Chapter One

Pitch-Class Set Theory: An Overture

A Tale of Two Continents

In the late afternoon of October 24, 1999, about one hundred people were gathered in a large rehearsal room of the Rotterdam Conservatory. They were listening to a discussion between representatives of nine European countries about the teaching of music theory and music analysis. It was the third day of the Fourth European Music Analysis Conference.[1] Most participants in the conference (which included a number of music theorists from Canada and the United States) had been looking forward to this session: meetings about the various analytical traditions and pedagogical practices in Europe were rare, and a broad survey of teaching methods was lacking. Most felt a need for information from beyond their country's borders. This need was reinforced by the mobility of music students and the resulting hodgepodge of nationalities at renowned conservatories and music schools. Moreover, the European systems of higher education were on the threshold of a harmonization operation. Earlier that year, on June 19, the governments of 29 countries had ratified the "Bologna Declaration," a document that envisaged a unified European area for higher education. Its enforcement added to the urgency of the meeting in Rotterdam.

However, this meeting would not be remembered for the unusually broad representation of nationalities or for its political timeliness. What would be remembered was an incident which took place shortly after the audience had been invited to join in the discussion. Somebody had raised a question about classroom analysis of twentieth-century music, a recurring topic among music theory teachers: whereas the music of the eighteenth and nineteenth centuries lent itself to general analytical methodologies, the extremely diverse repertoire of the twentieth century seemed only to invite *ad hoc* approaches; how could the analysis of

1. I have checked my account of the events described here with Patrick van Deurzen, then coordinator of the Fourth European Music Analysis Conference. I am grateful for his willingness to share his memories with me. For another account, see Cross 2000, 35. For general reports of the conference mentioned, see Maas 2000 and Bernnat 2000.

works from this repertoire be tailored to the purpose of systematical training without placing too much emphasis on particular styles of composition?

A late visitor entered the room, and seated himself on a chair in the middle of the front row. He listened for a while to the discussion, his face expressing growing astonishment. Then he raised his hand and said:

> "You guys are discussing methods of analyzing twentieth-century music. Why don't you talk about pitch-class sets?"

He was American. The chairman, a professor from the Sorbonne, was quick to respond:

> "We do not *talk* about pitch-class sets, because we do not *hear* them!"

This dismissive response was not effective. The visitor said it was not his intention to discuss whether pitch-class sets could be *heard,* or had been used by composers. He wanted to stress their value as an analytical *tool.* Pitch-class set theory, he argued, enabled students to come to grips with complex music of the posttonal era. It was successfully applied in the United States, and he could hardly believe that it was not taught anywhere in Europe!

Indeed it wasn't, as he could infer from the reactions of some of the Europeans present who appeared to be knowledgeable about the theory. They were willing to admit that it worked well in some cases—for example, it was helpful in clarifying the pitch structure of an early atonal composition by Anton Webern—but they made it clear they would never encourage its general use. In their view, it would force most music onto a Procrustean bed of preconceived relations.

The meeting had turned into a confrontation between European and American approaches to music analysis. And in the absence of a unified European methodology, the participants ended up debating American practice only.

Although this turn took many by surprise—most of all the unhappy chairman—it was to be expected at some point. For decades, the professional discourse on music theory and analysis[2] had been dominated by Americans. Whereas in most European countries music theory offered training in basic musical skills as part

2. A note is necessary on my use of the terms "music theory" and "music analysis." These do not signify two separate disciplines. "Music theory" often functions as an umbrella term comprising music analysis and other subjects, such as harmony and counterpoint. However, it can also refer to a framework of concepts and/or protocols underlying the analysis of musical works. It is in this sense that I will use it. The corollary that music analysis is "applied music theory" is not commonly embraced, as will be clear from what follows below. European music theorists, including the British, often distinguish themselves from their American counterparts by stressing the priority of analysis over theory. Characteristically, one British study is entitled *Music Analysis in Theory and Practice* (Dunsby and Whittall 1988), whereas the title of an American study is *Music Theory in Concept and Practice* (ed. James M. Baker, David W. Beach, and Jonathan W. Bernard, 1997). For a historic discussion of the relation between theory and analysis, see Cone 1967 and Lewin 1969.

of the conservatory tradition, in the United States it had grown into an academic discipline as well. Traditional pedagogy had been supplemented by an intensive research program, which had made the Americans pre-eminent in the production of music-theoretical knowledge. This pre-eminence was strongly apparent in the field of music analysis, mainly because of the American adherence to two distinctive bodies of analytical theory: the theory of Heinrich Schenker (1869–1935) for tonal music, and *pitch-class set theory*[3]—commonly identified with the name of Allen Forte (b. 1926)—for atonal music. On these twin pillars Forte himself based the first American graduate program in music theory (at Yale University) in 1965.[4]

A division of analytical practice along the lines of these two theoretical bodies is crude, of course. And today, as other perspectives on music analysis have gained prominence in the United States, it is also outdated. However, it has been of crucial importance to the image of American music theory. The Canadian composer and music theorist William Benjamin has—perhaps unwillingly—helped spread this image by addressing, in an article, the "curious marriage of convenience" between what he saw as two contradictory streams of thought (Benjamin 1981, 171). This metaphor came to the notice of the musicologist Joseph Kerman, who cited it in *Contemplating Music,* his widely read, critical account of postwar musical studies.[5] It confirmed Kerman's own critical assessment of American music theory: "a small field built around one or two intense, dogmatic personalities and their partisans" (Kerman 1985, 63). Meanwhile, Kerman saw more sense in the "marriage" than Benjamin, as did Patrick McCreless, a commentator of later years:

> Schenkerian theory and the current theories of atonal and twelve-tone music, however mutually exclusive in terms of the repertoires that constitute their objects, both share a value system that explicitly privileges rigor, system, and theory-based analysis and implicitly share an aesthetic ideology whereby analysis validates masterworks that exhibit an unquestioned structural autonomy. (McCreless 1997, 32)

In Rotterdam, the dual image of American analytical practice was prevalent in the minds of most conference-goers, and—much more importantly—so was its privileging of "rigor" and "system." When the chairman said: "We do not hear these pitch-class sets," he appealed to a common concern about "theory-based

3. Some people call it "set theory" (without the prefix "pitch-class"), reducing its name to that of its mathematical model: Georg Cantor's *Mannigfaltigkeitslehre* or *Mengenlehre.* Others speak of "set-class theory." Although these alternative names are sometimes used for good reasons—which will become obvious as we proceed—I have decided to stick to the designation "pitch-class set theory" throughout this study.

4. Significantly, this program was not founded within Yale University's professional music school, but within the Department of Music, where it was associated with graduate studies in musicology. Forte 1998b, 10.

5. Published in England under the title *Musicology.*

analysis" as practiced in the United States—a concern shared not only by those European music theorists involved in the teaching of musical performers, but also by American scholars like Kerman. He made himself the spokesman for those who suspected such analysis of seeking to demonstrate the workings of the theory rather than to reveal what is special about the music.

There may well have been grounds for this suspicion, although in Europe it cannot always be dissociated from an anxiety about American hegemony over the discipline. After all, Europe has its own breeds of analytical systems, and Heinrich Schenker lived in Vienna! The European Music Analysis Conferences, for all the work toward an *entente cordiale* between the national schools of musical analysis, have also been motivated by a desire to "remind the theoretical community of its European heritage" (Street 1990, 357). Pitch-class set theory—which is not part of that heritage—already divided Europeans and Americans at the very first of these conferences, held in Colmar in 1989. Then, Allen Forte crossed swords with the Belgian music theorist Célestin Deliège, who, in a preparatory paper, had criticized the theory for lacking explanatory power (Deliège 1989). More than a decade later, the controversy was still alive. What was it that aroused such persistent antagonism?

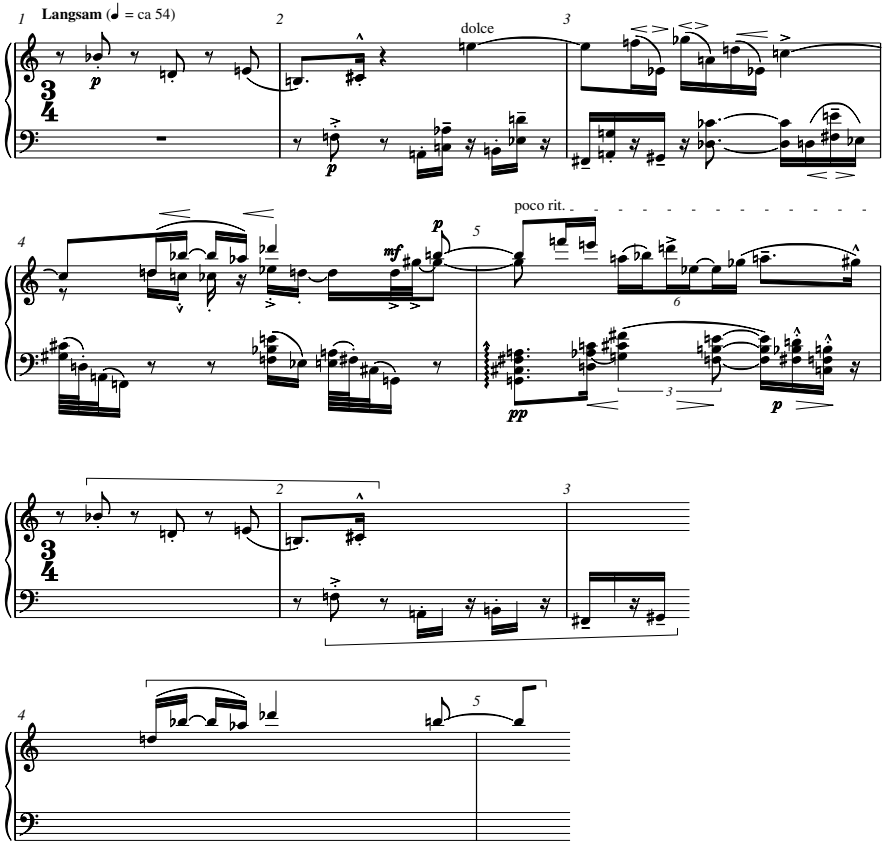
Paradigmatic Pieces

Pitch-class set theory addresses the notion of musical coherence. There are many ways in which music can be said to cohere. For example, it may be in one key, or be in a familiar form, it may obey a model of rhetoric, or it may have been set to a single text. Pitch-class set theory seeks coherence in the relations between various combinations of tones. A work susceptible to this approach is Arnold Schoenberg's Piano Piece Op. 23, no. 3 (1923). Example 1.1a shows its beginning.[6]

The piece first presents a single melodic line, involving the pitches B♭4, D4, E4, B3, and C♯4 respectively.[7] The same melody, now starting on F3, is formed by the successive bass tones in measures 2–3. And in measure 4 there is an inverted form of this melody starting on D5 in the top voice. These three statements are isolated and bracketed in the lower half of example 1.1a.

6. This piece is a favorite among analysts, especially those concerned with Schoenberg's path toward serial composition. Analyses of these opening measures have been provided by Stein (1925), Perle (1962), De Leeuw (1977), and Simms (2000), among others. I do not pretend to add anything new to the work of these authors. It is my sole intention to give the reader a basic understanding of what pitch-class set theory is about, in anticipation of the more systematic presentation in subsequent chapters.

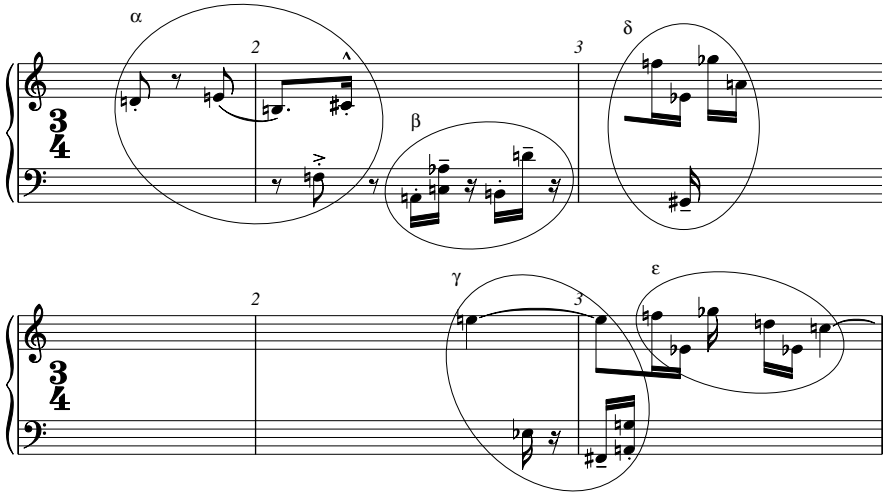
7. With regard to the letter names of pitches, I follow the rule proclaimed by the Acoustical Society of America. According to that rule, a pitch is identified by a capital letter, a sharp or a flat if so required, and by the number of its octave range. Octave ranges cover the pitches from any C through the next higher B, and are numbered from low to high. Middle C is C4.



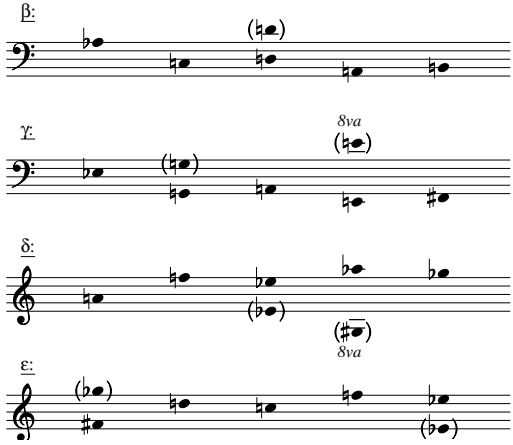
Example 1.1a. The beginning of Schoenberg's Piano Piece, Op. 23, no. 3. Obvious combinations of tones: three statements of a five-tone melody.

So far, an analysis of this piece does not seem to require a language other than that used for any work featuring imitative counterpoint. The melody actually functions like the subject of a fugue, particularly since it is first answered "at the fifth." The rhythm of the melody is slightly different at the second entry, and then is transformed beyond recognition at the third. Still, imitation—another device to achieve musical coherence—sanctions the combinations shown in example 1.1a. It is obvious that these tones belong together.

On closer scrutiny, however, less obvious groups of tones appear to relate to the opening melody as well. These are shown in example 1.1b. Each of them can be transformed into another statement of this melody, *in recto* or *in inverso*



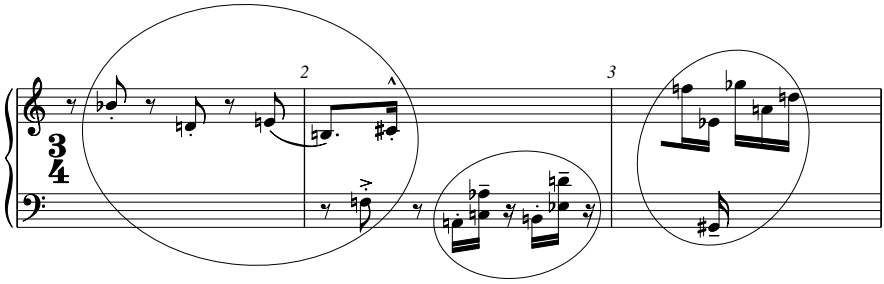
Example 1.1b. Non-obvious combinations related to the opening melody of Schoenberg's Piano Piece, Op. 23, no. 3.



Example 1.1c. New statements of the melody derived from the combinations in ex. 1.1b.

(ex. 1.1c). We only need to reorder the pitches and replace some of them by a higher or lower octave. Although these combinations are not musically articulated, we can define them on the basis of their hidden "substance." Thus, a dense web of relations emerges, in which the opening melody imposes its structure on the harmonies and accompanying figures.

We can continue this exploration, and add to the first statement of the melody the first tone of the second statement (F3), which sounds between the former's B3

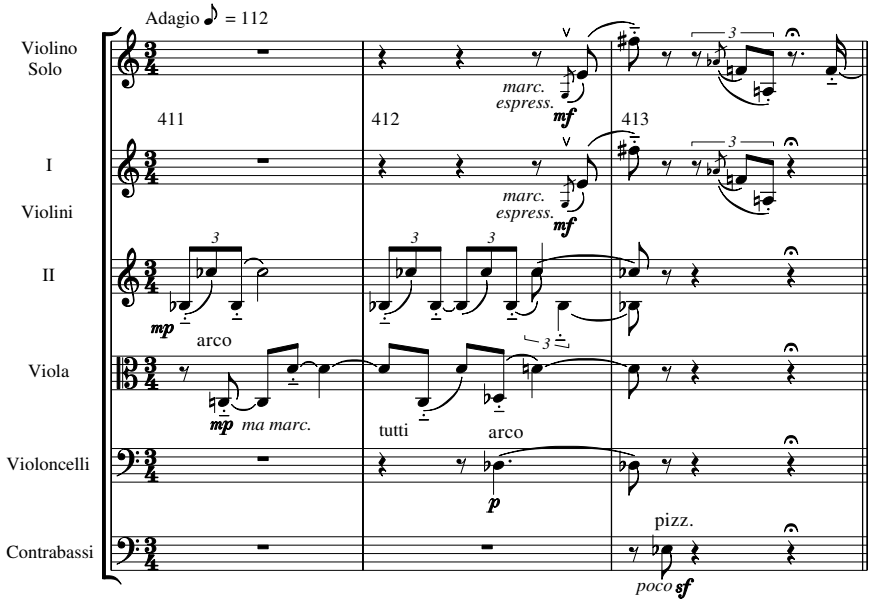


Example 1.1d. Non-obvious six-tone combinations.

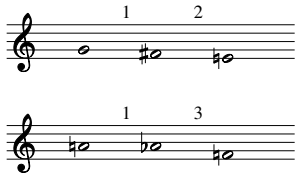
and C♯4. Now we have *six* tones instead of five (see ex. 1.1d, first 4 beats). These six tones form a shape that similarly recurs a couple of times in the first measures. Let us look at the second five-tone combination in example 1.1b, which is marked **β**. If we enlarge it to include E♭3—a tone originally assigned to the next combination (**γ**)—we have another instance of our six-tone combination (as shown in ex. 1.1d, in the center). It appears that **β** and **γ** are connected in the same way as the first two statements of the melody: **γ** answers **β** "at the fifth." In both cases, the six-tone combinations result from the progression from one five-tone combination to the next. In measure 3, the progression from **δ** to **ε** is not a "fifth progression"; however, it yields a similar six-tone combination (see ex. 1.1d, to the right).

The brief analysis above reveals a tightly woven pattern of recurrence. This tightness is not characteristic for each measure of this piece. For example, measure 4 is already less "close-knit" than the previous measures.[8] But it is the coherence of measures 1–3 that concerns us here. What is it that recurs so consistently throughout these measures? We have noted several related entities, but what do these have in common? They can all be traced to the opening melody, but some of them are not in the slightest way a representation of that melody. What they actually represent is a basic property of the melody's pitch material. Pitch-class set theory is concerned with such properties. A pitch-class set is an abstract concept of a combination of musical tones. It does not include the durations and octave ranges of these tones; nor does it include the order in which they appear. It reduces the combination to an unordered set of collective pitch designations ("pitch classes"). By using this concept, analysts can trace relations that are independent of shape and actual pitch content.

8. I agree with Bryan Simms, who writes: "As the piece progresses, dividing the entire texture into variants of the initial shape becomes ever more difficult and requires analytic strategies that fully bypass the musical context and, in all likelihood, the composer's intentions" (Simms 2000, 198). It is by no means foreign to the idea of contrapuntal writing to vary the pace of thematic development. In a fugue, thematic passages often alternate with freely constructed episodes. This holds true for Opus 23, no. 3 as well.

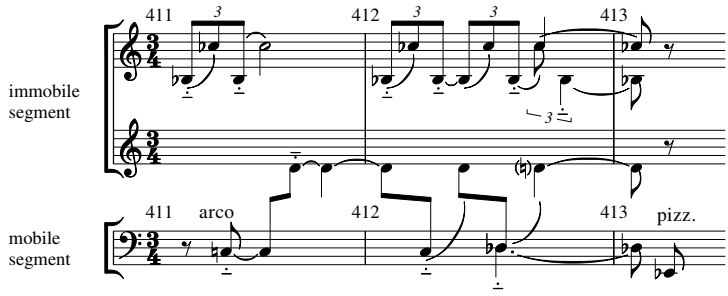


Example 1.2a. Stravinsky, Pas de deux from *Agon*. The opening sonic field, mm. 411–13.



Example 1.2b. Abstract forms of the motifs in the first-violin part, mm. 412–13.

Another composition in which such relations have been found is Igor Stravinsky's ballet *Agon* (completed 1957). Example 1.2a shows the first three measures of the "Pas de deux" (mm. 411–13). These have a more open texture than the first three measures of Schoenberg's Opus 23, no. 3. Rather than a contrapuntal fabric, they present a sonic field. This field is built from several tone combinations. Most conspicuous are the motifs played by the first violins in measures 412–13, which mark the end of these introductory measures. We can project the tones of each motif in a single octave range, and then place them in ascending or descending order (ex. 1.2b). It appears that the motifs reduce to different forms: a succession of a minor and major second (in chromatic steps: 1 and 2), and a succession of a minor second and a minor third (in chromatic steps: 1 and 3). One motif cannot be transformed into a statement of the other by the rearrangement and octave displacement of pitches.

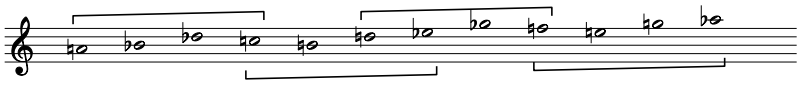


Example 1.2c. The mobile and immobile segments of the sonic field.

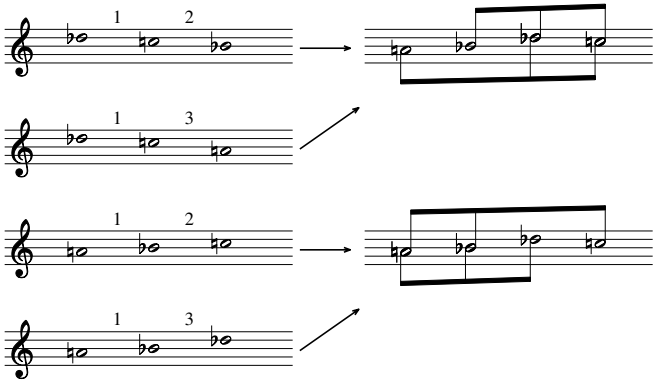
However, each of these motifs reflects the structure of a segment of the sonic field from which they emerge. Example 1.2c shows that this field consists of a mobile and an immobile segment. The former is a progression involving the pitches C3 (mm. 411–12, violas), D♭3 (mm. 412–13, violas and cellos), and E♭2 (m. 413, double basses); the latter consists of the repeated D4s, B♭3s and C♭5s played by second violins and violas. The first motif reflects the structure of the mobile segment, and the second that of the immobile segment. The motifs and segments, it should be noted, partition the total chromatic; the sonic field grows into a twelve-tone field.

Significantly, each of the two pieces presented above was written just before or at the time of its composer's turn to twelve-tone serialism. Neither of them is strictly twelve-tone, but they both display a remarkable consistency in the use of pitch intervals. Henri Pousseur (1972) has noted that Stravinsky's "Pas de deux" employs a group of intervals taken from the twelve-tone series of Anton Webern's Variations for Orchestra, Op. 30—a work Stravinsky is known to have admired (ex. 1.3a). This group of intervals—scalewise in chromatic steps: 1 2 1—combines the two intervallic patterns that emerged from our analysis of the first three measures (see ex. 1.3b). Indeed, from measure 414 onwards we can see that it is repeatedly generated by adjacent or overlapping occurrences of these smaller patterns (ex. 1.3c and 1.3d). It thus seems to function as a device of progression, similarly to the six-tone combination in Schoenberg's Piano Piece, Op. 23, no. 3 (ex. 1.1b and 1.1d above). In any case, it is the product of an intervallic consistency reminiscent of—if not inspired by—twelve-tone serialism.

It is not by accident that two musical works approximating dodecaphonic practice reflect so well the focus of interest of pitch-class set theory, for this theory is itself an outgrowth of the theory of twelve-tone serialism. Its pioneer was the composer Milton Babbitt (b. 1916), who had dedicated himself to extending, and strengthening the theoretical underpinning of, Schoenberg's twelve-tone technique. Babbitt set the example for the confluence of music theory and contemporary composition under the aegis of the university, America's principal employer of composers. He taught at the music department of Princeton University,



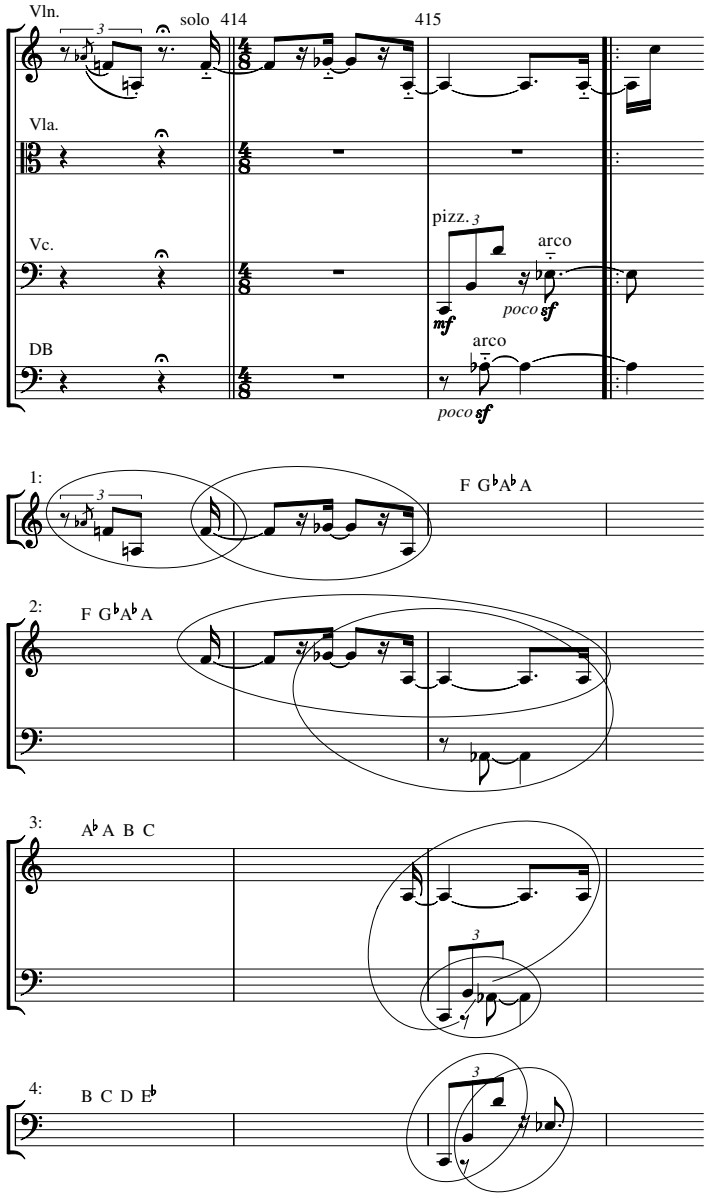
Example 1.3a. A source of inspiration: a recurring group of intervals in the twelve-tone series of Webern's Variations for Orchestra, Op. 30.



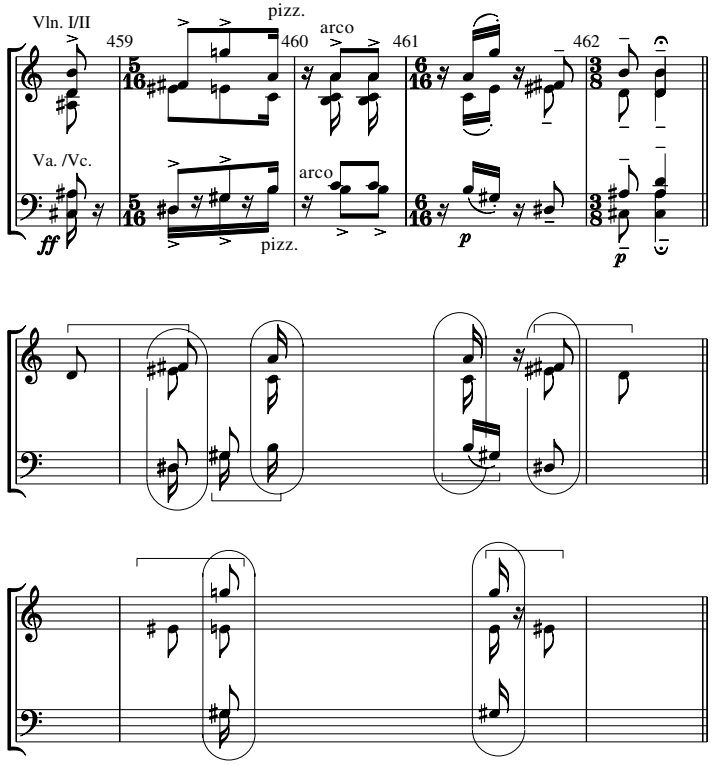
Example 1.3b. The derivation of this group from the abstract forms of the motifs in ex. 1.2b.

which owes to him its reputation as an American center of musical innovation. His theory proceeded from a mathematical description of the familiar twelve-tone operations (transposition, inversion and retrogradation). A good deal of its conceptual apparatus was adopted by Allen Forte, who tailored it to the analysis of non-serial music. For example, whereas Babbitt used the word "set" for "twelve-tone series," Forte also applied it to combinations involving less than twelve tones and showing no definite ordering—combinations such as found in Schoenberg's piano piece and Stravinsky's "Pas de deux."

The relations shown in example 1.1 through 1.3 are instances of what Schoenberg saw as a continuous process of variation, the "endless reshaping of a basic shape" (Schoenberg 1984, 290). The term "basic shape" is not very specific. It might signify a twelve-tone series. If, alternatively, we replace it by "pitch-class set," we interpret it more generally—in other words, we impose fewer constraints on the process of its "reshaping." However, pitch-class sets do not necessarily function as "basic shapes" in the Schoenbergian sense. The recurrence of a basic shape is not the only measure of musical coherence posited by pitch-class set theory. There are other categories of relations between groups of tones: relations between their interval contents, relations based on common tones, and relations delineating hierarchical levels of structure, to mention but a few. Pitch-class set theory imposes no limit on the number and nature of relations between tone combinations.



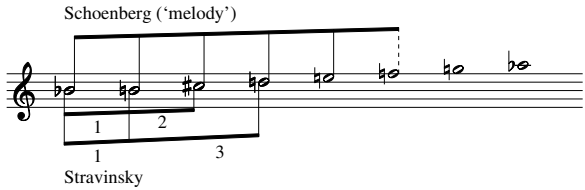
Example 1.3c. Stravinsky, Pas de deux from *Agon*. Four occurrences of the Webern-group in mm. 414–15. The circled pitches form the same intervallic patterns as those extracted from the motifs in mm. 412–13.



Example 1.3d. Stravinsky, Pas de deux from *Agon*, mm. 458–62. The Webern-group as a device of progression. Each three-tone chord (circled) is complemented by a member of the next, or the previous chord.

For example, the theory also deals with the question of how to conceive a relation between the two motifs in measures 412–13 of Stravinsky's *Agon* (ex. 1.2). It has provided ways to measure the degree to which such motifs are similar or different. (As shown in example 1.2b, the abstract forms of these motifs both contain the intervals of a minor second and a minor third. The remaining intervals are different: in one we find a major second, in the other a major third.) Even if there is not a single basic shape underlying the different melodies, motifs, and simultaneities, a composition may be shown to make a consistent use of particular tone combinations. These combinations may feature the same intervals, or follow one another according to a rationale of progression.

We can take yet another view of the two motifs in *Agon* and stress that they are both abstractly contained in the four-tone combination derived from Webern's



Example 1.4. The octatonic scale as the common ground between the materials of Schoenberg's piano piece and Stavinsky's Pas de Deux.

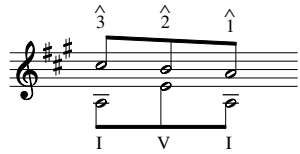
Opus 30 (as can be seen from ex. 1.3b). Each of them "descends" from the latter. In turn, this four-tone combination "descends" from combinations of yet higher magnitudes. In this way, we can plot entire family trees of pitch-class sets. It is interesting that the five- and six-tone combinations found in Schoenberg's Piano Piece, Op. 23, no. 3, and the three- and four-tone combinations found in the "Pas de deux" from *Agon* can be assigned to one family, since they all "descend" from the octatonic scale (ex. 1.4). The octatonic background is most conspicuous in measures 413–15 of the "Pas de deux," where the overlapping three- and four-tone combinations actually complement this scale (ex. 1.3c). These family-like relations have enabled pitch-class set theory to account for higher levels of organization in a musical work, and to hypothesize principles of structure governing an entire repertoire of music.

This aspect of the theory—its working toward a hierarchy of structural levels—is reminiscent of its tonal-music counterpart in the United States: the analytical theory of Heinrich Schenker.[9] This is not surprising when we consider that Allen Forte was a devoted Schenkerian. In 1982, he and his former student Steven Gilbert published a much-consulted introduction to Schenker's method (*Introduction to Schenkerian Analysis*); and throughout his career he has used it for the analysis of a wide range of music, including works from the late nineteenth and early twentieth centuries (*Contemporary Tone-Structures,* 1955; "Schenker's Conception of Musical Structure," 1959), and American popular songs from the 1930s and 40s (*The American Popular Ballad of the Golden Era,* 1995). Therefore, a brief digression on Schenker's approach to tonal music is now appropriate.

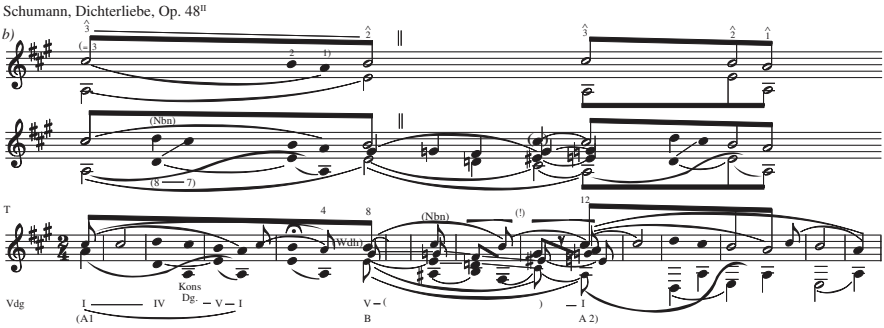
A Short Detour to Schenker

Schenkerian theory claims that harmonic progressions and voice-leading patterns governing single phrases of tonal music are also at the basis of entire

9. For a general reflection on the relationship between Schenkerian theory and pitch-class set theory, stressing their common roots in nineteenth-century organicism, see Hinton 1988. For an analysis combining pitch-class sets with a Schenkerian approach, see Forte 1988b.



Example 1.5a. A Schenkerian fundamental structure (*Ursatz*).



Example 1.5b. Heinrich Schenker's analysis of a song by Robert Schumann: "Aus meinen Tränen sprießen" from *Dichterliebe*. This analysis was published in Schenker's treatise *Der Freie Satz* (1935).

compositions. Small-scale patterns thus mark stages in the unfolding of larger ones; they "prolong" these stages. Through a series of reductions a Schenkerian analysis retraces the process of the work's unfolding to the "fundamental structure" (*Ursatz*), which is itself the prolongation of the tonic triad. This fundamental structure consists of two simultaneous parts: a fundamental line—a stepwise descent from the tonic third (or fifth, or octave) to the tonic—and a bass arpeggiation I V I that supports it (ex. 1.5a). It is important to note that the purpose of the analysis is the discovery, not of the fundamental structure, but of the way that leads from this fundament to the actual work.

Example 1.5b has been taken from Schenker's treatise *Der Freie Satz* (1935).[10] It shows three successive reductions of Schumann's song "Aus meinen Tränen sprießen" from the cycle *Dichterliebe,* Op. 48. Schenker himself did not waste many words on this analytical graph. However, it has provoked much comment from others. It has often been used as an example showing both the pros and cons of Schenker's analytical method: the insights it can offer, and the problems it may raise.

The lowest staff looks like a rough draft, with analytical markings indicating important tones and connections. A particular emphasis appears to be placed on

10. Translated in English as *Free Composition* (1979). The example is numbered 22a.

the first tone of the opening phrase (C♯5; beam, open note-head) and the first tone of the contrasting middle section (B4 in m. 8; beam). These tones form a large-scale progression: a descent from the third ($\hat{3}$) to the second ($\hat{2}$) of the A-major scale. The same progression starts in measure 12, which makes sense, as an altered recapitulation of the opening phrase begins here. But now the progression is shown to reach the tonic A4. This tone and the B4 that precedes it are represented by open note-heads, which suggests that they are more important than the corresponding tones in measure 4.

The middle staff gives much less detail. Its function is to highlight the progression from C♯5 to B4, and later that from C♯5 to A4. The brief middle section ("Und wenn du mich lieb hast") is shown here to prolong the B4 in measure 8, and to connect it to the C♯5 of the recapitulation. The middle staff thus reinforces the emphasis placed on the outer phrases. And we can now see *why* these phrases are emphasized: they contain the elements of the fundamental structure shown in ex. 1.5a.

The upper staff represents a basic elaboration of this fundamental structure. It shows us that in Schumann's song the descending third progression is first interrupted and then stated completely; the resolution of the treble and bass into the octave is suspended until just before the end.[11] In Schenkerian theory, "interruption" is an over-arching concept. It covers a span of music that is composed of different parts. This can be a small span (like an eight-bar period) or a large one (like a movement in sonata form). In other words, the term "interruption" can be applied to different levels of structure. It epitomizes Schenker's hierarchical approach to music analysis.

There are two reasons to dwell on example 1.5b. First, Forte presented Schenker's analytical graph in an article for *Journal of Music Theory* in 1959, and went into great detail to explain it. This article—entitled "Schenker's Conception of Musical Structure"—was also important for other reasons, which will be clarified in chapter 8. Second, it may provoke the objection that it imposes an *a priori* structural model on the song. It thus reinforces the image of a "theory-based" or "system-oriented" analytical practice, an image that Schenkerian analysis shares with pitch-class set analysis. Joseph Kerman, in his commentary on both Schenker's interpretation and Forte's rendering of it, raised this objection (Kerman 1980).[12]

It is questionable whether the graph of example 1.5b provides a good example of Schenkerian analysis. In any case, Schumann's song is a questionable example of a Schenkerian interruption. This concept—a premature halt, followed by a

11. It is unclear to me why Schenker chose not to beam the progression B–A in the last two measures, but did beam the corresponding progression in measure 15. It is obvious that the latter does not end the final phrase.

12. Kerman involved yet another analysis, which I take the liberty to exclude from consideration: an analysis published by Arthur Komar in 1971.

new start—is perfectly illustrated by classical themes in period form;[13] in "Aus meinen Tränen sprießen," however, the descending third progression starting on C♯5 is not interrupted at the end of the first phrase—as it would be in a period—but is stretched to the beginning of the next phrase. Furthermore, one remarkable thing about this song is the stealthy beginning of its recapitulation. The tonic third C♯5 is now the leading tone of a dominant seventh chord applied to D. As a consequence, it does not demand the same kind of attention that it received at the opening of the song. Neither the break in the continuity of the descending third progression in measure 8, nor the new start of that progression in measure 12 is musically articulated as such. Therefore, the term "interruption" does not seem to apply naturally to Schumann's song.[14]

Schenker's approach to Schumann's song seems to be geared too much toward the validation of a general concept of tonal structure, ignoring what is inconsistent with that concept. But what is it that we value in an analysis? Forte selected this one as typical for Schenker's achievement, which he summarized as follows:

> Schenker opened the way for a deeper understanding of musical structure with his discovery that the manifold of surface events in a given composition is related in specific ways to a fundamental organization. (Forte 1959, 4)

Forte liked the systematic, generalizing tendency of Schenker's late output, and saw his own role in the light of this tendency:

> Although Schenker came very close to constructing a complete system, further refinement and amplification are required if it is to fulfill its promise. (ibid., 16)

In spite of the dangers of overgeneralization, we should consider the reason for imposing such concepts as the Schenkerian interruption: it strengthens the image of music theory as a domain of competence distinct from musicology, musical performance, and composition. Within these disciplines music theory had traditionally played a subservient role. It provides historical musicologists with the knowledge and tools to access musical sources from the past; it enables performers to maximize their awareness and control of musical processes; and

13. As defined by William Caplin: "Essential to the concept of the period is the idea that a musical unit of partial cadential closure is repeated so as to produce a stronger cadential closure" (Caplin 1998, 49). An interruption in the Schenkerian sense demands that the first unit end with a half cadence.

14. Forte did not make this point; nor did Kerman. This, however, does not detract from the value of their observations. Forte saw the G in measures 12–13—which turns the initial A-major chord into a dominant seventh chord—as resulting from a chromatically descending inner voice (Forte 1959, 24). Kerman stressed this tone's expressive quality in relation to the word "klingen" (Kerman 1980, 326).

it offers composers a foundation for critical self-reflection. However, it does not stand on its own two feet. It was for analytical theories like those of Schenker and Forte to achieve that self-consistency (Forte's "promise"), sanctioning interpretations that, from other disciplinary perspectives, may strike one as subversive rather than subservient.

Institutionalization and Criticism

Judging from the reactions it elicited at the European Music Analysis Conferences, pitch-class set theory has not found an easy entry into Europe. Indeed, only in Britain has it become part of the standard repertoire of analytical resources. In North America, however, it has enjoyed a wide dissemination. As noted earlier, it has played an important role in the emancipation of music theory as an academic discipline in its own right. This emancipation was marked, first, by the appearance of specialized journals such as *Journal of Music Theory* (Yale University, 1957), *Perspectives of New Music* (Princeton University, 1961), and *The Music Forum* (Columbia University, 1967–87); second, by the increasing number of degree programs in music theory at American universities, especially the PhD programs that were established after the example of Yale's (1965); and, third, by the foundation of the Society for Music Theory (SMT) in 1977. The SMT was instrumental in, among other things, the organization of a large number of conferences, and provided its members with another important journal from 1979 onwards (*Music Theory Spectrum*). By 1980, then, an infrastructure was available that encouraged research, facilitated an ongoing professional debate, and raised the profile of music theory as a "body of knowledge and a set of shared practices."[15]

Pitch-class set theory has not itself spurred this development from the beginning. However, it has contributed to it by putting on the agenda the theoretical underpinnings of the twentieth-century post-tonal repertoire. Apart from providing a technical vocabulary, it has helped to formulate the premises and questions from which to proceed in the analysis of works from this repertoire: what was to

15. This is another quote from Patrick McCreless (1997, 17). He has described the birth and growth of academic music theory from a perspective developed by the French philosopher Michel Foucault, stressing the dependence of knowledge on power: "Music theory is in fact, like all academic disciplines, a 'docile body'—an object of control—with respect to the university, just as, in another sense, most music theorists, as individuals and employees of the university, are 'docile bodies.'" (ibid., 35) What is characteristic for this approach is the emphasis on a self-regulating academic discourse dictating the contributions of its individual participants. Although the present study will pay a good deal of attention to the intrinsic dynamics of the evolving discourse on pitch-class set theory, it will not refrain from also addressing the decisive role of personal involvement.

be searched for, and how this was to be done.[16] The influence it thus exerted on the study (and the composition) of post-tonal music has been profound and long lasting. The rise of pitch-class set theory has earned American music theory a reputation for engagement with musical modernism. However, the flurry of scholarly activity has left the modernist tradition of composition with mixed fortunes. On the one hand, this activity is a genuine response to that tradition, which has yielded textbooks and manuals of analysis giving students access to the music of such "difficult" composers as Schoenberg, Webern, Boulez, Carter, Babbitt, and (late) Stravinsky. On the other hand, this music's exposure in the literature—combined with its minor role in public concert life—has added to its reputation of being "cerebral" and "academic." Pitch-class set theory employs a mathematical vocabulary and mathematical models of presentation; and to designate pitches, it has substituted integers for the traditional letter names. Analyses proceeding along set-theoretical lines, then, convey an image of rationality that may confirm people in their rejection of the music concerned.

The integration of pitch-class set theory into the curricula of American colleges and universities is probably the most significant measure of its institutionalization. Table 1.1 may give us a tentative impression of the extent to which it has influenced music theory teaching at the college and graduate levels. It shows its place in the curricula of twenty institutions spread over the United States and Canada. The table reflects the situation in 1996. At that time, all of these institutions offered degree programs in music. Apart from their geographical distribution, they differed by type. They included private research universities with music schools (University of Rochester) or music departments (Harvard University, Columbia University), a private university with an integrated college (Bradley University), state universities with music schools (Florida State University, Universities of Iowa and Michigan) or music departments (Universities of Virginia and New Mexico), liberal arts colleges (Simpson College and Davidson College), a college conservatory (Oberlin), and a community college (Pima, the music program of which may have been exceptional for this type of institution).

In view of this diversity, it is significant that only one institution from this group did not teach pitch-class set theory in 1996. This was Davidson College. All the others had included it in their programs, although it received little coverage at the University of California in San Diego, at Memorial University of

16. Seen thus, pitch-class set theory has played a role comparable to that which Thomas Kuhn (1962) called a "paradigm." There are different interpretations of this term, but in one sense a paradigm is an intellectual achievement that sets the course for subsequent research in a particular field. More specifically, it confronts researchers with "puzzles," while at the same time providing them with tools for solving these "puzzles." For another comparison, Larry Laudan's concept of a "research tradition" is worth considering: "a set of general assumptions about the entities and processes in a domain of study, and about the appropriate methods to be used for investigating the problems and constructing the theories in that domain." (Laudan 1977, 81)

Table 1.1. Pitch-class set theory in the curricula of twenty teaching institutions in the United States and Canada (1996)

Institute	Representation	Academic level	Textbooks/manuals used
Bradley University, Peoria, IL.	Separate course	Undergraduate	Rahn 1980 (Forte 1973 and Straus 1990, articles, dissertations)
University of California, San Diego	Integrated (*Music Theory and Practice II*)	Undergaduate	(Rahn 1980 and Straus 1990)
Columbia University, New York	Separate Course	Graduate	Own materials (Perle 1962, Forte 1973, Rahn 1980, Straus 1990, Morris 1991)
Davidson College, Davidson, NC	None		
Florida State University, Tallahassee	Integrated (*20th-Century Styles, Atonal Analysis*)	Undergraduate and graduate	Straus 1990 (Forte 1973, Rahn 1980, et al.)
Harvard University	Integrated (*Mathematical Models for Music Theory*)	Graduate	Own materials (Lewin 1987, Lewin 1993)
University of Iowa	Integrated (*20th-Century Techniques*) Separate courses	Undergraduate and graduate	Rahn 1980 (Morris 1991, Lewin 1993)
University of Michigan, Ann Arbor	Integrated (*Basic Musicianship: Writing Skills; Analysis 20th-Century Music* Separate course	Undergraduate, graduate	Own materials (Morris 1991)

Table 1.1. Pitch-class set theory in the curricula of twenty teaching institutions in the United States and Canada (1996)—*(cont'd)*

Institute	Representation	Academic level	Textbooks/manuals used
University of New Mexico	Integrated (*Composition I*), Separate courses	Undergraduate and graduate	Straus 1990, Morris 1991
Oberlin Conservatory	Integrated (*Music Theory IV*)	Undergraduate	Lester 1989
Pima Community College, Tucson, AZ	Integrated (*Theory and Structure of Modern Music*)	Undergraduate	Own materials, Straus 1990
University of Rochester Eastman School of Music	Integrated (Various Courses) Separate Courses	Undergraduate and graduate	Straus 1990, Morris 1991 (Forte 1973, Rahn 1980)
Simpson College, Indianola, IA	Integrated (*Basic Theory*)	Undergraduate	Kostka and Payne 1984
University of Texas at Austin	Integrated Separate course	Undergradute and graduate	Rahn 1980, Straus 1990
University of Virginia, Charlottesville	Integrated (*Materials of Contemporary Music*)	Undergraduate	Straus 1990
University of Washington, Seattle	Integrated (*Post-Tonal Theory and Analysis, Analytical Techniques 1900-1950*)	Undergraduate and graduate	Forte 1973, Rahn 1980, Straus 1990
University of Wisconsin, Madison	Integrated (*Music Theory IV, Literature Survey of 20th-Century Music*) Separate course	Undergraduate and graduate	Forte 1973, Morris 1987
University of Alberta, Edmonton, Canada	Integrated (*Music Analysis*)	Undergraduate and graduate	Forte 1973, Rahn 1980, Lewin 1987, own materials

Table 1.1. Pitch-class set theory in the curricula of twenty teaching institutions in the United States and Canada (1996)—*(cont'd)*

Institute	Representation	Academic level	Textbooks/manuals used
Dalhousie University, Halifax, Nova Scotia, Canada	Integrated (*20th-Century Form and Analysis*)	Undergraduate	Straus 1990
Memorial University of Newfoundland, St. John's, Canada	Integrated (*Materials and Techniques of Music IV, 20th-Century Harmony,* Theory/Composition Seminar)	Undergraduate	Kostka and Payne 1984 (Forte 1973, Rahn 1980, Straus 1990)

Note: In the second column, one can see whether pitch-class set theory is the topic of a separate course, or is addressed in a more general context. In the latter case, I have included the title or subject of the course in brackets. The third column specifies the academic level(s) on which the theory is taught. The fourth column shows which texts students read. Here, the brackets indicate that a text is used for reference only, or is kept in reserve.

Newfoundland, at Oberlin Conservatory, and at Simpson College.[17] In some cases, it was a recent addition to the program (Bradley University and Simpson College, 1993; University of Virginia, 1992; University of New Mexico, 1991).

From table 1.1 it appears that several institutions offered separate courses on pitch-class set theory. Apart from the course at Bradley University—an undergraduate course entitled "Theories of Atonal Music" but entirely devoted to the theory of pitch-class sets—it concerned specialized graduate courses. A more important indicator of the theory's acceptance, however, was its appearance in *general* courses, especially those intended for students at the undergraduate level. This signified its inclusion in what was considered "basic knowledge" of music. In this connection, we should take special note of its place in the music theory core curriculum at universities like Michigan and Wisconsin. And the two weeks spent on pitch-class set theory at Oberlin Conservatory may be a better illustration of its success than its strong presence in the curriculum of the Eastman School of Music, an institution with a sixty-year tradition in the field of advanced music theory.

Although it has achieved a firm position as an analytical "paradigm" in the literature on twentieth-century music, and has found its way to the classroom, the theory of pitch-class sets has seldom been short of criticism. Some of it has already been mentioned. The theory has been criticized for its systematization of analytical practice. It has been criticized for the way in which it has constructed "autonomous" musical objects, for failing to consider the historical context of musical works of art, and for placing undue emphasis on their technical properties. But pitch-class set theory was not the only target of this criticism; music theory itself, as an independent academic discipline, was under attack, especially from those concerned with musical expression and immediacy, or from those who posited music as social discourse and sought to study it from a plurality of perspectives. I am referring to the members of the "New Musicology" movement of the 1980s and 1990s. The names most commonly associated with this movement are Lawrence Kramer, Susan McClary, and Gary Tomlinson. However, its progenitor was the earlier-mentioned Joseph Kerman, who, in *Contemplating Music,* had taken a stance against the narrow scope of mainstream music scholarship—against its unreflecting ideology, its uniform methodology, and its exclusive commitment to Western music in the high-art

17. The replies from these institutions to my inquiry (November 1996) included remarks to this effect, but it can also be inferred from the fourth column in table 1.1. At Simpson College and Memorial University, Stefan Kostka's and Dorothy Payne's *Tonal Harmony* was used as a course text; more specifically the last chapter of this book, "An Introduction to Twentieth-Century Practices," only a few pages of which deal with "set theory." Students at Oberlin Conservatory read Joel Lester's *Analytic Approaches to Twentieth-Century Music* (1989), an elementary text discussing other topics as well. In San Diego they did not work with a prescribed course text.

tradition. In this regard, Kerman made no distinction between theory-based analysis and historical musicology:

> Both were well calculated to thrive in the intellectual atmosphere of neopositivism. The appeal of systematic analysis was that it provided for a positivistic approach to art, for a criticism that could draw on precisely defined, seemingly objective operations and shun subjective criteria. (Kerman 1985, 73)

Whatever was new about "New Musicology," it wasn't the opposition to music theory and analysis as an area of specialization. Such opposition is the natural consequence of people claiming for themselves what others consider to be an integral part of their own discipline. The musicologist Richard Taruskin, someone not typically associated with the movement,[18] was equally averse to an *Alleingang* of music theory, as appears from his polemic with Allen Forte about the latter's analysis of *The Rite of Spring* (Forte 1978, 1985, 1986; Taruskin 1979, 1986). His remarks will concern us later (see chapter 7). And no spokesman for the New Musicologists has been more succinct than the composer-theorist George Perle, who characterized pitch-class set theory as "martian musicology" (Perle 1990).[19]

Pitch-class set theory also stands condemned for its failure to explain how music makes sense aurally. We often think that analyses of music should somehow reflect the way in which we hear it, or at least could *learn* to hear it. This is a concern of the music theory teacher, who helps students develop their hearing skills. But it is also a concern of those looking for a basis of scientific verification of analytical theories. A theory that tells us how we *hear* music can, in principle, be tested (that is, if we come to an agreement about who "we" are); a theory that tells us how it has been *conceived* cannot. Now, for a listener-based theory of music to be potentially testable, it should not merely produce interpretations of scores, but should also address the process through which such interpretations come into being.

The composer and researcher Fred Lerdahl has pointed out why pitch-class set theory falls short in this regard. For one thing, "it provides no criteria for segmenting the musical surface into sets" (Lerdahl 1989, 66). Indeed, without such criteria there is no way of knowing with certainty which tones form a meaningful combination. We might only refer to incidental corroborating evidence, such as the resemblance between the opening of Schoenberg's Opus 23, no. 3 and the exposition of a fugue. From this resemblance it follows that the combinations of example 1.1a stand out as important segments of structure. But how have we managed to identify the non-obvious combinations of example 1.1b and 1.1d as

18. Yet, Kerman included his work in an appraisal of some "radical" trends in American musicology around 1990, together with that of Susan McClary, Gary Tomlinson, and Carolyn Abbate. (Kerman 1991)

19. This expression had come to him through a remark of Richard Taruskin.

equally important segments? As said before, this involves a transformation, a reshuffling of the pitch material so as to match it with that of the fugal subject—the "melody"—and its answers. Why do we, as analysts, go to such lengths to show the importance of these non-obvious tone combinations? And in what sense are they important? The same questions apply to our analysis of Stravinsky's "Pas de deux." It is one thing to note and describe the motifs played by the violins in measures 412–13; to divide the accompanying sonic field into two segments that can be reduced to the same abstract forms—as in example 1.2—is quite another. Lerdahl would argue that a listener does not do this; the "hidden substance" of these segments reveals itself to the analyst alone. The latter's work is met with suspicion:

> Practitioners [i.e., analysts] have in effect relied on two external criteria for set segmentation: its "musicality," and its capacity to provide what the theory denotes as significant set relationships. The first criterion is unexplicated, and the second is self-reinforcing. (ibid.)

For this reason, Lerdahl wanted to describe music in terms of a "grammar" that the listener attributes to it. Such a grammar, he thought, was not likely to evolve from the abstractions of pitch-class set theory.

The principal milestone in the history of pitch-class set theory was the publication, in 1973, of Allen Forte's book *The Structure of Atonal Music*. The segmentation problem was immediately noted by William Benjamin in his review of it for *Perspectives of New Music* (Benjamin 1974), and it has remained a potentially fatal issue ever since.[20] It loomed all the larger in view of the scientific spirit with which the theory was suffused. This incongruity must have been deeply worrisome to Lerdahl. The lack of consistent rules for segmentation was not the only thing that bothered him, however. He also questioned the analytical relevance of the concept of a pitch-class set, and of the concepts for *relations* between pitch-class sets. In his view, these concepts did not account for the way in which he believed music (whether it be tonal or atonal) was heard. For example, Lerdahl argued that a pitch-class set does not appear to the listener as such—that is, as a whole to which each member contributes in equal measure. "In a real context,

20. Benjamin's criticism of Forte's approach was diametrically opposed to Lerdahl's. Whereas Lerdahl wanted clear criteria for segmentation in pitch-class set theory, Benjamin found Forte's directions too restrictive: "Forte seems to regard pitches as associated only if they sound simultaneously, form non-overlapping, uninterrupted successions, or are otherwise in close proximity to one another. Notably absent is any basis for the association of [pitch-classes] over longer time-spans, by means of registral distribution, similarity of articulation, or the simple fact that each is somehow emphasized in its own context." (Benjamin 1974, 178–79). Yet, both Benjamin and Lerdahl might be right, the former criticizing Forte's own segmentations, and the latter the informal way in which he has presented this topic in his book.

some pitches are heard as more or less structural than other pitches. Adjacent pitches and chords form relationships that tug and pull at one another" (ibid.). And he could cite a number of publications reporting experiments from which it had appeared that set-theoretical concepts do not inform our hearing, or only to a limited extent.

Lerdahl's proposal for a listener-based theory of atonal music—a theory along the lines developed in *A Generative Theory of Tonal Music* (Lerdahl and Jackendoff 1983)—will not concern us here. Rather, we should ask ourselves whether it is fair to want an analytical theory to be based on the musical intuitions of a listener. Should it pass a "reality check"? Should examples from manuals and textbooks of music analysis—or the observations of music students, for that matter—be rejected or modified when they fail such a check? Quite apart from the question of which form an inquiry into the empirical groundings of the theory should take—a very complex issue[21]—it might simply not be its purpose to match a verifiable reality.

What, then, *is* an analytical theory of music? How does such a theory come into being, and how does it function? To which needs does it respond, and what kind of hold does it have on our musical imagination? In this study, these questions will be addressed regarding pitch-class set theory. If there is one thing that has raised these questions, it is that, in spite of serious criticism, pitch-class set theory has left such a big imprint on music scholarship and music teaching in the United States and beyond. Perhaps paradoxically, we can add the criticism as another measure of its institutionalization. This criticism betrays a deep engagement with the issues that pitch-class set theory has addressed, opening up new avenues of investigation that would have been unthinkable without it.

Aim, Scope, and Structure of this Study

The questions raised above invite a historical and contextual account of pitch-class set theory. Such an account will be provided in this study, which can thus be seen as concerned with the history of music theory. Like the seminal works of this orientation—the narratives of François-Joseph Fétis (*Esquisse de l'histoire de l'harmonie*, 1840) and Hugo Riemann (*Geschichte der Musiktheorie im IX.–XIX. Jahrhundert*, 1898)—it looks at the history of music theory from the vantage point of a contemporary theory. However, it does not see the contemporary theory as the summit or logical end point of that history. Pitch-class set theory does not play the role of Fétis's *tonalité* or Riemann's theory of harmonic functions. It is true that a comparison of the pitch-class set with older musical concepts, such as chords, scales, motifs, or twelve-tone series, reveals

21. See for example Nicholas Cook's summary of the critical reception of Lerdahl's and Jackendoff's *A Generative Theory of Tonal Music* (Cook 1989b, 118–20).

certain similarities; music theory builds on its own legacy. For this reason, the present study describes the evolution of pitch-class set theory with occasional reference to sources from a past more remote than the beginnings of twelve-tone serialism. However, new musical concepts—or modifications of traditional ones—do not only result from a self-generating theoretical discourse on music. And similarities between past and present concepts of musical structure do not always signify lineal relationships. Such relationships can only be ascertained by a careful study of the use of these concepts. Apart from a conceptual history, then, this study offers a view of pitch-class set theory as a construction of its own time; a domain of musical competence that reflects contemporary concerns, interests, and perceptions.

Earlier, I called pitch-class set theory a theory "for atonal music." This does not mean the same as "atonal theory." A more comprehensive body of theory, atonal theory includes, for example, the early attempts to establish a compositional method on the basis of properties attributed to the equal-tempered chromatic scale, by composers such as Josef Matthias Hauer (*Vom Melos zur Pauke,* 1925, and *Zwölftontechnik,* 1926) and Herbert Eimert (*Atonale Musiklehre,* 1924). It also includes the compendia of the harmonic and melodic resources contained in the twelve-tone universe (from the writings of the nineteenth-century French music theorist Anatole Loquin to Howard Hanson's *Harmonic Materials of Modern Music,* 1960). And it includes the manuals and theories of twelve-tone serialism (e.g., Ernst Krenek's *Studies in Counterpoint,* 1940, Eimert's *Lehrbuch der Zwölftontechnik,* 1950, and Babbitt's articles on combinatoriality).

What all these theoretical works have in common is the idea of a tonal equilibrium that allows any combination of tones to be formed in both the horizontal and vertical dimensions. Any rule imposed on the combination of tones is *contextual*—that is, it pertains to a single work.[22] (The most obvious example is a twelve-tone series serving as the referential structure for only one composition.) However, work-specific rules can be subsumed under general principles of organization (such as the principle of serial organization). The more elaborate atonal theories deal with such principles. This is a very broad delineation of the scope of atonal theory; it even allows us to analyze *tonal* music from an atonal perspective. In such a case, the tonal equilibrium is not what the music achieves, but what the theory takes as its starting point. David Lewin's theory of transformations can be seen as a late outgrowth of atonal theory that has taken a portion of the tonal repertoire under its wings, especially music of the late nineteenth century (*Generalized Musical Intervals and Transformations,* 1987).

22. This use of the word "contextual" was introduced by Milton Babbitt: "Contextuality . . . has to do with the extent to which a piece defines its materials within itself" (Babbitt 1987, 167). Its antonym is "communal," a word referring to materials that many musical works share, such as the triadic structures and progressions of tonal music.

How should we distinguish pitch-class set theory from other varieties of atonal theory? This is not immediately obvious. First, as noted before, the concept of a "set" was already in use for the analysis of serial music. Second, pitch-class set theory was never introduced under this name. In 1964, in an article for *Journal of Music Theory,* Allen Forte presented what he called a "theory of set-complexes for music." This theory was not designed for the mere description of the structure of atonal music in terms of pitch-class sets and their various associations, even though a considerable part of the article dealt with just that topic. It was the statement of an organizational principle connecting various, if not all, major pitch-entities in an atonal work: the "[pitch-class] set complex." This is a special case of a "family" of pitch-class sets, something in which Forte took a particular interest. In *The Structure of Atonal Music,* he developed the idea further, convinced of its significance as a model for the pitch organization of movements or entire compositions. And in 1988 he advanced an alternative type of family: the pitch-class set "genus."

Almost one half of *The Structure of Atonal Music* deals with the pitch-class set complex. However, this has not proven the most durable part of this otherwise very influential book. In 1997, the composer and theorist Robert Morris, an advocate of the idea, noted that it had fallen, "if not by the wayside, at least in frequency of use" (Morris 1997, 275). The pitch-class set complex did not turn up in two successful, pedagogically inspired textbooks of pitch-class set theory: John Rahn's *Basic Atonal Theory* (1980) and Joseph Straus's *Introduction to Post-Tonal Theory* (1990), both of which are prominent in the fourth column of table 1.1.

For the present study it is important to note that *The Structure of Atonal Music* only represents a phase in the development of pitch-class set theory. Not every part of the theory is contained in Forte's book; nor has every chapter of this book been of lasting influence. Pitch-class set theory is represented by a literature stretching from 1945 to the present day, with the years between 1960 and 1990 forming a period of crystallization and consolidation.

The focus of chapters 2 through 6 will be on pitch-class set theory's conceptualization of musical structure. These chapters trace the path that led to the definition of musical elements, sets, operations, and relations. Notwithstanding its mathematical vocabulary, pitch-class set theory should be treated as the product of, and the basis for, a music-theoretical discourse. It is not a mathematician's theory of post-tonal music, but an invention of composers and music theorists. Therefore, it is appropriate for someone undertaking an inquiry into the rise and development of pitch-class set theory to determine how its conceptual apparatus relates to music history and the history of music theory; to ask, first, what it has adopted from older theory and what it has added to it, and, second, which cues it has taken from the repertoire and which constraints it has imposed on its interpretation. It goes without saying that such an inquiry should also include influences from outside the realm of music, such as from mathematics; and

should critically address the interaction of mathematical and musical concepts. These principles guide the discussion in chapters 2 through 6.

Having placed pitch-class set theory historically this way, we are left with the question of purpose and pragmatics. Chapter 7 ("Blurring the Boundaries: Analysis, Performance, History") broadens the horizons to discuss music analysis, not as the cool, taxonomic study of musical artworks, but as an activity representing music in the here and now, like performance; an activity driven by its own contemporary agenda, which it finds mirrored in the music around which it revolves. As a theory for analytical practice, pitch-class set theory came about because it provided answers to questions of its time. What were these questions, and where did they come from? Chapter 8 ("Mise-en-Scène") relates the theory to some crucial aspects and changes of its environment: to the impact of the computer on the study of music, and to the American university in its double role as protector of high culture and provider of mass education. And it acknowledges that, ultimately, individuals infused it with the sense of urgency that made it thrive.