

Sound Experiments: The Use of Four-Voice Writing in the Study of Twentieth-Century Music

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“One who cannot control four parts with a certain ability either has not worked seriously or is entirely untalented and should give up music at once.”

—Arnold Schoenberg¹

Four-voice writing exercises saturate music theory textbooks devoted to the common practice but play only a minor role in recent texts on the twentieth century.² Intrigued by this dichotomy, I have gradually been incorporating more four-voice exercises into the twentieth-century portion of the core music theory course that I teach. I have found that the use of homophonic musical models *throughout* the undergraduate curriculum promotes continuity, thereby helping to connect the twentieth-century repertoire to its stylistic antecedents. The exercises also provide material

¹ Arnold Schoenberg, *Structural Functions of Harmony*, ed. Leonard Stein (New York: Norton, 1969): xvi. Although the book focuses primarily on harmony in common-practice tonal music, it concludes with a few comments concerning quartal and whole-tone harmony.

² Using two popular texts as representative examples, Edward Aldwell and Carl Schachter's *Harmony and Voice Leading* (New York: Harcourt, 2003) contains several hundred part-writing exercises, while Stefan Kostka's *Materials and Techniques of Twentieth-Century Music*, 2nd ed. (Upper Saddle River: Prentice-Hall, 1999) contains less than ten. I hasten to add that Kostka's text contains many other useful assignments, such as composition exercises that require students to continue a given opening, to imitate an existing excerpt, and to illustrate various theoretical constructs. For various types of exercises that address twentieth-century harmonic materials see John Rahn, *Basic Atonal Theory* (New York: Longman, 1980); Joel Lester, *Analytic Approaches to Twentieth-Century Music* (New York: Norton, 1989); J. Kent Williams, *Theories and Analyses of Twentieth-Century Music* (New York: Harcourt Brace College Publishers, 1997); Joseph N. Straus, *Introduction to Post-Tonal Music* (Upper Saddle River: Prentice Hall, 2005); and portions of Roger Sessions, *Harmonic Practice* (New York: Harcourt, 1951) and Evan Copley, *Harmony: Baroque to Contemporary* (Champaign: Stipes, 1991). Two older compositionally-oriented texts provide a plentiful supply of composition exercises, some of which suggest homophonic texture: Vincent Persichetti, *Twentieth-Century Harmony: Creative Aspects and Practice* (New York: Norton, 1961) and Ludmila Ulehla, *Contemporary Harmony: Romanticism through the Twelve-Tone Row* (New York: The Free Press, 1966). These books remain wonderful resources because they discuss harmony in considerable depth.

for classroom singing, which helps students to connect aural experience to music-theoretic concepts. Further, students gain skill in the manipulation of the materials of extended tonal and atonal harmony, which improves analytic ability and prepares for composition.

In addition to engaging the harmonic phenomena associated with the extended tonal and atonal repertoires, these experiments also encourage consideration of motivic repetition. The assignments limit student's choices by providing one or more of the voices, by requesting particular chord/collection types, and/or by requiring certain root motions or other features. In addition to limitations imposed by the instructor, students must invent their own, ever striving for a self-inspired maximum. My goal is to give them more freedom—not the freedom to have *no* rules—but rather to choose at least some of *their own*.

I call these four-voice exercises “sound experiments.” The term “sound” has a double meaning, implying not only the connection to live musical experience but also the historical foundation on which the exercises are based. The term “experiment” encourages creativity and exploration. Since sound experiments mix harmonic phenomena suggested by the musical repertory with teacher-imposed notions and ideas from the student, they are neither style-emulation exercises nor free compositions, but rather abstract exercises that inhabit the middle ground between these two extremes. However, as shown later in the paper, sound experiments can lead to the emulation of existing styles and to the creation of original compositions.

The list in Ex. 1 augments the familiar four-voice issues of the common practice with techniques introduced in the twentieth century. Since there are so many ways to address and combine various musical concepts, even this small set of topics promotes great variety in student responses to a given assignment. Although the list is largely self-explanatory, it will be helpful to review labeling procedures for intervals, chords, collections, and motives as a preparation for the main body of the paper, which discusses sample sound experiments.

1. Intervals: specific, generic, step vs. leap, contour, pitch-class interval, interval class, etc.
2. Chords: (a) tertian: triads (major, minor, diminished, augmented, Italian), seventh chords (major, minor, dominant, half diminished, diminished, dominant with raised fifth, French, German, diminished-major, minor-major, augmented-major), extensions (b9, 9, #9, 11, #11, b13, 13) (b) quintal harmony, (c) set types ([014], etc.)
3. Scales: major, minor (natural, harmonic, melodic), pentatonic, octatonic, whole tone, acoustic, etc.
4. Modes: of diatonic collection (Ionian, Dorian, etc.), of pentatonic and other collections
5. Spatial layout: spacing (close, neutral, open), distance between adjacent notes, total span, chord inversion, chord member in soprano, one chord member above another, etc.
6. Chord progression: plagal, authentic, passing, neighbor, interval between roots, sequential, etc.
7. Common tones between chords/collections
8. Non-harmonic tones: neighbor, passing, pedal, etc.
9. Closure: cadence, statement-departure-return, aggregate completion, etc.
10. Motivic transformation: augmentation, diminution, transposition, inversion, retrograde, rotation, tonal vs. real imitation, fragmentation, ornamentation
11. Motivic repetition: within one voice, between/ among voices, stretto, canon, sequence, ostinato, etc.
12. Relationship of voices: contrary/ similar/ parallel/ oblique motion, voice overlap, voice crossing, voice exchange, voice pairing
13. Melodic shape: arch, inverted arch, zigzag, straight, meandering downwards, etc.
14. Meter/ Rhythm: measure, beat, strong/ weak beats, onbeat/ offbeat, syncopation, hemiola, duration, harmonic rhythm, etc.
15. Miscellaneous concepts: cross relation, modulation, pivot chord, modal mixture, resolution of dissonant chord members, change melodic direction after a large leap, consonance vs. dissonance, subset/ superset, set-type similarity, etc.
16. Treatment of issues: number to be balanced simultaneously, issue priority in case of conflict, strict vs. flexible application of rules

Example 1: Some Four-Voice Writing Issues

TERMINOLOGY

In tonal and extended tonal contexts, musicians identify pitch intervals either specifically (e.g. “major third”), generically (e.g. “third”), or in terms of a step/leap dichotomy. Interval descriptions may also specify direction, as in “descending major third,” “ascending third,” or “descending leap.” Contour intervals

(a) Interval types

Specific:	major third (M3)	minor seventh (m7)
Generic:	third	seventh
Step/leap:	leap	leap
Contour:	descending (↓)	ascending (↑)
Pitch-class:	8	10
Interval class:	4	2

(b) Tertian

Chord: CM F#m7 E7(#11) FM(add9)

Root motion: tritone ↓m3 ↑M2

(c) Quintal

D quintal C# quintal

↓m2

(d) Collections

D acoustic F acoustic

↑m3

(e) Atonal set types

[014]F# T2 [014]G# [016]Gb T9 [016]Eb

4 1 0 6 1 0

Example 2: Some analytic terminology.

indicate direction but not size (“ascending” or “descending”). In atonal contexts it is vital to consider other interval types as well. Given the pitch-class clock (C at 12 o’clock, C $\sharp$ /D $\flat$ at 1, D at 2, etc.), a *pitch-class interval* measures the numerical distance in a clockwise direction from one pitch class to another. For example, from A (9 o’clock) to F (5 o’clock) is pitch-class interval 8. An *interval class* counts the shortest distance between two pitch classes; for instance, A and F are interval class 4 apart. Ex. 2(a) summarizes these various interval types.

The remainder of Ex. 2 introduces notational conventions for chords and collections, and shows ways to indicate root motion and transposition. Tertian harmony is familiar. When a tonal center is present, roman numerals and figured bass describe the harmony, otherwise chord labels list root, quality, and extensions, as shown in Ex. 2(b). With quintal harmony, I choose the “bottom” note in a stack of fifths to be referential, even if it isn’t literally in the bass; as with the four-note quintal chords on D (D–A–E–B) and C $\sharp$ (C $\sharp$ –G $\sharp$ –D $\sharp$ –A $\sharp$) in Ex. 2(c).³ Taken as a pair, the D and C $\sharp$ quintal collections articulate transposition by descending minor second. Larger collections may be treated in a similar fashion, as with the minor-third related acoustic collections in Ex. 2(d).

In atonal harmony, students determine pitch-class set labels by plotting a set’s pitch classes on the clock and then determining the prime form as follows:

Find the widest gap between the pitch classes. Assign zero to the note at the end of the gap and read off a possible prime form clockwise. Then assign zero to the note at the beginning of the gap and read off another possible prime form counterclockwise. (If there are two gaps of the same size, choose the one that has another relatively big gap right next to it.) Whichever of these potential prime forms has fewer big integers is the true prime form.⁴

³ The referential pitch class facilitates the study of transposition among quintal harmonies but it is not strictly speaking a “root.” In *The Craft of Musical Composition, Book I, Theoretical Part*, trans. Arthur Mendel (New York: Associated Music Publishers, Inc., 1942, rev. 2/1948), Paul Hindemith writes: “the chord composed of two superimposed fourths...[has] no root, but only a root representative” because “the interpretation depends on the context.” (101)

⁴ Straus, *Introduction*: 58. Straus also lays out a method for determining prime forms that does not use a pitch-class clockface.

The complete *pcset label* is this *prime form*, along with the *direction* traveled to determine the prime form ($\uparrow$ for clockwise, $\downarrow$ for counterclockwise) and the *starting pitch class*. For example, the label for $\{F\sharp GB\flat\}$ is $[014]\uparrow_{F\sharp}$ because counting clockwise from $F\sharp$ yields prime form $[014]$ —that is, $F\sharp-G-A-B\flat$ yields zero-one-two-three-four, as in Ex. 2(e).⁵ Similarly, $\{G\sharp AC\} = [014]\uparrow_{G\sharp}$. In the same manner, $[016]\downarrow_{G\flat}$ describes $\{G\flat FC\}$ because counting counterclockwise from $G\flat$ yields prime form $[016]$ —that is, $G\flat-F-E-E\flat-D-D\flat-C$ yields zero-one-two-three-four-five-six. Likewise, $\{E\flat DA\} = [016]\downarrow_{E\flat}$.⁶ Example 2(e) also identifies transpositional relationships between these sets; the $[014]\uparrow$ articulate T2, transposition by pitch-class interval 2, and the $[016]\downarrow$ articulate T9.⁷

As with unordered sets, labels for *ordered sets* (also called rows, segments or motives) include type, orientation, and referential pitch class. An upper case letter such as X denotes a set of ordered sets related by transposition, inversion, and/or retrograde; P, I, RP, and RI specify orientation (prime, inversion, retrograde-prime, retrograde-inversion); and a subscript indicates the initial pc for P and I forms and the final pc for RP and RI forms. For example,

⁵ This notational system was laid out in an earlier article of mine, "No Simple Pieces: Curricular Coherence, Classroom Vocalization, Row Combination, and the 'Trio' from Schoenberg's *Suite for Piano*, Opus 25," *Journal of Music Theory Pedagogy* 15 (2001): 1–49. Although prime forms saturate the pedagogical sources, many texts do not specify orientation and/or referential pc, although some, using different notational conventions, indicate a pcset's relationship to the set-class prime form. For example, this article's $[014]\uparrow_{F\sharp}$ corresponds in some ways to $T_6\{0,1,4\}$ in Rahn, *Basic Atonal Theory*. I use $\uparrow$ and $\downarrow$ for pcset orientation, thereby keeping the symbols T_n and T_nI out of pcset labels, so that students clearly understand the difference between a pcset label and a transformation. I use letter names for pcs in the core curriculum course because they facilitate a quick and smooth transition from tonal to atonal theory, thereby increasing the amount of time left to study *the music*. Many other texts use integer representation of pcs, which has its own advantages, especially in more advanced situations. In "Recommendations for Atonal Music Pedagogy in General; Recognizing and Hearing Set-Classes in Particular," *Journal of Music Theory Pedagogy* 8 (1994): 75–134, Robert Morris argues for pc integers instead of letter names and provides an illuminating discussion of this and other pertinent issues. Of course, the four-voice exercises outlined below may be adapted to suit any notational system.

⁶ When symmetry is involved, there are multiple starting points and/or directions, as for example with $\{CD\flat F\sharp G\}$, which can be labeled $[0167]\uparrow_C$, $[0167]\uparrow_{F\sharp}$, $[0167]\downarrow_{D\flat}$, $[0167]\downarrow_{G\flat}$, or even $[0167]\uparrow_C\uparrow_{F\sharp}\downarrow_{D\flat}\downarrow_{G\flat}$. The idea of multiple possible labels for a single set of pitch classes is familiar to students acquainted with the enharmonic respelling of a diminished seventh chord (e.g. $C^\flat7$, $D^\flat7$, $F^\flat7$ and $A^\flat7$).

⁷ When pcsets have the same prime form but different orientations, they are related by T_nI , where n is the sum of the clock positions of the referential pcs. E.g. $[016]\uparrow_F$ and $[016]\downarrow_{D\flat}$ are related by T_6I because $5(F) + 1(D^\flat) = 6$.

⁸ Once again the pedagogical literature includes various notational conventions; for example $RI(X)_C$ might also be labeled RT_0IP (after Morris, "Recommendations"), $RI-0$ (Kostka, *Materials and Techniques*), or RI_0 (Straus, *Introduction* and Williams, *Theories and*

if $P(X)_C = \underline{C}-D-E\flat-B-G$, then $RP(X)_C = G-B-E\flat-D-\underline{C}$, $P(X)_F = \underline{F}-G-A\flat-E-C$, $I(X)_C = \underline{C}-B\flat-A-D\flat-F$, and $RI(X)_C = F-D\flat-A-B\flat-\underline{C}$.⁸ r_n indicates rotation-by- n order positions as with $r_1P(X)_F = C-\underline{F}-G-A\flat-E$, $r_2I(X)_C = D\flat-F-\underline{C}-B\flat-A$, and $r_4RI(X)_C = D\flat-A-B\flat-\underline{C}-F$. Order position numbers specify motivic fragments, as in $P(X)_{C(1-4)} = C-D-E\flat-B$ or $P(X)_{C(1-2,4-5)} = C-D-B-G$. When only one ordered set type is of interest in a particular context, as is often the case in the analysis of a twelve-tone piece, the label omits the capital letter, as with P_C , RP_C , P_F , I_C , RI_C , and r_1P_F . Or, if a situation involves R and T_n , but not I , then the P and I indications are unnecessary, yielding X_C , RX_C , X_F , and so forth.

In tonal and extended tonal contexts, motives are often subjected to “tonal” alteration, either to fit within a single scalar environment or to accommodate varying ones. For example, given $P_C = C-D-E\flat-B-G$ and a prevailing C harmonic minor scale, transformed versions such as $P_D = D-E\flat-F-C-A\flat$, $I_B = B-A\flat-G-C-E\flat$, and $RP_B = F-A\flat-D-C-B$ change at least some of the intervallic qualities of the original (e.g. from a major second to a minor second or augmented second). Concerning motivic repetition in multiple scalar settings, possible altered versions of $P_C = C-D-E\flat-B-G$ include $C-D-E-B\flat-G\sharp$ (whole-tone), $C-D-E\flat-B-G\sharp$ (octatonic), $C-D-E-B-G$ (C major), or even $C-D-E-A-G$ (pentatonic).

Overall, in addition to facilitating the study of harmony, motive, root progression, and transpositional relations in a variety of musical situations, this labeling system promotes curricular continuity. For example, a single motivic labeling method applies equally well, with only minimal alterations, to the music of Bach, Britten, and Babbitt. Also, the use of a letter name (instead of an integer) to indicate a pcset’s referential pitch class helps to relate atonal to tonal practice.⁹ Finally, the presence of referential pitch classes in harmonic *and* motivic labels, in both tonal *and* atonal contexts, promotes a coherent overall view of these analytic resources.

⁹ The referential pitch classes in pcset labels provide a useful analogy to chordal roots in tonal music, but not all associated concepts transfer in a meaningful way. For example, a discussion of voice-leading tendencies in tonal music may usefully identify root motion by ascending second in both $vii^{07}-i$ and iv^7-V , despite the *varying* chord types, but in atonal contexts T_n/T_n relations may only be asserted between pcsets of the same type. Furthermore, chordal roots usually connote acoustic primacy, whereas set label’s referential pcs do not. Nonetheless, referential pitch classes are powerful aids to the study of T_n/T_n relations.

(a)

(b) Transformations of Melody 1

PC = C-D-E♭-B-G-B♭-A-A♭	IC = C-B♭-A-D♭-F-D-D♭-E
PC♯ = C♯-D♯-E-C-G♯-B-B♭-A	IC♯ = C♯-B-A♯-D-F♯-D♯-E-F
PD = D-E-F-C♯-A-C-B-B♭	ID = D-C-B-E♭-G-E-F-G♭
PE♭ = E♭-F-G♭-D-B♭-D♭-C-B	IE♭ = E♭-D♭-C-E-A♭-F-F♯-G
PE = E-F♯-G-D♯-B-D-C♯-C	IE = E-D-C♯-F-A-F♯-G-G♯
PF = F-G-A♭-E-C-E♭-D-C♯	IF = F-E♭-D-F♯-B♭-G-A♭-A
PF♯ = F♯-G♯-A-F-C♯-E-D♯-D	IF♯ = F♯-E-D♯-G-B-G♯-A-B♭
PG = G-A-B♭-F♯-D-F-E-E♭	IG = G-F-E-G♯-C-A-B♭-B
PA♭ = A♭-B♭-C♭-G-E♭-G♭-F-E	IA♭ = A♭-G♭-F-A-D♭-B♭-B-C
PA = A-B-C-G♯-E-G-F♯-F	IA = A-G-F♯-B♭-D-B-C-C♯
PB♭ = B♭-C-D♭-A-F-A♭-G-G♭	IB♭ = B♭-A♭-G-B-E♭-C-C♯-D
PB = B-C♯-D-B♭-F♯-A-G♯-G	IB = B-A-G♯-C-E-C♯-D-E♭

Example 3: Melodies to be harmonized.

SOUND EXPERIMENTS

Like their tonal counterparts, sound experiment exercises come in various types. Students may be required to harmonize a given melody, to continue a given opening, or to create a progression with certain required features *ex nihilo*. This article focuses on melody harmonization, in particular, multiple settings of the melodies shown in Ex. 3(a); Melody 1 is harmonized with poly-triads, minor seventh chords, extended tertian sonorities, pentatonic collections, [016] and [0147], and Melody 2 receives a range of modal and bi-modal treatments. Example 3(b) lists the various P and I versions of Melody 1, from which can also be inferred retrogrades and rotations. Students fill in this chart early in the semester and refer to it later as they incorporate complete and incomplete forms into their various settings of Melody 1. Most of the solutions provided below are actual student responses although I have adapted / created some to illustrate certain points.

Provide a six-voice harmonization of the melody. The top three voices form a MAJOR triad and the bottom three voices form another MAJOR triad. The roots should differ by some consistent interval. For octatonic sounds choose either minor third (e.g. CM/E♭M or CM/AM) or tritone (e.g. CM/F♯M). For diatonic sounds choose a whole tone (e.g. CM/B♭M or CM/DM) or perfect fourth (e.g. CM/FM or CM/GM). Provide analysis and explain your choices.

Upper: A♭ B♭ C♭ G E♭ G♭ F E

Lower: B♭ ∅ ∅ A F A♭ G G♭

Lower: G♭ A♭ A F ∅ E E♭ ∅

I didn't really know where to start so I did parallel 6/4 chords in the upper voices, then I wrote down the possibilities for left-hand chords. To make choices I tried to reuse chords whenever possible, giving a voice exchange at the beginning, the double voice exchange at the end, and the held over chords in the middle.

Example 4: Poly-triadic harmonization of Melody 1.

Ex. 4 provides a sample sound experiment assignment with a typical student solution. The solution adheres to the given directions, contains no technical errors, and includes additional interesting features such as the voice exchanges and held over chords. Further, it provides clear harmonic analysis and gives a reasonable account of compositional process.¹⁰ As graded assignments are returned, I direct classroom vocal performance of several such answers to engrain the poly-triadic diatonic/octatonic sounds into students' aural memories. I also point out additional (positive) features not mentioned by the student description. In this case for example, the lower voices emphasize 6/4 spacing, although not quite as extensively as the upper ones do, and the bass voice moves primarily in descending stepwise motion, which when chromatic at C♯–C–B foreshadows the end of the given soprano line. Further, each six-note chord articulates

¹⁰ The short prose explanations help students learn to explain musical concepts and teachers to better evaluate student work. For an extensive discussion of the role of prose writing in music theory curricula consult Bruce C. Kelley, "Part-Writing, Prose Writing: An Investigation of Writing-to-Learn in the Music Theory Class," *Journal of Music Theory Pedagogy* 13 (1999): 65-88.

an incomplete diatonic collection; for example, major triads on A $\flat$ and B $\flat$ combine to articulate an incomplete E-flat major collection. The resulting series of collections is E $\flat$ -E $\flat$ -E-D-C-B $\flat$ -B-B $\flat$ -B, or if duplications are removed, E $\flat$ -E-D-C-B $\flat$ -B, which is remarkable for its symmetrical layout of ascending minor seconds (beginning and end) and descending major seconds (middle).

Such discussions inspire continued excellence in various ways. Students gain an increased sense of how many four-voice issues can be invoked simultaneously. They learn about pre-compositional planning vs. on-the-fly intuitive decisions, strict vs. flexible application of self-imposed rules, and composer intent vs. post-compositional analytic perspective. Particularly illuminating are moments when extraordinary relations are uncovered that the composer did not realize, facilitating discussions of how various theoretical concepts relate to composer intuition. Finally, nothing fuels students' creative fires more than seeing their professor treat the solutions with the same analytic respect that s/he does the works of Bartok, Debussy, and others.

It is also useful to improvise on such models in order to suggest how students can transform these exercises into music. Example 5 provides realizations of the homophonic model found in Ex. 4. In (a) and (b), consistency in chordal texture and register make the relationship of model and realization straightforward. In (c) chordal arpeggios effect a sweeping registral ascent and in (d) there is a salient change from melody-and-accompaniment to note-against-note texture, as well as some octave transfer, note omission, and triadic misalignment.¹¹

Overall, students create, play and describe their own poly-triadic experiment, sing and ponder several others, and hear improvisations in a variety of musical textures. This experience equips students to understand relevant excerpts from the twentieth-century repertoire in the same way that four-voice writing, keyboard harmony and aural skills exercises dealing with common-practice harmony facilitate the analysis of tonal music. It is therefore natural to

¹¹ Ironically, despite the obvious compositional implications of the sound experiments, I have found it helpful to emphasize, especially at first, that the experiments produce harmonic models, *not actual music*. On a basic, somewhat humorous level this wins over students who are skeptical of dissonant harmonic materials, but more seriously it also helps to alleviate the musical paralysis that grips some students when they are asked to "compose music." Moreover, this attitude towards the exercises discourages shallow and subjective evaluation of the results. It is irrelevant whether or not a student "likes" the sounds or not (although they often do, at least eventually); instead we value accuracy, clarity, clever pre-compositional manipulations, intuitive idiosyncratic touches, the balancing of multiple compositional considerations—in short, effort.

(a) *Leggiero*

(b) *Eclatant*

(c) *Scherzando*

(d) *Andante espressivo*

Example 5: Sample musical realizations of Ex. 4.

pair this sound experiment with analysis of existing poly-triadic passages, a plentiful supply of which is provided by extant texts and anthologies. For example, Burkhart's *Anthology for Musical Analysis* includes the second movement of William Schuman's *Three Score Set* (1943), which has a straightforward chord-against-chord texture, Stravinsky's *Le Sacre du Printemps* (1911-12) (Introduction to Part II), where the chordal strata move at different rates, and Ives's "General William Booth Enters into Heaven;" Kostka's text provides a passage from Persichetti's *Little Piano Book*, as well as two short Stravinsky excerpts (from *Petrushka* and *The Rake's Progress*) that feature triadic arpeggiation; and Persichetti suggests further passages, including several by composers whose works are studied less often in such courses (Peter Racine Fricker, Roy Harris, Arthur Honegger, and Albert Roussel).¹²

(a) Complete the following chart by spelling all twelve minor seventh chords, arranged so that tritone-related ones are vertically aligned:

C E $\flat$ G B $\flat$	C $\sharp$ E G $\sharp$ B	D F A C	E $\flat$ G $\flat$ B $\flat$ D $\flat$	E G B D	F A $\flat$ C $\flat$ E $\flat$
F $\sharp$ A C $\sharp$ E	G B $\flat$ D F	G $\sharp$ B $\sharp$ D $\sharp$ F $\sharp$	A C E G	B $\flat$ D $\flat$ F A $\flat$	B $\sharp$ D $\sharp$ F $\sharp$ A $\sharp$

(b) Tritone-related minor seventh chords combine to form what collection type? octatonic

(c) Harmonize the following melody in four voices with tritone-related minor seventh chords. Consult the chart in (a) for possibilities. For example, start by looking in the chart for a vertically-aligned chord pair with C in one chord and D in the other. Consider voice-leading carefully. Provide analysis and explain your choices.

P_{C(1-4)} P_{C(5-8)}
 RP_{F $\sharp$ (4-1)} RI_{D(4-1)}
 I_{A $\flat$ (1-4)} I_{B(5-8)}
 m7: F B F B E B $\flat$ B F

Example 6: Tritone-related minor seventh chords.

¹² See Charles Burkhart, *Anthology for Musical Analysis*, 6th ed. (New York: Schirmer, 2004): 440, 458–60 and 514; Kostka, *Materials and Techniques*: 66–69; and Persichetti, *Twentieth-Century Harmony*: 150. Indeed, these books are useful sources of material for many of the topics mentioned in this paper.

The exercise in Ex. 6 leads the student step-by-step to a harmonization saturated with tritone-related minor seventh chords. The student spells all twelve minor seventh chords organized into tritone-related pairs, notes the resulting octatonicism, and receives directions on how to use the chart to harmonize the melody.¹³ Sometimes the pre-compositional plan is sufficient to “make” a choice; for example, only Fm7–Bm7 can harmonize C–D and E♭–B. (The use of its retrograde, Bm7–Fm7 to harmonize A–A♭ creates clear harmonic closure.) At other times the plan does not completely restrict choice, as with G–B♭, which has two possible harmonizations, Em7–B♭m7 and Am7–E♭m7.

But once again the solution goes beyond the minimum requirements, this time in the motivic realm, as shown by the numerous melodic fragments labeled on the score. Given the strict harmonic framework, it might seem that tremendous pre-compositional planning would be required to create the simultaneously unfolding set of P/RP/RI/I-related fragments at the beginning of the passage, but in this case it is mostly luck. If one sets out humbly attempting to create a bass line that is inversionally symmetrical with the soprano, the alto and tenor’s motivic connections arise automatically by using the smoothest voice leading possible with the remaining chord tones.

The next exercise explores dominant seventh chords with octatonic extensions (♭9, #9, #11, 13).¹⁴ Like the previous example, this one requires students to create a preliminary chart (Ex. 7). But this time students are *not* told how to choose chords from the chart; they are simply urged to “give careful thought to the bass line,” a deliberately vague direction that leaves innumerable possibilities. Although students are asked for only two solutions, the example provides ten, demonstrating various ways to organize the bass line.

¹³ Here and below, examples do not include student’s prose explanations; instead salient points from these explanations are incorporated into the text of the article..

¹⁴ ♭9, #9, #11, and 13 are called octatonic extensions because a dominant seventh chord with all of these extensions forms an octatonic collection. For example, B7 (B–D♯–F♯–A) and its octatonic extensions (C, D, E♯, G♯) combine to form B–C–D–D♯–E♯–F♯–G♯–A. A thorough understanding of the collectional embeddings of various extended tertian chords is essential for analysis, not only of jazz, but also of the music of Debussy, Scriabin and many others.

(a) Complete TWO four-voice harmonizations of the given soprano, in which the lower three voices state dominant seventh chords (omit the fifth), and the soprano voice is one of the "octatonic" extensions ($\flat 9$, $\sharp 9$, $\sharp 11$, or 13). First, complete the chart below to see which chords can harmonize each soprano note. (For example, if the first soprano note C is a $\flat 9$ then the chord is B7, if C is $\sharp 9$ then the chord is A7, etc.).

Soprano:	C	D	E $\flat$	B	G	B $\flat$	A	A $\flat$
$\flat 9$:	B7	C $\sharp$ 7	D7	B $\flat$ 7	F $\sharp$ 7	A7	A $\flat$ 7	G7
$\sharp 9$:	A7	B7	C7	A $\flat$ 7	E7	G7	F $\sharp$ 7	F7
$\sharp 11$:	F $\sharp$ 7	A $\flat$ 7	A7	F7	D $\flat$ 7	E7	E $\flat$ 7	D7
13:	E $\flat$ 7	F7	F $\sharp$ 7	D7	B $\flat$ 7	D $\flat$ 7	C7	B7

(b) Now complete your harmonizations, giving careful thought to the bass line. Provide analysis and explain your choices.

1. Root motion by descending fifth

13 $\flat 9$ $\sharp 11$ $\sharp 9$ $\sharp 11$ $\sharp 9$ $\sharp 9$ $\sharp 9$ 13
 Eb7 Ab7 C7 F7 Eb7 Ab7 F#7 B7

2. Root motion by tritone

$\flat 9$ 13 $\flat 9$ $\sharp 9$ 13 $\sharp 11$ $\flat 9$ $\sharp 11$
 B $\flat$ 7 F $\flat$ 7 D $\sharp$ 7 A $\flat$ 7 B $\flat$ 7 E $\sharp$ 7 A $\flat$ 7 D $\sharp$ 7

3. Root motion by major second

13 $\flat 9$ $\sharp 9$ 13 $\flat 9$ $\sharp 11$ $\sharp 11$ $\sharp 9$
 Eb7 D $\sharp$ 7 C $\sharp$ 7 D $\sharp$ 7 F $\sharp$ 7 E $\sharp$ 7 E $\sharp$ 7 F $\sharp$ 7

4. Descending bass, primarily stepwise

$\flat 9$ $\sharp 11$ 13 $\sharp 11$ $\sharp 11$ 13 13 13
 B $\flat$ 7 A $\flat$ 7 G $\flat$ 7 F $\sharp$ 7 D $\sharp$ 7 B $\flat$ 7 C $\sharp$ 7 B7

Example 7: Dominant sevenths with $\flat 9$, $\sharp 9$, $\sharp 11$, 13 extensions.

5. Each measure is octatonic

Chord symbols: $\flat 9$ B7, 13 F7, $\flat 9$ D7, $\flat 9$ B $\flat$ 7, $\sharp 9$ E7, $\flat 9$ A7, $\sharp 11$ E $\flat$ 7, 13 C7, $\sharp 9$ F7, 13 B7

6. Root motion that alternates ascending minor thirds and descending major thirds

Chord symbols: $\flat 9$ B7, $\sharp 9$ D7, $\flat 9$ B $\flat$ 7, 13 C $\sharp$ 7, 13 A7, $\flat 9$ C7, $\sharp 9$ A $\flat$ 7, 13 B7

7. Bass moves exclusively in minor seconds

Chord symbols: $\sharp 9$ A7, $\sharp 11$ A $\flat$ 7, $\sharp 11$ A7, $\sharp 9$ A $\flat$ 7, $\sharp 11$ F7, $\sharp 9$ E7, $\sharp 9$ G7, $\sharp 9$ F $\sharp$ 7, $\sharp 11$ E $\flat$ 7, $\sharp 11$ D7

Interval: $\downarrow M2$

8. Pedal bass

Chord symbols: $\sharp 11$ F $\sharp$ 7, $\sharp 11$ A $\flat$ 7, 13 F $\sharp$ 7, $\sharp 9$ A $\flat$ 7, $\flat 9$ F $\sharp$ 7, $\flat 9$ A $\flat$ 7, $\flat 9$ F $\sharp$ 7, $\sharp 11$ A $\flat$ 7 = D7, $\sharp 11$ F $\sharp$ 7, $\sharp 9$ A7, $\sharp 9$ C $\sharp$ 7, $\sharp 9$ C7, $\flat 9$ B $\flat$ 7, $\flat 9$ F $\sharp$ 7

9. Bass articulates $r_4 RP_{B\flat}$

Chord symbols: $\sharp 9$ A7, $\sharp 9$ C $\sharp$ 7, $\sharp 9$ C7, $\flat 9$ B $\flat$ 7, $\flat 9$ F $\sharp$ 7

10. Bass articulates $r_2 RP_A$

Chord symbols: $\sharp 9$ G7, $\flat 9$ A $\flat$ 7, $\sharp 9$ F7, $\flat 9$ B7, $\sharp 9$ A7, $\sharp 11$ F7, $\sharp 11$ F $\sharp$ 7, $\sharp 9$ G7, $\sharp 9$ E7, $\sharp 11$ A $\flat$ 7, $\flat 9$ C7, 13 B7

Example 7 continued

Solutions 1–4 each focus on a single interval, but vary with respect to interval type. Solution 1 focuses on the “descending perfect fifth,” a directed specific interval, while 3 highlights the “major second,” an *undirected* specific interval. Solution 4 articulates “descending” contour intervals, with particular emphasis on the “descending step,” a directed generic interval. In solutions 1–3, each of four chord-pairs articulates the featured interval, while 4 contains a complete string of “descending” contour intervals. Such solutions are easy to construct using the chart developed in part (a).

But each of these solutions also has other interesting features. In solution 2 all but the fifth and sixth chords belong to a single octatonic collection. Solution 3’s bass line divides into transpositionally related halves, E^b-D^b-C-D and $F^\sharp-E-E^b-F$. In solution 4, although the musical surface does not articulate a particularly clear pattern, the underlying root progression $B-A^b-G^b-F-D^b-C-B$ alternates perfect fourths and minor seconds, travelling an octave overall. In this interpretation the A^b and D^b chords are viewed as “passing,” which is sensible given their weak metric positions.

Solutions 5 and 6 each focus on a *pair* of intervals. In solution 5 each measure is limited to a single octatonic collection and so there is root motion by tritone and minor third perforce. Moreover, the bass in the third measure is motivically parallel to that of the first measure, and the ending $F-B$ creates closure by reversing the opening $B-F$. In solution 6, root motion alternates ascending minor thirds and descending major thirds. The progression begins and ends on B and the harmonic rhythm accelerates then decelerates. While it may seem unlikely that a student would come up with such an answer, it is not far fetched. For example, if one sets out with the modest goal of holding a common root note wherever possible, four possibilities arise directly from the chart in Ex. 7(a): $B7$ harmonizes $C-D$, $D7$ harmonizes E^b-B , B^b7 harmonizes $B-G$, and $C^\sharp7$ harmonizes $G-B^b$. This leads to the harmonization of the first six melodic notes with $B7-D7-B^b7-C^\sharp7$. The recurrence of the ascending minor third at $B-D$ and $B^b-C^\sharp$ is mere coincidence, but if the pattern is noticed, it can be continued to yield the given harmonization. The appearance of $B7$ at both beginning and end, and the accelerating-then-decelerating harmonic rhythm are purely accidental. The solution is elegant because of the intervallic pattern but quirky because the accompanying chords never proceed at the same rate as the soprano melody.

The foregoing solutions use only root position chords, but solutions 7 and 8 include some chordal inversion in order to facilitate consistent bass lines. The bass in solution 7 moves exclusively by half-step and in a constant quarter-note rhythm. Additional traits include the repetition of A7–A^b7, the sequential repetition of a four-beat pattern down by step, the exclusive use of *root* motion by minor second and minor third, and only two types of extensions, #9 and #11. In solution 8 a static bass line underpins F#7/A^b7 oscillation. Further, except for the tenor voice G, the entire alto, tenor and bass lines belong to a single whole-tone collection. In order to accomplish this the sixth chord places ^b9 in the *tenor* voice and the final chord #11 in the *alto*, thereby breaking the rule of having the octatonic extensions in the soprano. But this seems a small price to pay for such an extraordinary harmonization—a static bass line and only two different harmonies! Besides, the tenor ^b9 arises smoothly through a voice exchange and the final chord is enharmonically equivalent to D7(#11), an interpretation that *does* place the #11 extension in the soprano.¹⁵

Instead of creating recurring bass patterns as the first eight solutions do, 9 and 10 place transformed versions of the given soprano in the bass, $r_4RP_{B^b}$ and r_2RP_A respectively. Solutions such as these can be extracted from the chart in part (a) through simple trial and error, although the amount of work required is admittedly more than most students would choose to undertake. Nonetheless, such advanced solutions can be presented to students as a way of inspiring effort in subsequent assignments. Solution 9 is particularly amazing because it uses only two types of extensions, ^b9 and #9, arranged into a precise palindrome!

¹⁵ Students are encouraged to break rules only when necessary to include some extraordinary relationship.

Provide TWO five-voice pentatonic harmonizations of the given melody. (You will find it helpful to draw a circle of perfect fifths to outline the possibilities because each pentatonic collection is composed of five consecutive notes on the circle.) The harmonizations should contrast with each other in some way. Provide analysis and explain your choices.

(a) Minimum common tones

Pentatonic: A^b (p5ths) G A^b A B^b G^b C G^b (add6,9)

(b) Many common tones within measures

Pentatonic: B^b (add6,9) E^b D G B^b F B (add6,9)

Example 8: Pentatonic settings.

Ex. 8 provides two pentatonic harmonizations that are sensitive to the number of pitch classes shared by adjacent pentatonic chords. In (a), adjacent chords share *no* common pitch classes, except for the sharing of B^b by the B^b and G^b collections. In (b), pentatonic chords within the same measure share *four* common pitch classes, but chords separated by a bar line share *zero* or *two*, which creates clear and strong harmonic change at the beginning of each measure. Solution (a) is also notable because the alto voice is a strict r_4RT6 transformation of the soprano voice. Extraordinarily enough, the alto and soprano voices are invariably either a perfect fourth or a perfect fifth apart. Although chord spacing is not strictly systematic, the first and last chords of each harmonization create harmonic stability by placing their referential pitch class in the bass voice. Solution (a) begins with a stacked-fifth chord on A^b , while the others suggest a tertian interpretation—root position major triad with added sixth and ninth.

SOUND EXPERIMENTS: THE USE OF FOUR-VOICE WRITING

You will be creating harmonizations saturated with [016]. It will be helpful to have a list of all of the possible [016] to use as a reference, so complete the following chart:

[016] [↑] : C C [♯] F [♯]	C [♯] D G	D E [♭] A [♭]	D [♯] E A	E F B [♭]	F F [♯] B
F [♯] G C	G G [♯] C [♯]	G [♯] A D	A B [♭] E	A [♯] B E	B C F
[016] [↓] : C B F [♯]	C [♯] C G	D C [♯] G [♯]	E [♭] D A	E E [♭] B [♭]	F E B
G [♭] F C	G F [♯] C [♭]	A [♭] G D	A G [♯] D [♯]	B [♭] A E	B B [♭] F

(a) Add an alto and bass line to the given soprano so that each chord is a [016][↑] or [016][↓]. As shown on the chart, there are six possible chords for each soprano note. The bass line should move primarily by descending step. Provide analysis and explain other features of the setting.

complementary hexachords produce the aggregate

[016][↑]: C B, D A, E G, F F[♯], G A, A B, B C, C D
 [016][↓]: F C, E D, D C, C B, B A, A G, G F, F E

palindrome T11 T9 T9 T11 T11

(b) Provide a six-voice harmonization in which the upper three voices form [016], as do the lower three. The upper and lower [016] share no pitch classes. Provide analysis and explain chord choice, chord spacing, and bass line.

Upper[016][↑]: C, D, A, B, F[♯], E, A, A[♭]
 Lower[016][↓]: B, C[♯], A[♭], B[♭], F, E[♭], A[♭], G

T2 T7 T2 T7 T10 T5 T11

(c) Add an alto and bass line to the given soprano so that each chord is a [016][↑] or [016][↓]. Provide analysis and explain other aspects of the setting.

[016][↑]: C C[♯], D E[♭], E F, F G, G A, A B, B C
 [016][↓]: C C[♯], D E[♭], E F, F G, G A, A B, B C

T2 T2 T2 T10 T10 T10 T10

Example 9: [016].

Creating a smooth transition from extended tonal to atonal materials, we move directly to [016] harmonizations of Melody 1. Referential charts such as those found in Ex. 9 are crucial because students are initially less adept at spelling set types and because such charts facilitate the consideration of various possibilities; for example, it is helpful to have at hand all six [016]s that can harmonize a given soprano note.

Solution (a) is particularly elegant because the bass line is *completely* stepwise, beginning and ending with $F-E\flat-D$, $I_{F(1-3)}$. The bass keeps quarter-note motion going throughout, and even includes a pair of eighths that leads smoothly to the return of $F-E\flat-D$. As a bonus, the alto line also emphasizes descending stepwise motion and ends with $RP_{D\flat(3-1)}$.

Compelling harmonic relations complement these melodic associations.¹⁶ The passage begins with the palindromic nesting of $[016]\downarrow_{E\flat}$ and $[016]\uparrow_B$. Taken as a unit, these trichords articulate $[023568]\uparrow_{A'}$ which is followed by its literal pc complement, thereby completing the aggregate just in time for the return of $F-E\flat-D$. (Only the sustained soprano B even slightly obscures the clear hexachordal division of the aggregate.) $[023568]$ is also the only hexachordal set type that is a subset of both the octatonic and acoustic collections, which is of particular interest because the bass line in its entirety articulates an $A\flat$ acoustic collection ($A\flat-B\flat-C-D-E\flat-F-G\flat$)¹⁷ and T9-related [016]s create octatonic subsets near the end of the passage. There is also some uniformity with regard to chord progression: the palindrome T11–T9–T9–T11, an additional T11, and two places where inversionally-related [016]s with the same starting point are contiguous ($\uparrow_G-\downarrow_G$ and $\uparrow_{E\flat}-\downarrow_{E\flat}$). Extraordinary here is the juxtaposition of disparate interpretation types: simple stepwise motion alongside the erudite notion of pitch-class complementation, and extended tonal interpretations alongside atonal ones.

Solution (b) demonstrates consistency in the use of [016] within each chord, in the progression from one chord to the next, within the bass line, and concerning outer-voice intervals. In each chord the women's voices articulate $[016]\uparrow$ and the men's $[016]\downarrow$. With

¹⁶ For the sake of clarity these solutions use a labeling shorthand in which the prime form—which is the same for each set—appears only at the beginning of the line.

¹⁷ Since each acoustic scale is a “mode” of some ascending melodic minor scale, and since this bass line articulates no clear tonal center, the bass pitch classes could also be characterized as an $E\flat$ ascending melodic minor collection ($E\flat-F-G\flat-A\flat-B\flat-C-D$).

only one exception the $[016]\uparrow$ s span less than an octave and the $[016]\downarrow$ s span more than an octave. The starting point for each $[016]\uparrow$ is consistently one half step higher than that of the accompanying $[016]\downarrow$, as for instance with the opening chord's $[016]\uparrow_c$ and $[016]\downarrow_{B^b}$, so that each six-note chord articulates the same set type, $[012378]$. Given the non-sequential nature of the given soprano line, it is remarkable that the passage includes a recurring pattern of transpositions: alternation between T2 and T7, followed by their complements T10 and T5. The bass line divides neatly in half, with $F-G-A^b-A$ being answered by its inversion $F-E^b-D-D^b$. This bass line also creates a limited set of intervals with the given soprano voice, compound major ninths in m. 2 and compound perfect fifths elsewhere.

In solution (c) a series of $[016]\uparrow$ articulates T2–T2 and a later series of $[016]\downarrow$ articulates the complementary T10–T10.¹⁸ Although the concluding $[012]$ contravenes the directions for the assignment, it makes sense for many interesting reasons. First, the $[012]$'s bass G^b_4 extends the chromatic descent initiated in the soprano voice's $B^b_4-A_4-A^b_4$ and continued by the alto's G_4 . Second, not only does the concluding D^b-G^b create a quasi-cadential dominant-to-tonic bass motion, but it also reinforces salient bass pitch classes—the bass line's opening $F^\sharp$, the T7I-related melodic fragments that end on $F^\sharp$ and D^b respectively, and the D^b major triad arpeggio.

(a) T10/T2 model (b) With rhythm of passage (c) With pitch layout of passage

The image displays three musical staves labeled (a), (b), and (c). Staff (a) shows a sequence of chords: T10, T10, T10 in the soprano line and T2, T2, T2 in the bass line. Staff (b) shows the same chords with the rhythm of the passage. Staff (c) shows the same chords with the pitch layout of the passage.

Example 10: Hearing the T2 and T10 series in Ex. 9(c).

¹⁸ There are other instances of $[016]$ in the passage but they do not significantly disrupt the T2 and T10 series. One occurs at the beginning (before the T2 series) and the others appear in metrically weak positions, the quarter-note triplet in m. 2, and the eighth-note offbeat at the beginning of m. 3.

You will be creating harmonizations saturated with [0147]. It will be helpful to have a list of all of the possible [0147]s to use as a reference, so complete the following chart:

[0147]↑:	C	C♯	E	G	C♯	D	E♯	G♯	D	E♭	F♯	A	E♭	E	G	B♭	E	F	G♯	B	F	F♯	A	C	
	F♯	G	A♯	C♯	G	G♯	B	D	A♭	A	C	E♭	A	B♭	C	E	B♭	B	D	F	B	C	D♯	F♯	
[0147]↓:	C	B	A♭	F	C♯	C	A	F♯	D	C♯	B♭	G	D♯	D	B	G♯	E	D♯	C	A	F	E	D	B♭	
	F♯	F	D	B	G♯	G	F	E♭	C	G♯	G	E	C♯	A	G♯	F	D	B♭	A	G♯	E♭	B	B♭	G	E

Complete in four voices. (1) The bass line should articulate an I, RP, or RI form; use a mixture of quarter and half notes so that interval class 2 does not appear between soprano and bass. If ic 2 is a continuing problem, pick a different row form. (2) Complete the inner voices so that each chord is [0147]. This is guaranteed to be possible because [0147] includes every interval class except 2. Complete THREE such harmonizations, limiting yourself to either ↑ OR ↓ forms of [0147] within each harmonization. Provide analysis and explain other aspects of your setting.

(a)

[0147]↓: C Eb F# D A

[0147]↑:

(b)

octatonic octatonic octatonic

[0147]↑: Ab D Ab Bb G G Bb Ab D Ab

[0147]↓:

(c)

[0147]↑: C C# D B C A Ab G E

[0147]↓:

Example 11: [0147].

Further, the final G^b helps to create $[016]\downarrow_{G'}$, which extends the T10 series. In fact the last measure extends both the T2 *and* T10 series, so that each travels T6 overall. There is a sense of completion to each series and a clear relationship between them because each begins and ends with a $[016]$ that includes the $\{C\sharp G\}$ dyad. Ex. 10(a) represents the T2 and T10 series in note-against-note fashion with consistent inversionally-symmetric pitch-space layouts. Parts (b) and (c) alter the rhythm and spatial layout of this model to conform to the actual passage. A performance of this example followed by the passage can help some students to understand, hear, and even embrace the interpretation because it connects the model in 10(a), where T2 and T10 are very easy to hear, to the actual passage, where the transformations are more subtly articulated.

The settings in Ex. 11 require that each note be harmonized with $[0147]$ and that a transformation of the melody be present in the bass. Of further note in solution (a) are three soprano-bass voice exchanges, a set of $[0147]\downarrow$ whose starting points project $[0147]$ and smooth alto and tenor voices. Solution (b) articulates a palindromic set structure that goes hand in hand with the RT0-related pairs of voices (sop/bass, alto/tenor). Further melodic and harmonic coherence is provided by repeated use of $[0147]\uparrow_{A'}$, octatonicism, inner-voice minor thirds, and quartets of pitches that state $[0147]$ or $[0258]$, which, due to the palindrome, also appear in the second half of the passage.

Solution (c) is notable for its motivic saturation. Outer voices state P_C and RP_F and inner ones project motivic fragments. The tenor line's $P_{B^b(4-7)}$ forms a fleeting canon with the soprano line, and the final six alto pitches interlock $I_{C\sharp(5-7)}$ and $I_{B(5-7)'}^b$ one articulated by half notes and the other by quarters. It is also possible to hear $I_{C\sharp(5-7)}$ and $I_{B(5-7)}$ as a unit, a series of $[02]$ dyads, $\{E\sharp\}-\{D^bE^b\}-\{DE\}$, that articulates T9–T1. T9 and T1 also figure prominently in the transformation of one $[0147]\uparrow$ into the next. The chain T1–T9–T1–T9 signals overlapping $RP_{(5-7)}$ and $I_{(5-7)}$ references, and T1–T1 and its complementary T11–T11 allude to order positions 6–8. All told, the main motive pervades each voice independently as well as the four-voice texture as a whole.

Overall, these [016] and [0147] exercises can be linked pedagogically to a study of repertoire excerpts that contain consecutive instances of a single set type. A prime example is the thirteen-chord series of [0146]s in Carter's *First String Quartet*, which the composer himself highlights in his lecture "Shop Talk by an American Composer."¹⁹ Since most atonal passages include more than one set type some sound experiments should too. For example, one could instruct students to create progressions involving *two* trichord types of their choosing (excluding [036], [037] and [048]) and then create an *ad hoc* dictation activity based on exemplary solutions. Play each progression twice, asking the class first to identify the two set types used and then to aurally distinguish between these set types, chord by chord. Another possibility is to study the supersets of [016] by creating four-voice harmonizations in which the lower three notes of each chord cooperate to articulate [016] without duplicating the chord's soprano pitch class. Within these constraints, nine tetrachordal set types are possible. For a more limited tetrachordal repertoire study only set types that also contain [012] ([0126] and [0127]), that contain at least two [016]s ([0127], [0156], and [0167]), or that are also octatonic subsets ([0136], [0137], [0146], [0147], [0167]). In general, the loosening of harmonic restrictions should be coupled with a tightening of melodic ones such as by requiring that melodic motion be limited to one or two intervals.

As malleable as Melody 1 has proven to be, it is unhelpful when a clear tonal/modal center is needed. Ex. 12 and 13 include harmonizations of Melody 2, a G Dorian tune. Ex. 12(a) is triadic, with authentic and plagal embellishments of tonic and a standard IV–v–i cadence. In 12(b) a series of lower-voice perfect fifths articulates loose inversive symmetry with the soprano melody and then an inexact motivic parallelism. When reckoned in conjunction with the melody, these fifths create three types of sonorities: open fifths (on the tonic and dominant scale degrees), incomplete seventh chords, and three-note quintal chords.

While most solutions treat harmony quite systematically, solution (c) is primarily focused on *melodic* concerns. X_D and Y_C from the given

¹⁹ See Elliott Carter, "Shop Talk by an American Composer," in Jonathan W. Bernard, ed., *Elliott Carter: Collected Essays and Lectures, 1937-1995* (Rochester, NY: University of Rochester Press, 1997): 214-224. The excerpt, m. 477 from the third movement, appears on page 220. For other passages that feature a single set type consult Carter's "Dolphins" from *In Sleep, In Thunder*. mm. 32 and 56 feature series of [0147] and mm. 53-55 a series of [01235689], the complement of [0147]. See also the series of [014] at the opening of the third of Webern's *Five Movements for String Quartet*, op. 5.

(a) Primary triads

g dorian: i v i i IV i IV v i

(b) Lower voices in parallel perfect fifths

same

$W_{G/D}$ (loose symmetry with sop) $W_{B\sharp/F}$ (altered to conclude on tonic)

Open fifths: i i v v i
 Inc 7th chords: VII7 7 ii7 IV7 III7 VII7
 Quintal: * * * *

(c) Saturation of all voices with soprano's melodic material

X_D X_G X_E X_D Y_C $Z_{B\sharp}$ RZ_G Y_C

Harmonic Outline: i IV7 v 4-3 i6 VII7 v6 III7 IV i

Example 12: Dorian settings of Melody 2.

soprano appear in other voices, transposed and/or rhythmically transformed. The alto voice is saturated with X_D - X_G - X_E - X_D , while tenor and bass each articulate Y_C . $Z_{B\sharp}$ and RZ_G , pitch and rhythmic retrogrades of one another, create coherence within the tenor line. Harmonically, an underlying foundation of primary triads (i, IV, and v) is ornamented both by secondary seventh chords (VII7 and III7) and by other diatonic dissonance, which is only sometimes resolved in a conventional manner.

(a) G and F dorian

F dorian: $\overset{9}{i7}$ $VII7$ $\overset{\sharp 11}{III7}$ $\overset{\flat 13}{ii7}$ $i7$ $\overset{13}{11}$ $\overset{\sharp 11}{VII7}$ $\overset{9}{i7}$

(b) G dorian and B mixolydian

B mixolydian: I VII I VII I vi v ii I ii VII I

Root motion by Maj 2nd: $\underbrace{\quad\quad\quad}$ $\underbrace{\quad\quad\quad}$ $\underbrace{\quad\quad\quad}$ $\underbrace{\quad\quad\quad}$

Combined sonority:

AugMaj 7th: * * *

MinMaj 7th: *

Major 7th: * *

M/m triad: * *

Triad w/ $\flat 9$: *

Example 13: Bi-modal settings of Melody 2.

Ex. 13 provides bi-modal harmonizations of Melody 2. In solution (a) the lower voices move in parallel seventh chords drawn from F Dorian. Since the G and F Dorian scales share five common tones it is not surprising that the soprano notes often fit into the accompanimental harmonies or form only mild dissonances (e.g. G–B $\flat$ within E $\flat$ M7 and G that forms a ninth above Fm7). In solution (b), the B Mixolydian accompaniment contains several whole-step root progressions: I–VII–I, vi–v, and ii–I–ii. Since the G Dorian and B Mixolydian modes share only two common tones—the minimum for a pair of diatonic collections—the result is predictably dissonant. Moreover, each soprano note is in a half-step relationship with one of the notes in the triad that accompanies it, creating dissonant sonorities such as augmented-major seventh chords (e.g. G–B–D $\sharp$ –F $\sharp$), superimposed major and minor triads (e.g. B–D–D $\sharp$ –F $\sharp$), and triads with added $\flat 9$ (e.g. A–C $\sharp$ –E–B $\flat$).²⁰

²⁰ For a particularly impressive source of modal and poly-modal excerpts, see Persichetti, *Twentieth-Century Harmony*: 41–3, which suggests more than fifty passages from the works of more than thirty different composers.

MORE FREEDOM

By completing such tightly-controlled musical experiments students learn to manipulate harmonic materials, to balance harmonic and melodic/motivic issues simultaneously, to create pre-compositional plans, to make *ad hoc* decisions on the fly, and to explore the implications of their own musical ideas. Equipped with these vital skills, students are ready for assignments that allow them freer reign. Ex. 14 provides one such composition assignment, which I use near the end of the study of extended tonal music after

Provide a four-voice vocal setting of ONE of the following excerpts from *The Little Zen Companion*:

- a. We are more curious about the meaning of dreams than about things we see when awake.—Diogenes
- b. This magnificent butterfly finds a little heap of dirt and sits still on it; but man will never on his heap of mud keep still...—Joseph Conrad
- c. Thus shall ye think of all this fleeting world:
A star at dawn, a bubble in a stream;
A flash of lightning in a summer cloud,
A flickering lamp, a phantom, and a dream.
—The Buddha

Include dynamics, phrasing, rests, tempo indication, etc. You may repeat text, especially if the text is very short. Provide some accompanying prose that explains salient harmonic, melodic, and motivic features of your piece.

You may use Hindemith's "A Swan" as a model—harmony that focuses on quintal chords and other pentatonic subsets, open fifths or major triads at phrase beginnings and endings, adjacent chords that usually belong to the same diatonic collection, primarily homophonic texture (perhaps with an imitative section), and a clever musical mirroring of the text's main idea. But use this song as a model only to the extent that it helps you. You are free to incorporate other harmonic materials and features that we have studied, *as long as the result is a unified and coherent composition*.

Example 14: Composition Assignment.

Example 15: Student response to Assignment 14.

Example 15: Student response to Assignment 14.

ten experiments including the ones in Examples 4, 6, 7, 8 and 12 above. Students are encouraged to use Hindemith's "A Swan" as a model *only* to the extent that it helps them create a good piece of their own—this is a composition assignment, not a style-emulation exercise. Examples 15–17 provide excerpts from student responses. Example 15, a quintal harmonization of an octatonic soprano, is notable for its lack of adjacently repeated pitches. The middle of the excerpt alternates transposition by descending major third and tritone and the end features two trios of chords whose referential pitch classes form quintal sonorities, $F-B^b-E^b$ and $E-A-B$, thereby replicating the construction of each chord. The excerpt concludes with the chord progression $E^b-E-A-B$, an ordered summary of the first half's $E^b-E-C\#-A-E^b-B$.

Although the passage unfolds primarily in a quarter-note harmonic rhythm, there are several longer harmonies: the opening half-note harmony created by side-by-side E^b chords, the mid-phrase dotted quarters that emphasize beat two (also E -flat chords), and the whole-note "dreams" chord, whose arrival *on* the measure downbeat resolves the metric/rhythmic conflict created by the mid-phrase emphasis on beat two. There is also a sense of drive towards the final chord because the attack points of the longer harmonies articulate the series of durations 5–4–3 (measured in

quarters), a large-scale acceleration. The “dreams” chord is also remarkable because its upper note (F#5) marks a registral highpoint and completes the soprano voice’s octatonic collection, and because the chord is the work’s only deviation from *strict* quintal harmony, the “top” fifth being diminished instead of perfect (B–F#–C#–G). Perhaps most compelling, the sonority articulates [0157], the set type also projected by two quartets of chords at the end of the passage (B–F–B♭–E♭ and E♭–E–A–B).

mp

This mag - ni - fi - cent but - ter - fly finds a lit - tle heap of dirt.

mp

G: I(add 9) quintneigh I aug ii7(9) P6/4 ii6/5 V4-

Penta: * * * * *

soprano line repeats pitch classes of m.2 with contour of m. 3

(1)

This mag - ni - fi - cent but - ter - fly sits still on it.

I(add9) quintneigh I(add9) ii6 V 6-(5) I 9-8

* * * * *

Example 16: Student response to Ex. 14.

Ex. 16 owes a considerable debt to conventional tonal practice. The excerpt features a pair of four-measure phrases and a prevailing G major tonality rife with familiar progressions such as I–ii–V–I. Diatonic dissonances ornament this underlying structure, often creating chords that are pentatonic subsets. These dissonances are usually treated freely, as with the soprano B in m. 3, a chordal ninth

quintal

octatonic

p *mf*

mf

Thus shall ye think of all this

Thus shall ye think of all this

Thus shall ye think of all this

Thus shall ye think of all this

Quintal: E F# G E C Eb V7 of... F#m Am o7 F#m D#o7

diatonic

C acoustic (plus D)

pp *p* *mp* *mf*

flee - ting world: A star, a star at dawn

flee - ting world: A star, star at dawn

flee - ting world: A star at dawn

flee - ting world: star at dawn

Am Em fifths on G Daug Eo7 CM(add6)

Example 17: Student response to Ex. 14.

that is approached and left by leap. In a particularly ingenious touch, the quintal collection G–D–A occurs at the end of each phrase, first as an unresolved 4–3 suspension figure over dominant harmony and later creating a 9–8 appoggiatura figure over open-fifth tonic harmony. The passage’s chromatic tones are treated carefully, invariably resolving by half step to an adjacent diatonic note; consider for example each note of the quintal neighbor chord in m. 1. The augmented triad in m. 2, which is further ornamented by an appoggiatura F $\sharp$, contrasts with the prevailing quintal/pentatonic sonorities, but seems to arise sensibly nonetheless, at least partially because the alto voice’s chromatic D $\sharp$ has already appeared enharmonically as E $\flat$. Perhaps the nicest motivic moment occurs in m. 6, where the soprano line simultaneously refers to mm. 2 and 3.

Ex. 17 divides clearly into four sections: quintal, octatonic, diatonic, and acoustic. With such harmonic multiplicity, clever touches are needed to provide continuity. First, the quintal sonority in m. 3 morphs smoothly into C $\sharp$ 7, which then resolves as a dominant to F $\sharp$ m at the beginning of the octatonic section. Second, the transition from octatonic to diatonic is eased by the side-by-side statements of the progression F $\sharp$ m–Am, first within the octatonic section and then straddling the octatonic-diatonic boundary. (The latter F $\sharp$ m–Am is ornamented by an intervening weak-beat D $\sharp$ ⁷ harmony.) Further, the cadence at “world” recalls the chords on the downbeats of mm. 1 and 2, sharing most of the same pitches and all but one pitch class ({EBF $\sharp$ }-{GDAE} in mm. 1-2 vs. {EBG}-{GDAE} in mm. 7-8). At the end of the passage “at dawn” recalls “world” in a similar fashion ({EGB $\flat$ D}-{ACEG} vs. {EGB}-{GDAE}).

Moreover, a recurring motive connects these various sections. In the first two sections all voices but the tenor articulate parallel motivic statements. At first, the bass line’s P_E = E–F $\sharp$ –G–E, the alto’s P_{F $\sharp$} , and the soprano’s P_{B $\flat$} , which is ornamented by an opening C appoggiatura, create parallel quintal harmonies. (This straightforward parallel motion is complicated by the tenor voice, which only briefly moves in parallel motion with the other voices.) In the octatonic passage, RP_{C $\sharp$} , RP_{A $\flat$} , and RP_{F $\sharp$} unfold together, creating a triadic parallelism that is camouflaged by several factors. First, RP_{F $\sharp$} and RP_{A $\flat$} include “tonal” alterations to accommodate the prevailing octatonicism, so that for instance the upper voices unfold

in a mixture of major and augmented thirds. Second, each motivic statement is ornamented with an interpolated note, in the bass an arpeggio, and in the upper voices neighbor notes B $\sharp$ and B $\flat$, which together help to create a striking non-harmonic formation. Finally, the motives are occasionally offset rhythmically, as when the final note of RP $_{C\sharp}$ arrives before the final notes of RP $_A$ and RP $_{F\sharp}$. Once again, the tenor voice is left out of the motivic party; this time it shadows the soprano throughout the phrase, doubling it an octave lower on measure downbeats and diverging elsewhere. The bass's I $_C$, which reuses the pitches of the opening P $_E$, overlaps with the end of RP $_{F\sharp}$ and continues on into the diatonic section. In the acoustic section, the soprano and alto voices once again unfold in a mixture of major and augmented thirds, articulating P $_D$ and P $_{B\flat}$. Of more global interest, the soprano line's statement of P $_{B'}$, RP $_{C\sharp}$ and P $_D$ over the course of the entire passage provides a large-scale articulation of the first three notes of P $_{B'}$ B–C $\sharp$ –D!

STYLE EMULATION

In addition to branching out from the sound experiments in the direction of original choral composition, it is also possible to require strict conformance to the style of a particular composer or repertoire. I have tended to shy away from style emulation assignments in the third-year core curriculum music theory course that I teach because there is not enough time to do them well—only twenty-four classroom hours to “cover” the many and diverse musical styles of the twentieth-century repertoire. Nonetheless, if a teacher is so inclined, many exciting types of four-voice exercises are possible.

For example, the class could undertake a detailed study of multiple movements from Hindemith's *Six Chansons* (including “A Swan” mentioned in Ex. 14) to prepare for four-voice composition in that style.²¹ Ex. 18 provides three Hindemith-like settings of a poetic fragment from Rilke's *Vergers (Orchards)*, which is also the poetic source for the *Six Chansons*.²² Most chords are pentatonic

²¹ Thanks are due to the anonymous reader whose suggestions led to this avenue of investigation. I also appreciate the many other helpful comments made on earlier drafts of this paper, not only by the anonymous readers and editor, but also by my colleagues Ryan McClelland and William Marvin.

²² The text and translation are taken from *The Complete French Poems of Rainer Maria Rilke* (Saint Paul: Graywolf Press, 2002): 170-1, with English translations by A. Poulin, Jr.

(a)

Sou - vent au - de - vant de nous l'â - me - oi - seau s'é - lan - ce;

Translation: The soul-bird often soars ahead of us;

(b)

Sou - vent au - de - vant de nous l'â - me - oi - seau s'é - lan - ce;

(c)

Sou - vent au - de - vant de nous l'â - me - oi - seau s'é - lan - ce;

Example 18: Emulating the style of Hindemith's *Six Chansons*.

subsets (quartal harmonies, minor seventh chords, major triads with added ninth, and so forth) and adjacent chords often belong to the same pentatonic (or at least diatonic) collection. Phrase beginnings and endings feature open fifths and triads, so that phrases are often “less dissonant” at the beginning and end and “more dissonant” in the middle. The text setting is usually syllabic, the melodic motion primarily stepwise, and the rhythm straightforward.

In addition to these general features, the excerpts contain more specific references to *chanson* passages. In setting (a), the opening choral unison recalls “The Doe” and “In Winter” (not shown). The “soaring” melisma suggests the quasi-melismatic setting of “sur notre âme” in “The Swan” and contrary motion between the upper- and lower-voice perfect fifths loosely imitates the climax at m. 11 of “The Doe.” In setting (b) the initial bass pedal B $\flat$ mimics the sustained soprano B at the outset of “A Swan” and the sustained bass A $\flat$ in the first phrase of “Springtime.” The outer voices at “s’élance” move in contrary motion by half-step (B $\flat$ –B and A $\flat$ –G), thereby recalling “la tremblante image” in “A Swan” where soprano F $\sharp$ –G and bass B–B $\flat$ bound the Bm7–E $\flat$ M $_4^6$ progression. Setting (c) features a phrase-long stepwise divergence of the outer voices reminiscent of phrase 2 of “Springtime,” a liberal sprinkling of major seventh chords into the otherwise pentatonic chordal vocabulary as in phrase 1 of “A Swan,” and, like setting (b), a chromatic approach to the cadence at “s’élance.”

In addition to exploring choral works by other composers, one could also branch out into the instrumental repertoire by using homophonic passages as a starting point. For instance, after studying Messiaen’s *L’Ascension* (1933), students could emulate the outer movements, which are primarily homophonic, or the inner movements, where homophony and other textures are mixed. As but one of many other possible examples, one could introduce the harmonic style of Schoenberg’s *Pierrot Lunaire* through homophonic passages in its accompaniment²³ and then require students to complete similar ones. In advanced pedagogical situations this harmonic work could be coupled with assignments concerning melody and motive, all leading to *Pierrot*-like compositions. Overall, whatever exercises are undertaken, it seems vital to encourage

²³ See for instance the piano’s chord progressions in “Valse de Chopin” (mm. 14–19), “Rote Messe” (mm. 23–4), “Die Kreuze” (m. 14), “Heimweh” (mm. 1–6) and “Serenade” (mm. 16–29), the wind/string homophony in “Eine blasse wäscherin,” and the violin/cello double-stop chords that begin “Raub.”

students to emulate, not only the surface harmonic and melodic features that define style, but also the profundity of the musical relationships that generate internal coherence and that make the music worthy of study.

CONCLUSION

The approach set forth in this article may be adapted to suit various pedagogical situations. Teachers can create easier or more difficult sound experiments as needed, and may explore many types of assignments other than melody harmonizations. These exercises can imitate the methods of a particular composer, invoke general compositional practice, or bring into play tonal organization that has yet to be exploited. The approach can deal with the harmonic materials of a wide range of repertoires and has implications for theoretical constructs other than those mentioned above. For instance, instead of harmonic controls based on set type, experiments could investigate aspects of Hindemith's chord classification system, Persichetti's "chords by seconds," or Morris's "twelve-tone figured bass."²⁴ Twelve-tone applications abound. Not only are there many possible homophonic realizations of a single row, but multiple row forms can unfold simultaneously and/or consecutively, creating progressions that illuminate various combinatorial and invariance properties. Moreover, three- and four-voice musical models are ideal vehicles for illuminating the properties of trichordal and tetrachordal partitions of the aggregate.²⁵ Finally, although most exercises in this article treat harmony quite systematically and incorporate additional features on an *ad hoc* basis, other exercises could reverse this bias and consider linear and motivic concerns to be primary.

Through such exercises students gain an intimate and detailed knowledge of twentieth-century harmonic materials and learn to relate these theoretical concepts to aural experience. These exercises constitute an integral part of a balanced set of assignment types (part writing, composition, analysis, keyboard, sight singing, dictation, etc.), which promotes a comprehensive understanding of

²⁴ See Hindemith, *Craft of Musical Composition*: 94-106; Persichetti, *Twentieth-Century Harmony*: 121-134; and Morris, *Recommendations*: 102-5.

²⁵ Properties of these and other aggregate partitions are addressed in Robert D. Morris and Brian Alegant, "The Even Partitions in Twelve-Tone Music," *Music Theory Spectrum* 10 (1988): 74-103.

post-tonal musical practice. Such knowledge is vital for musicians, not only because they may be called upon to lecture intelligently about the music, but also because increased sensitivity to pitch structure leads to more nuanced musical performance. Moreover, as students become familiar and comfortable with these musical materials, they are more likely to listen to, perform, and teach the repertoire. Put more urgently, perhaps it is only when we inside the theory classrooms treat twentieth-century music as seriously as we do common-practice tonal music that our students will respect and understand the repertoire enough to promote it enthusiastically outside the classroom. And it is high time that university-trained musicians be encouraged to acquire considerable technical expertise in this area. Many of the tonal practices under discussion were developed a full hundred years ago—the twentieth century is now over.