for C, B♭, and E♭ treble-clef instruments and for untransposed bass-clef instruments. The author intends for students to learn the solo using their instruments, preferably by playing along with the original recorded solo. This book can be recommended for the improvisation student who is (or who the teacher thinks *should* be) interested in studying a wide range of improvised solos as well as the usual chord-scale patterns. For the theory student, the book's transcriptions amount to an improvisation anthology through which the stylistic development of improvised jazz by some of its best practitioners can be studied.

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[6] Improvisation method books abound. Some could be used as jazz theory books, especially in situations where performance is integrated into the theory classroom. An excellent improvisation method is Jerry Coker's *Complete Method for Improvisation* (Lebanon, IN: Studio P/R, 1980), which presents six "vehicles" for improvisation: be-bop and standard, modal, blues, contemporary, ballad, and free form. Each vehicle demands a different approach and mastery of certain concepts presented as they become necessary to improvising on a specific kind of piece.

Another author of improvisation method books is David Baker. His outstanding *Jazz Improvisation: A Comprehensive Method of Study for All Players*, revised ed. (Bloomington, IN: Frangipani Press, 1983) is far more than a chord/scale compendium as the following sample of chapter titles makes clear: "The Use of Dramatic Devices," "Developing a Feel for Swing," "Constructing a Jazz Chorus," and "A Psychological Approach to Communicating Through an Improvised Solo." Baker has also authored a series of monographs presenting transcriptions and analyses of various players: *The Jazz Style of Cannonball Adderley* (Lebanon, IN: Studio P/R, 1980); other volumes deal with Clifford Brown, Fats Navarro, John Coltrane, Miles Davis, and Sonny Rollins.

The Jazz Sound by Dan Haerle[7] is the most recent improvisation book (an 88-page booklet). This is exclusively a chord/scale correlation study guide, but it surpasses others in that the improvisor is provided with alternative scale choices for given chord symbols and then provided with tools to make intelligent and musical choices among them. The improvisor is urged to become aware of the context of chords and to move beyond merely realizing chord symbols. Haerle suggests that consideration should be given to the piece's original melody and to each chord's function within a broader progression.

Although *The Jazz Sound* is probably too narrow in focus for a typical theory teacher's use, an earlier, even smaller (58-page) book by Haerle might work as a text for a jazz unit within a theory course where Lawn/Hellmer might be more than needed. In very concise form, *The Jazz Language*[8] covers the usual chords and scales plus chord substitution, voicing, and connection. Each brief chapter ends with study questions to verify that the material has been assimilated, as well as written, keyboard, and ear-training exercises. The layout of the book is unattractive; maximum information is presented in minimum space. But it is *well*-presented and accurate. This book is recommended for consideration as an inexpensive supplementary book to include some jazz study in a traditional theory course.

In summary, a definitive jazz theory text has yet to be written. The Benward/Wildman and Jaffe texts, both fairly good, have gone out of print and have been replaced with Lawn and Hellmer's *Jazz Theory and Practice*, a better text not without its own problems. Perhaps insufficient demand for a jazz theory book geared to theory students has discouraged competition. On the other hand, perhaps the arrival of a really fine book would spark demand. In the meantime, books intended for improvisation students might be valuable supplements in theory classes. The Lawn/Hellmer book is certainly worth considering where a full jazz theory text is needed or where theory teachers want to add to their own knowledge of jazz.

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[7] Dan Haerle, *The Jazz Sound* (Milwaukee, WI: Hal Leonard Publishing Corporation, 1989).

[8] Dan Haerle, *The Jazz Language* (Lebanon, IN: Studio P/R, 1980).

Reviews

Harold Owen, *Modal and Tonal Counterpoint: From Josquin to Stravinsky*. New York: Schirmer Books, 1992. x, 389 pp.

Reviewed by David L. Mancini

Harold Owen's *Modal and Tonal Counterpoint: From Josquin to Stravinsky* (New York: Schirmer Books, 1992) is in many ways a unique contribution to current texts in the field. As the only available text that covers the entire historical span of contrapuntal writing, it should be of interest to those teachers in search of a text whose primary focus is the stylistic and technical development of contrapuntal genres throughout music history.[1] The book also has the potential to shift the traditional balance of counterpoint coursework somewhat away from compositional activities and more toward analysis and discussion.

The book is divided into six parts. Part one, "Introductory Concepts," explores the nature of polyphonic music in general and guides the student through a comparison of musical examples, both vocal and instrumental, from the fourteenth to the twentieth centuries. Part two covers counterpoint in the late Renaissance (1500-1600); parts three and four treat counterpoint in the early and late Baroque (1600-1750); part five is devoted to musical examples from the Classical and Romantic eras, while part six covers polyphony in the first half of the twentieth century. The book contains three appendixes: the first identifies the musical examples used in chapter 1; the second gives a brief outline of the ecclesiastical modes and hexachord system; and the third reviews the figured bass system.

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[1]Although no longer available, Harold AtKisson's *Basic Counterpoint* (New York: McGraw-Hill, 1956) predates Owen's text in covering both sixteenth- and eighteenth-century contrapuntal styles. More a manual than a full-fledged textbook, AtKisson takes a nonspecies approach to counterpoint. With an almost polemical tone in his preface, AtKisson labels the third and fifth species of counterpoint "completely erroneous" and rejects the use of whole-note *cantus firmi* in the composition of exercises.

In addition, the book contains a glossary, discography, and a briefly annotated bibliography of selected sources.

The author's intent is that the book be used in a year-long course after the student has completed basic studies in harmony and musicianship. Since many institutions offer two counterpoint courses, the book could function as the principal text for both. Indeed, the largest portion of Owen's text, slightly over 72%, is devoted to the traditional core of university counterpoint studies: the music of the late Renaissance through the late Baroque. The sections on Classical/Romantic and twentieth-century polyphony each occupy roughly 9% of the text.

One of the most salient features of Owen's text is what the author calls "the discovery approach." Each chapter begins with one or more complete compositions followed by questions intended to stimulate class discussion. Following the questions are the author's "observations," which are essentially complete answers to the preceding questions. The author's belief, of course, is that students, either individually or as a group, will attempt to answer the discussion questions as they study the music. Once they have developed their own responses, they compare them to the author's observations. Admittedly, students in search of the "quick answer" may be tempted simply to read the author's response to a given question. Instructors pressed for class time might find themselves just assigning students something to read about a particular piece. While we all recognize the ultimate superiority of the discovery approach, we must also admit that it can be very time consuming. I do not believe we can fault Professor Owen if classes sometimes take shortcuts.

One way to reinforce the discovery process would be for a text to allow students to replicate the activity with a variety of compositions. For instance, Owen could have provided as exercises additional questions for other pieces without providing answers, although reproducing the scores probably would have too greatly increased the length of the text. Each chapter includes suggestions of other works for further study. I find these suggestions uniformly appropriate and readily available (although Owen usually does not suggest specific editions). The author could have given at least one set of questions for a particular suggested work without providing

a score. Such an approach would have provided more flexibility for the instructor without greatly expanding the text. In addition, many of the discussion questions already included are general enough to apply to other compositions, and both instructor and student should be able to formulate many of their own questions.

The questions for discussion that the author does provide are usually quite pertinent to the given musical example. For a violin sonata movement by Corelli, the author poses questions on melodic, harmonic, and rhythmic elements (pp. 175-76). Students are asked about the kinds of melodic motion found in solo part and bass, how motives are developed, the various cadence types in the piece, and how the composer achieves rhythmic variety.

The compositions at the beginning of each chapter constitute an anthology of sorts. Whether there is enough music for an entire course depends on many factors; I would guess that most instructors would avail themselves of the sources for further study as supplementary material. Even so, Owen is to be commended for providing such a wide variety of music in one place, an important factor for instructors considering this text. Three of the most popular counterpoint anthologies, those by Berry and Chudacoff, Hardy and Fish, and Soderlund, are no longer in print.[2] The only currently available self-contained texts plus anthologies are Thomas Benjamin's *The Craft of Modal Counterpoint* (New York: Schirmer Books, 1979), the same author's *Counterpoint in the Style of J.S. Bach* (New York: Schirmer Books, 1986), and Robert Gauldin's *A Practical Approach to Sixteenth-Century Counterpoint* (Englewood Cliffs, NJ: Prentice Hall, 1988). None of these approaches the scope of Owen's text.

I was very impressed with the quality of the musical examples, all newly typeset. Most of the pieces, for solo instrument and small vocal and instrumental ensembles, can be easily performed in class. In only one case that I could find does the reproduction get in the

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[2]Wallace Berry and Edward Chudacoff, *Eighteenth-Century Imitative Counterpoint* (Englewood Cliffs, NJ: Prentice Hall, 1969); Gordon Hardy and Arnold Fish, *Music Literature: A Workbook for Analysis,* Vol. II: Polyphony (New York: Dodd, Mead, 1966); Gustave Soderlund and Samuel Scott, *Examples of Gregorian Chant and Other Sacred Music of the 16th Century* (New York: Appleton-Century-Crofts, 1971).

way of classroom performance. The score of the Minuet and Trio from Mozart's Serenade, K. 388 is nontransposing. While student analysts would welcome this, their performer colleagues on clarinets and horns would not!

There are fewer compositional exercises here than in most other counterpoint texts, an understandable decision given the book's premise. Following the text's focus on stylistic development within a historical context, most instructors would probably give other assignments of a more analytical nature. For these, the sources for further study at the end of each chapter should prove especially helpful. Owen indicates which exercises are more appropriate for advanced students; most instructors would also wish to use some exercises of their own creation.

Part two of the text, which treats counterpoint in the late Renaissance, comprises eight chapters. Three chapters present the basic principles of sixteenth-century counterpoint along with Owen's approach to the species. In a deft organizational strategy, the remaining chapters of this section simultaneously cover composition in two, three, four, and more parts along with a presentation of sacred and secular vocal and instrumental genres. Too often, courses in sixteenth-century counterpoint neglect secular vocal and instrumental music. It is not enough to tell students that the secular music of the period is based on the same general structural principles as the sacred music. While this may be true in the broadest sense, there are some technical differences between the two that Owen manages to bring out (see for instance p. 68).

Perhaps the most striking and possibly controversial element of Owen's treatment of sixteenth-century counterpoint is his use of the species. In this area, the text breaks ranks with some other well-known texts that favor the so-called direct (nonspecies) approach to teaching the counterpoint of this period.[3] The difficulty with the

[3]Gustave Soderlund's *Direct Approach to Counterpoint in 16th-Century Style* (New York: Appleton-Century-Crofts, 1947), the model for this approach, is now out of print, although it and the 1946 edition of its companion anthology are available, at high cost, through Reprint Services Corporation of Irvine, CA. Robert Gauldin also follows the direct, nonspecies approach in his *A Practical Approach to Sixteenth-Century Counterpoint.*

species approach in the teaching of sixteenth-century counterpoint is the eventual development of rhythmic flexibility and the achievement of musical results. Before examining Owen's approach to the species, let us see how two other authors grapple with these problems.

In his monumental counterpoint treatise, Knud Jeppesen presents strict species in two and three parts along with some examples of combined species.[4] In a section on free two-part counterpoint, Jeppesen discusses exceptional cases that lie outside the boundaries of strict species writing. A new text by H. Gilbert Trythall attempts to achieve more musical results with the species by expanding their rhythmic scope.[5] The first species uses only whole-note values. Second species exercises are presented first in half notes against whole notes. In this familiar context, the half-note passing tone is the only dissonance allowed. Second species exercises are then presented in quarter notes against half notes, a context that allows further dissonance such as the neighbor tone, accented passing tone, and anticipation. Trythall presents the third and fourth species in the usual way but expands the fourth species to accommodate the consonant anticipation of the suspension resolution.

To address the problem of achieving reasonably musical results in species exercises, Owen offers an "expanded species approach" that allows for greater rhythmic flexibility while still maintaining the basic rhythmic ratio of the species. In Examples 1 and 2, one of Owen's exercises in strict species is followed by an example of expanded second species. (The mistakes in interval labeling , which occur in both examples, appear in Owen's text.)

The strict exercise is completed according to the traditional rules. The expanded exercise incorporates a wider variety of rhythmic figures but maintains the 2:1 note ratio of second species. Both upper and lower voices are allowed to move in second species against the opposite voice. Moreover, the relationship is sometimes half notes against whole note (m. 3) and sometimes quarter notes against half

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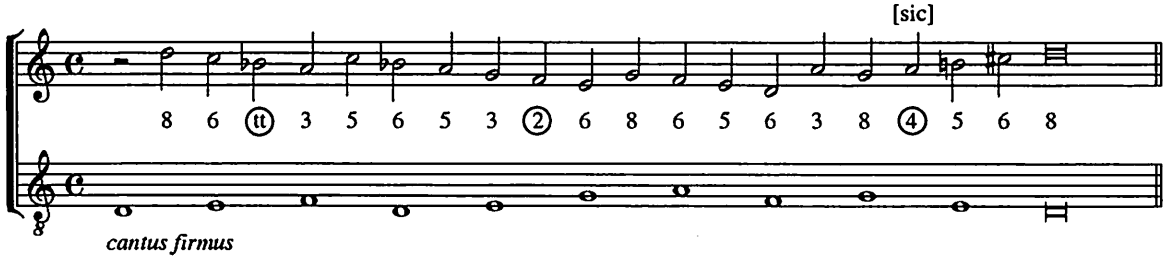
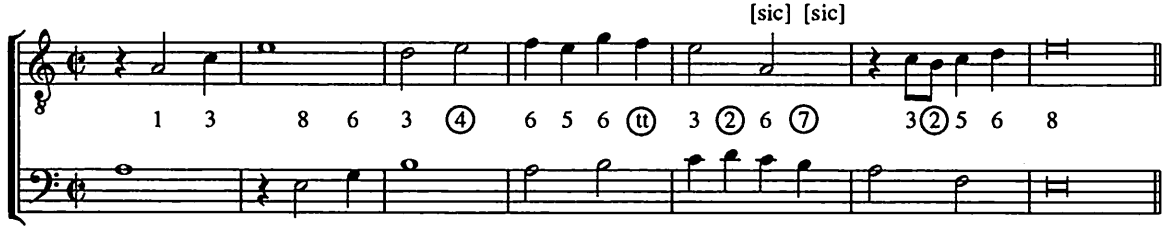
[4]Knud Jeppesen, *Counterpoint: The Polyphonic Vocal Style of the Sixteenth Century* (Englewood Cliffs, NJ: Prentice Hall, 1939).

[5]H. Gilbert Trythall, *Sixteenth-Century Counterpoint* (Madison, WI: Brown & Benchmark, 1994)

EXAMPLE 1. Exercise in strict second species (Owen, p. 38)



EXAMPLE 2. Exercise in expanded second species (Owen, p. 38)



note (m. 4). This proportional change in the second species relationship is similar to Trythall's approach discussed above, but is not nearly as systematic. The modifications of Owen's expanded species approach seem to me quite a bit for beginning counterpoint students to manage. Perhaps a sympathetic instructor could provide some limits for the numerous possibilities of the expanded species in order to help students gain some initial confidence.[6]

One annoying aspect of this section of the text is the notational inconsistency. Some examples employ continuous bar lines through all staves of an ensemble piece, others use separate bar lines on the individual staves. On a single page (p. 51) we see one example with *mensurstriche,* another with continuous bar lines, and yet another with no bar lines at all! Some species exercises are notated with bar lines (p. 35) and some without (p. 38).

A problem of potentially greater impact in musical examples and exercises is the often unannounced shift in meter between 4/2 and 4/4. The complete examples from the sixteenth-century sacred repertory are presented in the now standard 4/2, while many of the species exercises are in 4/4. Sometimes this metric change can be problematic in the expanded species exercises. Example 3 shows an exercise in expanded fourth species.

Following Owen's procedure of allowing a proportional change in the species notation, the suspension can now be written as two quarters against one half (see m. 2). As Jeppesen points out, the suspended quarter note forming a dissonance should rarely occur after an unaccented half note.[7] Of course, if the note values of the exercise were doubled, the suspension problem would disappear.

As in its treatment of modal counterpoint, this book differs from some other well-known texts in its approach to tonal counterpoint. In his *A Practical Approach to Eighteenth-Century Counterpoint,*[8] Robert Gauldin begins with note-against-note exercises and proceeds

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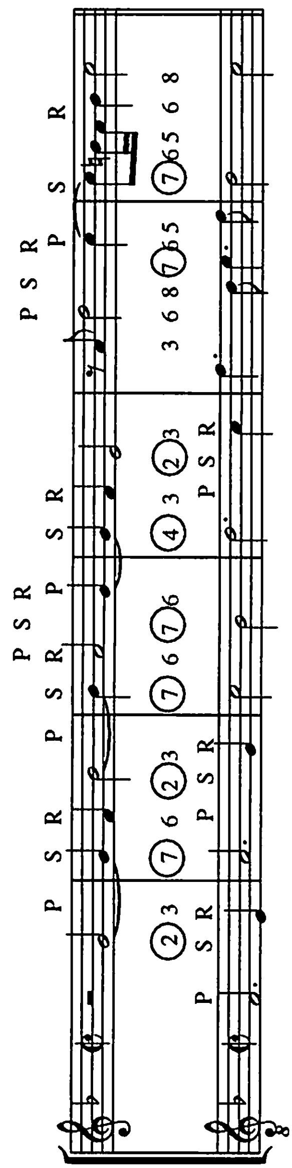
[6]One organizational problem appears in Owen's treatment of expanded fourth species: his inclusion of suspension decorations before they are adequately explained in fifth species.

[7]Jeppesen, *Counterpoint,* 143.

[8]Robert Gauldin, *A Practical Approach to Eighteenth-Century Counterpoint.* (Englewood Cliffs, NJ: Prentice Hall, 1988).

EXAMPLE 3. Exercise in expanded fourth species (Owen, p. 45)



to diminution techniques in the ratios of 2:1, 3:1, 4:1, and even beyond. These diminutions do not fit strictly within the constraints of the traditional species, since a much wider variety of dissonance types and chordal figuration is employed. Of course, all of the diminutions occur with a harmonic framework. Kent Kennan, in his *Counterpoint,*[9] takes an approach similar to Gauldin's with the gradual introduction of elaborative techniques within increasing rhythmic ratios of 2:1, 3:1, and 4:1. In contrast, Owen approaches tonal writing through the melodic elaboration of simple harmonic progressions (chapter 15). Unfortunately, this treatment of elaborative principles should probably come earlier in the text. In chapter 12, on continuous variations, students are asked to compose variations of a simple harmonic skeleton by adding "divisions" to the two upper parts of the three-part texture. They are thus required to do something that is explained more fully later in the book.

Still, there is much to recommend in Owen's handling of tonal counterpoint, especially its coverage of the important genres of the period. He divides this part of the text into two parts: one devoted to the early Baroque (chapters 11-14), the other devoted to the late Baroque (chapters 15-24). The former is especially good because it treats the harmonic and contrapuntal innovations of the period—a subject usually avoided in most texts. Other topics in this section include continuous variation (ground bass, chaconne, and passacaglia), trio texture, and predecessors of the fugue (canzona, ricercar, fantasia, and choral fugato). The latter topic exhibits a "spiral" organization in relation to later chapters on the mature fugue: Owen presents basic information on fugal exposition to which he returns in more expanded form in later chapters.

The section on counterpoint in the late Baroque is the longest section of the text, occupying about one third of its total length. In this section we find the core of the traditional subjects in tonal counterpoint: the chorale prelude, invention, canon, and fugue. The chapter on the chorale prelude is very effective in its presentation of the various types of this genre. I also like the way Owen builds increasing complexity into the exercises of the fugue chapters. In the first

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[9]Kent Kennan, *Counterpoint,* 3rd ed. (Englewood Cliffs, NJ: Prentice Hall, 1987).

chapter (chapter 21), students compose subjects and responses. In the second (chapter 22), they compose complete three- and four-part expositions. Finally (chapter 23), they compose an entire fugue. This section of the text closes with a discussion of genres using fugal technique, such as the gigue, fugal sonata movement, and the fugal chorus. Like the material on the early Baroque, these genres are often omitted from counterpoint texts.

Part five of the text, on polyphony in the Classical and Romantic eras, introduces no new technical material but is nonetheless significant in providing a class the opportunity to study interesting post-Baroque examples of polyphony. The author runs into some trouble when he attempts to generalize about the stylistic characteristics of certain periods. While some observations, like those regarding periodic phrase structure in Classical music, are relevant, others, like the importance of primary triads, hardly qualify as stylistic differences between centuries within the common-practice period.

Owen divides his coverage of early twentieth-century polyphony into chapters dealing with serial/atonal and extended tonal techniques. The first chapter is not intended as an exhaustive discussion of twelve-tone and atonal music; rather, Owen gives the student just enough information to draw some initial conclusions about the pieces studied. Although I would have chosen an example simpler in texture than the fourth piece from Schoenberg's op. 23, Owen's choice of the second movement of Webern's op. 27 piano variations is a good one.[10]

In the chapter on extended tonal procedures, Owen presents examples by Hindemith ("Fuga quarta in A" from *Ludus Tonalis),* Bartók ("Theme and Inversion" from *Mikrokosmos,* Book IV), and Stravinsky ("Great Chorale" from *L'Histoire du Soldat).* These choices allow the author to discuss a variety of topics. The Hindemith leads to a discussion of nontertian harmony and the fugue's relationship to traditional contrapuntal technique; the Bartók to a discussion of two-part counterpoint, modal implications, and motivic develop-

[10]There is an error in the discussion of the Webern movement. The motivic set of eighths with grace notes first appearing in mm. 3-4 at a dynamic level of *p* appears at other dynamic levels not only in m. 6, as Owen states, but in mm. 17, 18, and 21 as well.

ment; and the Stravinsky to a discussion of implied keys and voice leading procedures.

Harold Owen's *Modal and Tonal Counterpoint: From Josquin to Stravinsky* embodies an approach to counterpoint instruction that stresses the historical and stylistic development of polyphony. The text, with minimal supplementation, could serve as the primary text for either a combined counterpoint course or the traditional separate courses in modal and tonal counterpoint. While the author inevitably must sacrifice the detailed compositional instruction of many competing texts, the reward for the general student is a synthesis of analytical, theoretical, and historical detail. Those instructors who see counterpoint as a significant component of a broad music education should welcome Professor Owen's contribution to the pedagogy of counterpoint.

Readers' Comments

Continuing The Dialogue: The Potential of Relative Solmization for the Music Theory Curriculum at the College Level

Micheál Houlahan and Philip Tacka

Editor's note: These comments by Professors Houlahan, Tacka, and Smith are in response to two articles by the same authors, which appeared in Volume 6 (1992) of this journal ("The Americanization of Solmization: A Response to Timothy A. Smith" by Micheál Houlahan and Philip Tacka, 137-151 and "The Liberation of Solmization: Searching for Common Ground" by Timothy A. Smith, 153-168). The 1992 exchanges of ideas, in turn, were responses to articles which appeared in earlier issues of the journal (see 4/2, Fall 1990 and 5/1, Spring 1991). The editorial board decided that the exchange included here would be the last we would print from these three authors about this issue. We invite others, however, to comment about solmization, either in short responses to the editor or in submitted articles.

We wish to thank Professor Timothy Smith for his reply to "The Americanization of Solmization." However, we disagree with several of his interpretations and conclusions pertaining to our work. Smith has misinterpreted again our definition of function and tonality as outlined in our writings. We define function, as we did in our initial response to Professor Smith, as the relationship between sounds. We define tonality as a system of these interrelationships that is valid for particular musical styles and compositions. Smith has chosen to respond to our pedagogy using a much narrower definition of function and tonality, focused on the application of solmization to teaching music of the late 1600s to late 1800's. We did not limit our initial reply to this narrow definition.

In our response, we provided an abbreviated melodic sequence of our presentation of musical elements. This sequence is taught

using a variety of materials from multicultural folk music to art music. Pentatonic motives, hemitonic and anhemitonic pentatonic scales and modal scales are taught before the presentation of major and minor tonalities. Within the pentatonic system we use the notes *d-r-m s-l* to create the following scales: *do* pentatonic, *re* pentatonic, *mi* pentatonic, *so* pentatonic and *la* pentatonic. With the introduction of modal scales, students are taught to hear the tonic for each of the modes: *do* - Ionian, *re* - Dorian, *mi* - Phrygian, *fa* - Lydian, *so* - Mixolydian, *la* - Aeolian. We do not teach pentatonic, modal, or minor scales as alterations of the diatonic major scale where *do* is the tonic. Through the sequential presentation of solfège syllables, students are accustomed to the tonic note being represented by any one of the seven solfège syllables. Following this sequence, once major and minor tonalities are introduced, students logically hear centeredness in a tonic with *do* for major and *la* for minor. Once students have a firm grasp of the above concepts, they also sing major and minor scales and melodies with numbers using the number I for tonic major and i for tonic minor.

We do utilize the "*la* minor" system of solfège but our approach to teaching varies considerably with a traditional usage of this system. All of Smith's interpretations and conclusions relative to our work derive from the fact that he believes that the "*la* minor" and "Relative Solmization" systems for teaching musicianship skills are synonymous. They are not. Relative solmization:

> links the notes to *tonal images* and associations in our hearing so that they may be transferred to any tonal system be it major, minor, modal, pentatonic or prepentatonic, with the exception perhaps of the 20th-century dodecaphony. It is not associated with scales, for a so-mi minor third will sound identical in the major or Dorian scales. . . .In short, the music reading elements and the auditive elements form a unity in relative solfa.[1]

Undoubtedly Professor Smith will now agree that he was wrong in his assumption that we, as advocates of relative solmization, are unwilling to solmize music without knowing the mode. We train

[1]László Dobszay, *After Kodály, Reflections on Music Education* (Kecskemét: Zoltán Kodály Pedagogical Institute of Music, 1992), 54.

our students to be able to solmize **motivic patterns** as well as **complete musical examples** using several solfège possibilities. We do not present to our students all the solfège syllables at one time but rather present them gradually. In the beginning of the first semester of sight-singing and ear-training classes, we restrict the music examples to pentatonic examples and use only the solfège syllables *d - r - m - s - l.* When students are asked to sing or aurally identify a *mi* pentatonic folk song or scale they use the following solfège syllables:

m - s - l - d - r - m - r - d - l - s - m

Smith will solfège the same passage as follows:

d - me - f- le - ta - d - ta - le - f- me - d

This solution has inherent intonation problems for the neophyte musician and would not be the most intelligent solution for our students.

As a pedagogical technique to develop students' facility with solfège syllables, pitch names and memory, we often ask students to solfège **motivic patterns related to a specific tonality.** A sample procedure follows:

1. Students sight sing a musical example with solfège syllables.
2. Students sing the musical example with note names.
3. Teacher hums selected motivic patterns from the musical example for individual students to solfège without looking at the music.
4. Teacher hums selected motivic patterns from the musical example for individual students to sing with letter names.

As a further pedagogical technique to develop students' facility with solfège syllables and keys we often ask students to solfège motivic patterns not related to a specific tonality.

1. Teacher hums a motivic pattern.
2. Students repeat the motivic pattern from memory.
3. Students are asked to indicate a centeredness in the musical example and offer possible solfège solutions and indicate key possibilities.
4. Teacher indicates the pitch name of the first note and students are then asked to sing with pitch names.

Using the above procedure, students will solfège the motivic pattern provided by Smith with the following solfège syllables: *s,-d-r-d-t,-d.*

Depending on their knowledge of solfège syllables, students will offer other solfège possibilities. They will solfège the above example using the solfège syllables: *mi-la-ti-la-si-la* towards the second half of their first-semester sight-singing and ear-training class after they have a knowledge of altered solfège syllables connected with the harmonic and melodic minor scales.

The following are the solfège solutions given by our students to the two different endings that Smith provides:

First ending: *s,-d-r-d-t,-d-l,-s,*
or
m-l-t-l-si-l-fi-m
or
*r-s-l-s-fi-s-m-r**

Second ending: *s,-d-r-d-t,-d-le,-s,*
or
m-l-t-l-si-l-f-m
or
*r-s-l-s-fi-s-me-r**

[*These solfège solutions would be offered only by second-semester theory students who have had more practice using altered solfège syllables.]

Our students are just as capable as *do* minorists of using altered notes and can aurally identify many more solfège and key possibilities. (In harmony class these skills are invaluable when students are asked to harmonize modulating material.) If Smith were to present his two musical motives in succession and ask our students to analyze aurally and solfège these examples to show similar structures, our students would use the following solfège syllables:

s,-d-r-d-t,-d-l,-s, for the first motif and
s,-d-r-d-t,-d-le,-s, for the second motif.

Students will provide the above solution in the third semester of sight singing and ear training. During this semester musical materials include works by Mozart, Beethoven and Schubert. Frequently many of these pieces switch from major into minor tonalities or the

melody is repeated in the minor tonality. In the above case our students are able to hear this momentary modulation and sing the minor tonality sections keeping *do* as the tonic but using the altered tones of *me* and *le*.

In conclusion we would like to address again some themes that permeated our initial response to Professor Smith. As music theorists we have no disdain for music analysis. How could we? What we have is a disdain for the current tendency among some college theorists of failing to understand the problems of teaching the neophyte musician. If entering first-year students are no longer prepared to meet the demands of a standard theory curriculum, we must search for other means of teaching them rather than relying on techniques that have no proven value. Rather than investigate successful systems of teaching the neophyte, some theorists are more concerned with the propagation of theories concerned with musical analysis that have no immediate bearing on the development of the students' musicianship. We must establish a balance between musicianship and theory. We have no problem with the entering gifted students who have no need of solmization symbols and who can tackle the demands of a current curriculum. But their numbers are dwindling.

Regretfully we have come to the end of our reply but we suspect and hope that this is not the end of this discussion. In closing, we would ask for music theorists involved in teaching ear-training and sight-singing skills to begin a dialogue at a national meeting of the Society of Music Theory on the problems facing entering first-year students and to investigate comprehensively the potential of the "relative solmization" system for ear training, sight singing and analysis at the college level.

Ending the Dialogue: Imaginary Solutions Are No Solution

Timothy A. Smith

We may conclude from the foregoing reply that Micheál Houlahan and Philip Tacka have conceded my sixth proposition: **the *do*-tonic system is oriented more toward the ear than is *la*-minor.** While they did not in so many words *say* that they agreed, their main argument seems calculated to prove it. By deciphering a minor host of relative solutions to my example, Houlahan and Tacka confirm that their method does indeed "require comparatively more analysis when going from sound to sight," as I lately prefaced that proposition. For my thesis, the opposition could not have submitted a better proof. Now, like the fox that lost its tail, my partners in debate desire that we should entertain the notion that a proclivity to "hear several solfège syllable possibilities" before choosing the "most intelligent solution" is a pedagogical advantage. It is not, and here is why.

First, Houlahan and Tacka's solutions attribute to my example something that it did not contain. My melody, *sans* endings, was tonal, but without mode. To fake one, by suggesting that it might be solfèged either as (1) m-l-t-l-si-l, (2) r-s-l-s-fi-s, (3) s-d-r-d-t-d, (4) l-r-m-r-di-r, or (5) d-f-s-f-m-f, is to torture the very tonality that we wish to teach.[1] My colleagues' solutions represent nothing more than their imaginations—arguments from silence.

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[1]The example was, the reader will recall, a melody that ascended a P4, continued in the same direction a M2, returned to the second pitch, descended a m2, and returned once more, with the second pitch perceived to be tonic. While the original example was represented as waiting for two possible endings, it could just as well have been complete, without the endings, as I represent it now. Houlahan and Tacka's students did not solfège my example with strings four and five, but they, too, are plausible in a relative system.

Their solutions imply, moreover, that the music is incomplete. "If we had but two or three more scale degrees," their protégés might be heard to think, "*then* we could choose which one of our relative readings is, in our mentors' words, 'most intelligent'." In truth, all of the mentors' readings are *equally* intelligent because they are equally fictitious. To recommend that students should dignify one solution as more intelligent than another is to insinuate that they should hear modality where it is not. And, if there is no mode, each solution necessarily implies a relationship that is pure fantasy.

Houlahan and Tacka's use of the word "solution" betrays a misunderstanding of the purpose of solmization. Representing structure in melody ought not to be construed as a puzzle wherein students are compelled to deconstruct what *might* be inferred from that which does not exist. It ought, rather, to represent what does exist. And what *does* exist in my example is a tonal center—nothing more, nothing less. To imply that the melody has five potential solutions is little different (only to the degree that it is less farcical) from the implication that "Bruckner is potential Wagner." Both do violence to what *is* by requiring that inferences be erected upon a foundation of what *is not*.

By imposing theoretical sounds upon my example and suggesting that students should be taught to *hear* them, not only do Houlahan and Tacka give an abstruse twist to the concept of audiation, but they contradict themselves. They parade their theory before practice (a fallacy that they loudly boo in one breath but applaud in the next). When they write "We train our students to hear several solfège syllable possibilities," they confess that they train their students, like the schizophrenic, to hear things. What they hear are theoretical possibilities for which my example provides no aural basis in fact.

As predicted, Houlahan and Tacka's arguments against my third and fourth propositions could not be made without abandoning my second: **the essential function that movable systems seek to identify is the sense of centeredness in a tonic.** While they write that they accept the thesis, by providing multiple solutions to my example, Houlahan and Tacka unwittingly confess the antithesis. So, according to their own dialectic, the relative system does not do what they purport to agree that it should.

The problem becomes evident when a student sings back a "solution and Houlahan and Tacka cannot be certain to which pitch has been ascribed tonal function.[2] Student Schmoke, for example, solfèges the melody as *mi la ti la si la.* Unless Joe divulges that it is *la* he has heard as tonic, Houlahan and Tacka cannot know whether Joe has sensed centeredness in *fa, do, re, la,* or *sol.*[3] (They have taught Schmoke, after all, that *any* syllable could represent the center.) It is not the relative system, then, that symbolizes centeredness, but the selfsame Schmoke, in pleasant conversation, and without reference to any system whatsoever.

I am amused, therefore, by Houlahan and Tacka's admission that, in spite of their students' ability to fabricate an array of possible solutions to my minor mode ending, after all was said and

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[2] Remember the way my example was originally framed. The student perceives the second pitch to be tonic, but the instructor does not yet know what the student has perceived. The instructor awaits, then, the revelation of centricity by means of syllables.

[3] That the same string is comfortable with other pitches functioning as tonic is shown by the following table. The last line represents the only hearing in which the second pitch has been perceived as tonal center (bold type).

Mode	Relative System	*Do*-Tonic System
Ionian	*mi la ti la si la sol* ***do***	*mi la ti la si la sol* ***do***
Dorian	*mi la ti la si la fa* ***re***	*re sol la sol fi sol me* ***do***
Phrygian	*mi la ti la si la fa* ***mi***	*do fa sol fa mi fa ra* ***do***
Lydian	*mi la ti la si la sol* ***fa***	*ti mi fi mi ri mi re* ***do***
Mixolydian	*mi la ti la si la ti* ***sol***	*la re mi re di re mi* ***do***
Aeolian	*mi* ***la*** *ti la si la do* ***la***	*sol* ***do*** *re do ti do me* ***do***

In one interpretation the relative system consistently articulates the first six pitches of the melody as "m-l-t-l-si-l," yet students could have sensed tonal centeredness anywhere. The instructor cannot determine where, from syllables alone. But this is just the beginning. The relative system allows that the same *incipit* could have been interpreted with the four additional strings listed in my second paragraph, each of these, too, with six possible ways to hear the tonal center, for a grand total of five ways that the relativist could string together syllables with each string admitting of six possible tonal centers. Thankfully Houlahan and Tacka didn't suggest that their students should "solve," or hear, the half of them.

done they chose to abandon the relative system for a *do*-tonic rendering: "s-d-r-d-t-d-le-s." By so choosing, the students reveal that they have seen the Emperor's new clothes. The followers acknowledge what the leaders do not—that a *do*-tonic system is not only better oriented toward the ear but also better suited to teach the aural particulars of major and minor. If the relative solmization system has any potential for the music theory curriculum at the college level, it is, I suspect, to help students discover for themselves that there is a tonic in which the Emperor (and his relatives) might be clothed with common sense.

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Stewart, Robert. *An Introduction to Sixteenth Century Counterpoint and Palestrina's Musical Style.* New York: Ardsley House Publishers, Inc., 1994. Melodic writing; counterpoint in two, three, four, and five parts. Examples by Lassus and Palestrina.

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Gretz, Ronald. *Music Language and Fundamentals.* 2nd edition. Madison, WI: Brown & Benchmark, 1994.

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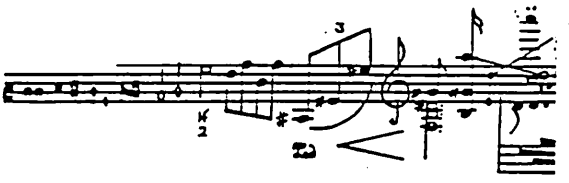

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