A Transformation Approach to Collection and Mode in the Music of Béla Bartók

Kris Shaffer
Yale University

Music 980a
Prof. David Clampitt
15 December 2005

Over the past several decades, many theorists have hypothesized on the essence of Béla Bartók's musical style. Many of those theorists—among them, Eliott Antokoletz, Ernö Lendvai, George Perle, and Leo Treitler—addressed the issue of recurring collections in Bartók's music, and there is agreement among them regarding a significant portion of what I will call *primary collections* in Bartók's music. However, there are several collections concerning which there is disagreement. More significant is the fact that there is little to no consensus concerning the reasoning behind the primacy of certain collections in Bartók's music. This may in part be due to the limitations of traditional post-tonal analysis and the T_n and I_n operations, and their lack of ability to sufficiently explain relationships between different set classes. It may also in part be due to the analytical bias underlying the work of certain theorists, which has caused some to favor certain collections over others for reasons foreign to the music of Bartók. However, by applying principles of transformational theory (following Lewin, Gollin and others), one can more systematically explore the relationships between these different collections. Thus, in this paper, I will take a critical view of the choices of primary collections made by the aforementioned theorists, and apply transformational analytical concepts in order to attempt to answer the following questions:

- What are the primary collections in Bartók's music?
- What properties, if any, do the primary collections share?
- What are the potential transformations between the primary collections?
- How are these relationships and transformations manifest in the literature?

This transformational approach not only allows one to sift out collections of less universal significance from the body of analytical work, but it does so in a way that privileges on the abstract level the kind of musical relationships and transformations which Bartók clearly valued on the surface and structural levels of his compositions.

What Are the Primary Collections?

In the 1950s, three key theorists weighed in on the idea of primary collections in Bartók's music. In 1955, George Perle coined the terms "set X" and "set Y," referring to the (0123) and (0246) tetrachords, respectively.[1] In 1959, Leo Treitler extended this selection of sets to include set "Z," the (0167) tetrachord, which—according to his analysis—plays a vital role in the fourth quartet in its relationship to X and Y, but also plays a greater role in Bartók's repertoire as a subset of the octatonic scale.[2]

While these three tetrachords occur frequently on the surface of Bartók's music, only the Z-cell regularly plays an important structural role. Also, of these three, only the Z-cell is given any significant sense of primacy in the work of other Bartók theorists. For these reasons, it is safe to rule out the X and Y cells for primary collection consideration at this point; though the transformational interpretation will confirm this later, as well.

At roughly the same time as Perle and Treitler were writing their Bartók analyses (1957), Ernö Lendvai authored *Béla Bartók, Weg und Werk, Schriften und Briefe* (later translated into English as *Béla Bartók: An Analysis of His Music*), in which he noted two separate tonal systems in Bartók's music, one chromatic, based—according to Lendvai—on the Fibonacci sequence (and

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1. George Perle, "Symmetrical Formations in the String Quartets of Béla Bartók," in *Music Review* 16 (1955), cited in Elliott Antokoletz, *The Music of Béla Bartók: A Study of Tonality and Progression in Twentieth-Century Music* (Berkeley: University of California Press, 1984), 69.
2. Leo Treitler, "Harmonic Procedure in the *Fourth Quartet* of Béla Bartók," in *Journal of Music Theory* 3, no. 2 (1959): 292-298.

thus the Golden Section), and one based on the diatonic tonal system. The collections at play in the Fibonacci system included the octatonic scale (the 1:2 model), the hexatonic scale (the 1:3 model), and the (0167) tetrachord (the 1:5 model, or again, the Z-cell).[3] Of these three, the 1:2 model was given "greatest importance."[4] Lendvai, like Treitler, also noted the subset-superset relationship between the 1:2 and 1:5 models. These three collections were part of Lendvai's "chromatic system," which also included five sonorities labeled α through ε. However, the α chord is merely a reproduction of the 1:2 model (arranged in a symmetrical fashion which highlights the GS intervals), and the others are subsets of α; thus, for our purposes, these five sonorities can be subsumed by the octatonic scale.

Lendvai's "diatonic system," on the other hand, gave primacy to the acoustic scale (i.e., the major scale with a raised-fourth and lowered-seventh), not the diatonic. His justification was that "Bartók's diatony is simply an exact and systematic *inversion* of the laws of his chromatic technique, i.e. the GS rules,"[5] and demonstrated this by—among other things—showing that "these two spheres of harmony complement each other to such measure that the chromatic scale can be separated into a GS sequence and an acoustic scale."[6]

Lendvai also mentions the pentatonic scale and the collections equally dividing the octave as significant, but they are considered of less importance than those more closely tied to the Golden Section.

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3. Ernö Lendvai, *Béla Bartók: An Analysis of His Music* (London: Kahn & Averill, 1971), 51 ff.
4. Ibid., 55.
5. Ibid., 67.
6. Ibid., 70.

Though a number of theorists have called into question Lendvai's bias towards the Golden Section and its manifestation, as he presents it, in Bartók's music, subsequent theorists tend to agree with the ubiquity of the octatonic scale, the acoustic scale, the Z-cell, and—to a lesser extent—the hexatonic scale. However, the GS-bias causes Lendvai to overlook several other collections which are not only prominent in the literature, but which also share some key structural properties with the collections he highlights.

Elliott Antokoletz brings these collections to light in *The Music of Béla Bartók: A Study of Tonality and Progression in Twentieth-Century Music*.[7] In addition to Lendvai's three models, the acoustic scale, and the pentatonic scale, Antokoletz cites many examples of diatonic (both tonal and modal) and other folk modes, as well as whole-tone collections and their subsets. Lacking the GS-bias, Antokoletz spends a considerable amount of time on folk modes[8], with which Bartók was familiar, and on the "interaction of diatonic, octatonic, and whole-tone formations."[9] On the smaller scale, Antokoletz does give primacy to the Z-cell. However, the X-cell is mentioned with little relative frequency, and the Y-cell is often treated as a subset of the whole-tone collection.

Taken together, the primary collections of greatest significance are the octatonic collection and its subset, the Z-cell. Shortly following in significance are the diatonic, acoustic, pentatonic, and whole-tone collections. On the borderline of primacy is the hexatonic collection. I will include it because it occurs with some frequency, and because it shares

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7. Elliott Antokoletz, *The Music of Béla Bartók: A Study of Tonality and Progression in Twentieth-Century Music* (Berkeley: University of California Press, 1984).

8. Ibid,, chapters II-III, pp. 26-66.

9. Ibid., chapter VII, pp. 204-270.

significant structural principles with the octatonic collection and the Z-cell; however, I do so with some hesitation because of the secondary role it plays relative to the other primary collections.

What properties, if any, do the primary collections share?

To answer this question, a transformation-theoretical approach is very helpful. It reveals three types of symmetrical structure at play amongst the primary collections, which I will flesh out over the next few pages. The first structure employs inversional symmetry about one axis, but no rotational symmetry. The second structure employs both inversional and rotational symmetry, where the total number of symmetrical permutations is equal to the cardinality of the collection (half are inversional axes, half are rotational permutations); these collections exhibit simple transitivity with a dihedral group. The third structure is pan-symmetrical (i.e., the number of inversional axes is equal to its cardinality, as is the number of rotational permutations), employing an equal division of the octave.[10] Thus the primary collections can be divided into three categories:

- **the natural and traditional scales (i.e., the acoustic, diatonic and pentatonic scales)[11]**
  inversional symmetry only
- **collections that exhibit simple-transitivity with a dihedral group (i.e., the octatonic and hexatonic scales, the Z-cell)**
  inversional and rotational symmetry

10. This category is rather trivial, in that it only contains one primary collection: the whole-tone collection. The greater significance of the whole-tone collection over other equal-division collections (i.e., (0369), (048), and the full chromatic scale) will be discussed later.

11. The "natural scale" (e.g., C D E F-sharp G A B-flat) is thus called because it is derived from the overtone series, or the Chord of Nature. The term "traditional scale" applies to the diatonic and pentatonic scales, from which the traditional tonal system and many folk modes are derived.

- **the whole-tone collection and its subsets**
  pan-symmetrical

All of the primary collections—as well as the collections which I ruled out previously—exhibit inversional symmetry. The difference is in the degree of inversional symmetry and the presence or absence of rotational symmetry. Also of note is the fact that the first two categories are analogous to the two types of tonal centricity in Bartók's music: the traditional tonal scale built up from a pitch-class and the symmetrical arrangement around a centric pitch or pitch-class (this dichotomy is noted by both Lendvai[12] and Antokoletz[13]). I will now examine each these categories in greater detail.

The Natural and Traditional Scales

The chief collections in this category are the acoustic, diatonic, and pentatonic scales (the pentatonic being a subset of both the acoustic and diatonic scales). All three share an inversionally symmetrical structure, which can be easily seen in $_{\text{mod}}12$ chromatic pitch-class space and on the line of fifths.

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12. Ernö Lendvai, *Béla Bartók: An Analysis of His Music* (London: Kahn & Averill, 1971), 74.
13. Elliott Antokoletz, *The Music of Béla Bartók: A Study of Tonality and Progression in Twentieth-Century Music* (Berkeley: University of California Press, 1984), 138.

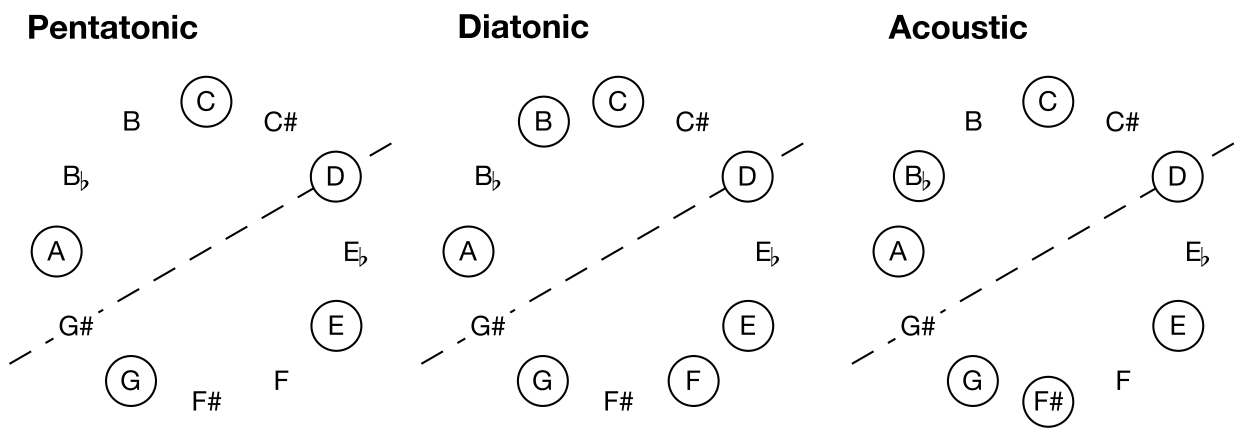

Figure 1: Inversional Symmetry of the Natural and Traditional Scales

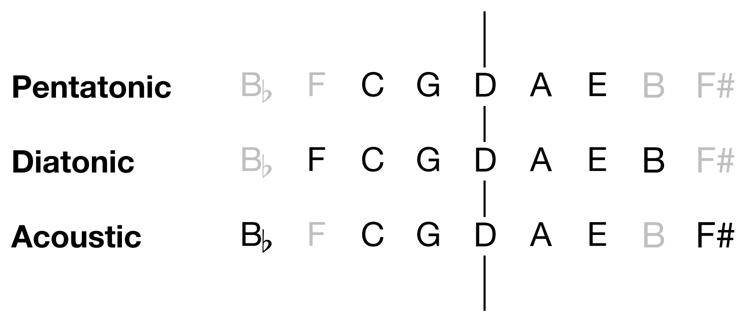

Figure 2: Symmetry of Natural and Traditional Scales on the Line of Fifths

The difference between diatonic and acoustic can be most clearly seen on the line of fifths. Where the diatonic scale continues (after the pentatonic) in a series of contiguous fifths away from the axis, the acoustic scale leaves a gap on either side of the pentatonic collection. Thus, though all three share inversional symmetry, the the acoustic scale does not retain the well-formedness (after Carey and Clampitt) of the other two.[14] Thus, where there a fifth transposition of the pentatonic or diatonic scale yields a parsimonious move to another

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14. C.f. Norman Carey and David Clampitt, “Aspects of Well-Formed Scales,” in *Music Theory Spectrum* 11, no. 2 (1989), 187-206.

pentatonic or diatonic scale, respectively[15], that is not the case with the acoustic scale. In fact, there is no such parsimonious move from one acoustic scale to another.

Collections That Exhibit Simple-Transitivity With a Dihedral Group

As previously noted, Lendvai grouped the octatonic scale, the hexatonic scale, and the Z-cell together as collections which "arise from the periodic repetition of intervals 1:5, 1:3, and 1:2."[16] Because of their "periodic repetition," these collections exhibit some interesting properties.

First, all three have intervallic structures analogous to each other: namely, alternation of a semitone and one other interval, such that the cycle repeats periodically at the sum interval of the pattern (i.e., model 1:5 is periodic at ic6, 1:3 at ic4, 1:2 at ic3) and periodically at the octave, allowing it to work in both pitch space and in $_{mod}12$ pitch-class space.

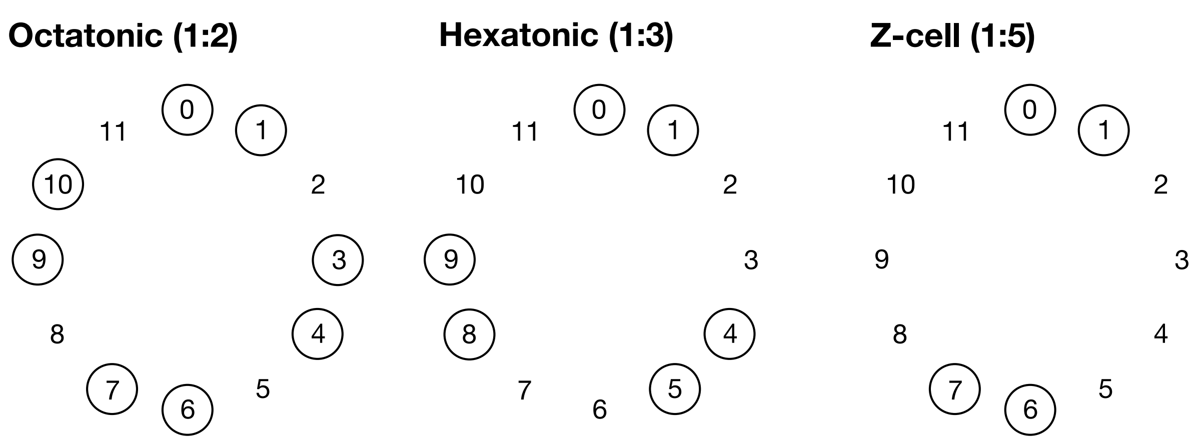

Figure 3: Dihedral-Group Collections

15. That is, moving one pitch-class by semitone while all others remain constant.
16. Ernö Lendvai, *Béla Bartók: An Analysis of His Music* (London: Kahn & Averill, 1971), 51.

This periodicity generates rotational symmetry in each collection under T_n operations, where n represents every multiple of the sum interval ${}_{\text{mod}}12$. The number of T_n operations which preserve the collection is equal to half the cardinality of the collection (including the identity operation, T_0). For example, the T_n operations which preserve the octatonic collection are T_0, T_3, T_6, and T_9.

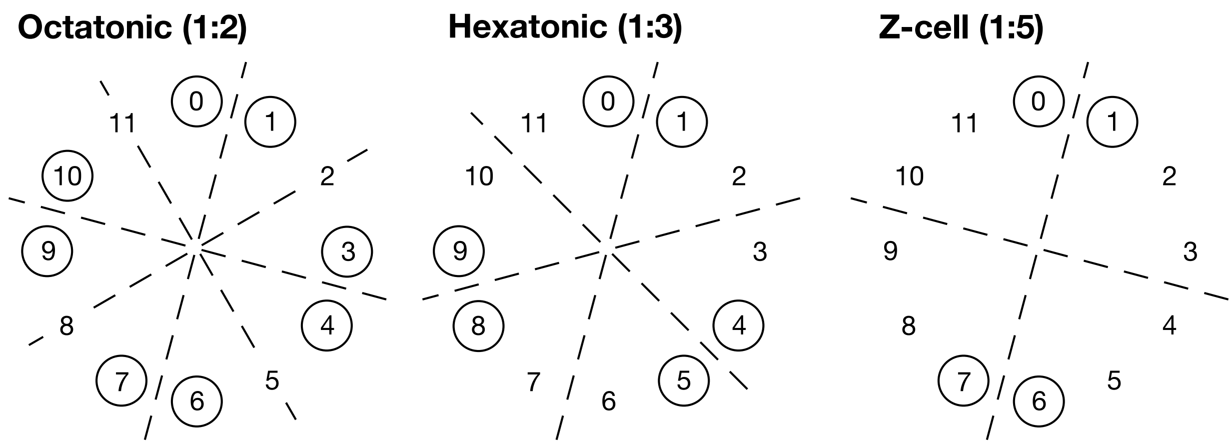

Figure 4: Inversional Symmetry of Dihedral-Group Collections

This periodicity also generates inversional symmetry about the median points between members of the collection which are adjacent in ${}_{\text{mod}}12$ pitch-class space. Thus, there are collection-preserving I_n operations, where n equals the sum of any two adjacent pitches in the collection ${}_{\text{mod}}12$. Since the inversional axes of these symmetrical transformations are tritone axes, and are thus periodic at the tritone (in addition to the octave), the number of inversional transformations which preserve one of these collections is equal to half the cardinality of the mode. Thus the I_n operations which preserve the C-D-flat octatonic collection are I_1, I_4, I_7, and I_{10}.

Taken together these T_n and I_n operations form a non-commutative group of operations of equal cardinality to the collection in question, and which acts simply transitively on the collection.[17] Additionally, this group is a *dihedral group*, which Edward Gollin defines as "a group that is isomorphic to the n rotations and n reflections that preserve the symmetry of a regular n-gon."[18] He gives the example of a square which alternates four corners with four sides, and which has four rotations and four reflections which preserve symmetry. The octatonic scale is isomorphic to the square in that it alternates four semitones and four whole-tones, and has four rotations and four reflections which preserve its symmetry.[19]

There is another kind of non-commutative dihedral group which acts simply transitively on these three collections (and forms a GIS with composition of functions): one equal or analogous to David Lewin's Q/X group of octatonic operations from Appendix B of GMIT.[20]

While these Q/X groups—like the T_n/I_n groups—also emphasize the rotational and inversional symmetry of these collections, the Q/X groups—unlike the T_n/I_n groups—do not preserve intervals in all cases. Within the subsets which divide the octave equally—(0369) for octatonic, (048) for hexatonic, (06) for the Z-cell—intervals are preserved; outside those set-

17. In fact, this group with composition of functions forms a Generalized Interval System with the collection (set), as defined in David Lewin, *Generalized Musical Intervals and Transformations* (New Haven: Yale University Press, 1987).

18. Edward Gollin, "Some Unusual Transformations in Bartók's 'Minor Seconds, Major Sevenths'" in *Intégral* 12 (1998), 25-51.

19. The hexatonic scale is isomorphic to the triangle, and the Z-cell to the line segment (which has two ends and two "sides").

20. David Lewin, Generalized Musical Intervals and Transformations (New Haven: Yale University Press, 1987), 251-253; and Edward Gollin, "Some Unusual Transformations in Bartók's 'Minor Seconds, Major Sevenths'" in *Intégral* 12 (1998), 25-51.

classes, intervals change, allowing the Q/X-analogous group of operations to govern movement between subsets of differing set-classes.

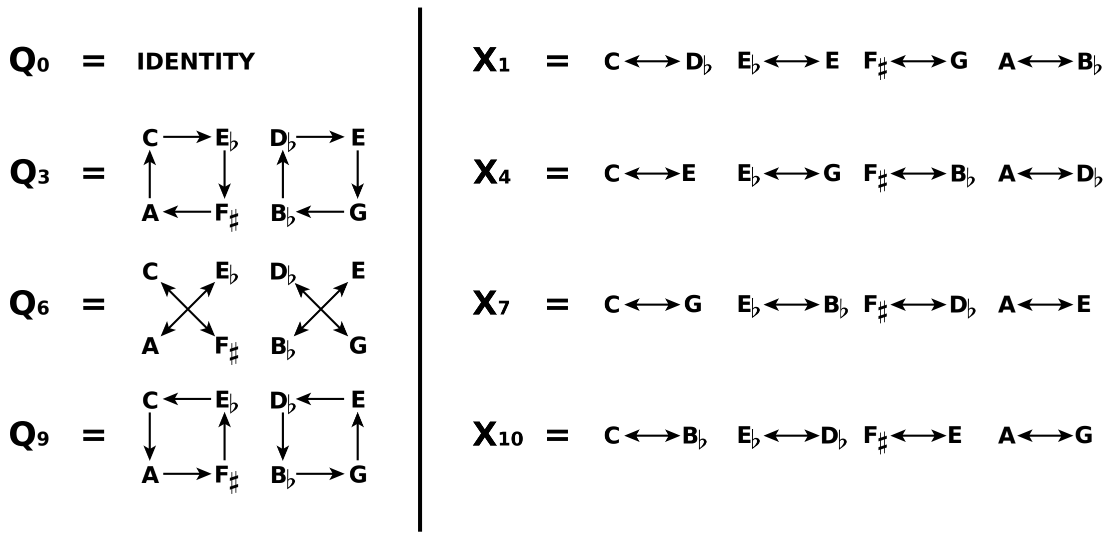

Figure 5: Octatonic Q/X Dihedral Group

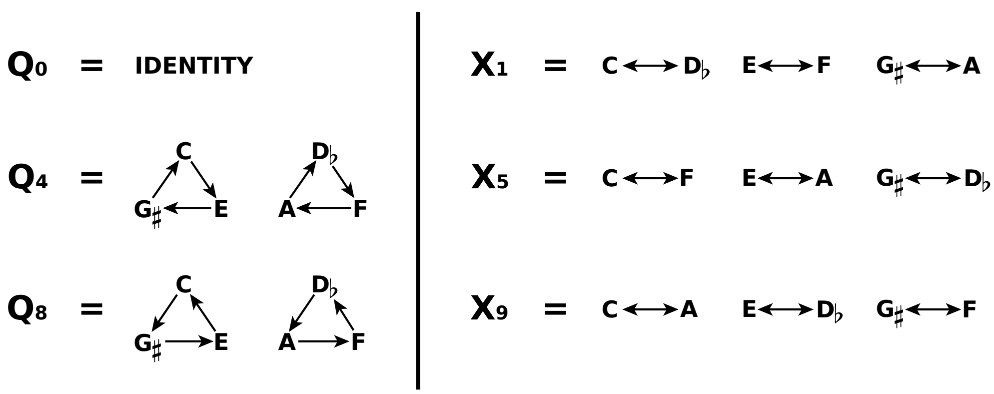

Figure 6: Hexatonic Q/X Dihedral Group

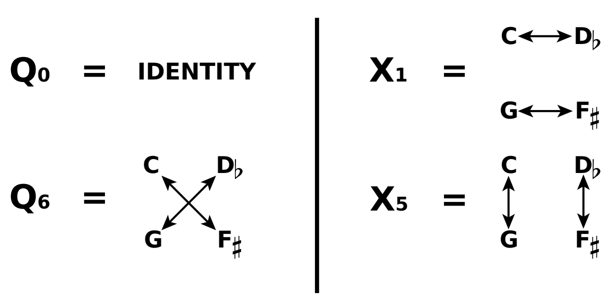

Figure 7: Z-cell Q/X Dihedral Group

As Bartók's music often focuses on the subsets of these collections, the Q/X operations offer valuable insights into Bartók's use of these collections, particularly the octatonic.[21] Additionally, the Q/X operations have the advantage that many Lewinian transformations have over T_n/I_n operations: the index numbers of the transformations do not change with transposition. Previously, when I listed the I_n operations for the octatonic scale, I had to declare which octatonic scale I was discussing (this is not necessary for T_n operations, however). But with the Q/X operations, the index *n* for the X_n operations (which are the reflexive transformations, analogous to I_n) declares the interval which is being exchanged. Thus X_4 always exchanges pitches ic4 apart, regardless of what pitch-classes are involved. All analytical implications being equal, the nomenclature of the Q/X operations makes them of more practical use for abstract theoretical discussions than the T_n/I_n labels.

At this point, one must ask if there are collections other than Lendvai's three models which exhibit these properties; and if there are others, are they also common in Bartók's music? The answer to both questions is yes. Though Lendvai's three models exhaust the collections which alternate a semitone with one other interval and do so with octave periodicity, there is one other collection which alternates two intervals in a cycle that has octave periodicity: the (0268) or French-sixth tetrachord, which alternates ic2 and ic4. This tetrachord is also exhibits simple transitivity with two dihedral groups (one T_n/I_n group and one Q/X group), and those groups are, in fact, isomorphic to the dihedral groups which act simply transitively on the Z-cell.

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21. Edward Gollin's aforementioned article offers a more detailed explanation of this property of the Q/X operations.

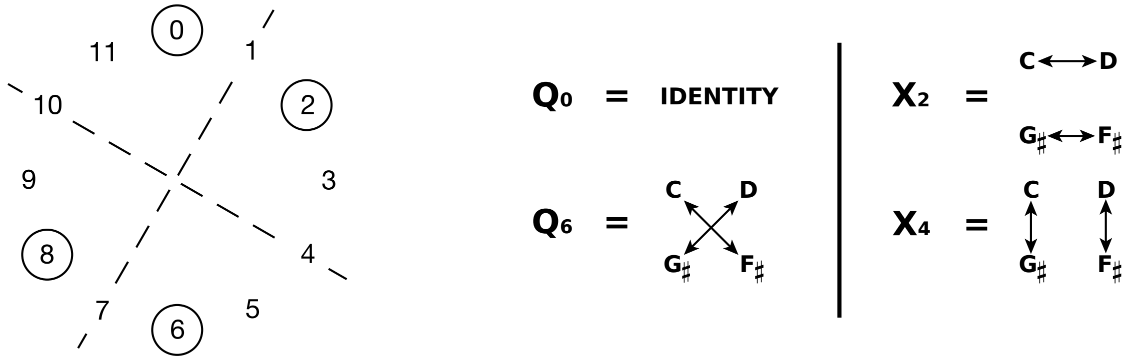

Figure 8: French-sixth Collection and its Q/X Dihedral Group

Lendvai overlooks this collection in his analysis not because this collection is uncommon in Bartók's music (it is at least as common as the hexatonic, likely moreso). Rather, he overlooks it for the same reason he focuses on the acoustic scale as the foremost collection in the "diatonic" system: the Golden Section. Apart from the Golden Section, the relationship of the octatonic, hexatonic, and Z-cell remain, as I have shown, but not exclusively so; the French-sixth must be considered alongside the other three. Not only does it share the properties illustrated above, and not only is it common in the literature, but it is both an octatonic subset and a whole-tone subset. Thus it has potential to serve as an important link between the dihedral-group collections and the whole-tone collection.

The Whole-Tone Collection and its Subsets

The whole-tone collection is pan-symmetrical, as is any collection which divides the octave equally. The cardinality of the collection is the equal to the number of rotational permutations which preserve the collection, and it is also equal to the number of inversional permutations which preserve the collection. This pervasive symmetry—among other reasons—makes the whole-tone collection less useful in melodic construction or the establishment of a tonal center than the other aforementioned collections, especially those which are well-formed. However, it makes the collection very useful as a bridge between other collections—similar to the role that the equal-division set-classes (048) and (0369) fill in the "cube dance" and "power towers" of Douthett and Steinbach[22,23]—and Bartók capitalizes on this when he uses the whole-tone collection in his compositions.

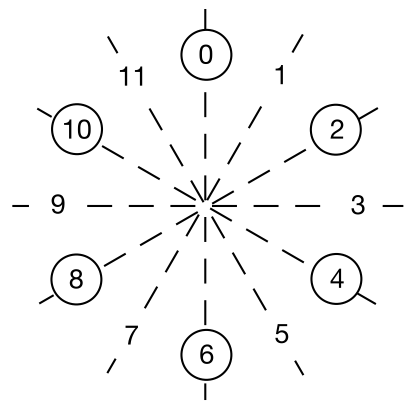

Figure 9: Whole-Tone Collection and its Axes of Symmetry

Subsets of the whole-tone collection also exhibit this potential for bridge functionality, but because they are not as homogenous as the whole-tone collection, they make better candidates for melodic material (this principle also applies to other highly symmetrical collections, like the dihedral-group collections). The most notable of these subsets in Bartók's music are the Y-cell (0268), the French-sixth sonority (0268), set-class (026), and the whole-tone pentachord (02468).

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22. Jack Douthett and Peter Stenbach, "Parsimonious Graphs: A Study in Parsimony, Contextual Transformations, and Modes of Limited Transposition," in *Journal of Music Theory* 42, no. 2 (1998), 241-263.

23. It is interesting to note the role that the dihedral-group collections play in Douthett and Steinbach's study of parsimony (and Richard Cohn's, as well), as their equal-division chords act not only as bridges, but as bridges between dihedral-group collections, which are, in turn, pitch aggregates of sets of diatonic-based chords; thus, their system provides another abstract relationship between the three categories of symmetrical collections discussed in this paper.

What are the potential transformations between the primary collections?

Because these three categories of primary collections all exhibit some degree of inversional symmetry, and because within the categories the collections are constructed by similar means, there exist some interesting symmetrical transformations between certain pairs of primary collections.

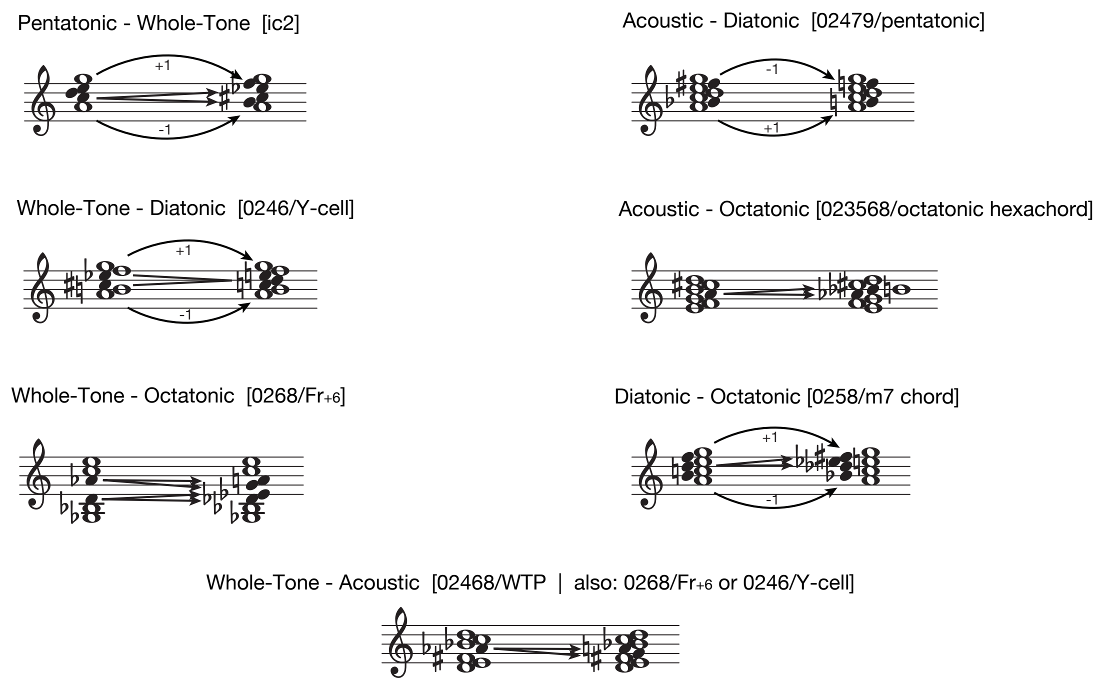

Figure 10: Some Symmetrical Transformations Between Primary Collections

Figure 10 gives the shortest-distance (i.e., most parsimonious) symmetrical transformation between pairs of primary collections of cardinality 5 or greater[24] (excluding simple subset-superset relationships like pentatonic to diatonic or acoustic), where such a symmetrical

24. I have limited this discussion to collections of cardinality 5 or greater for two main reasons: 1) the tetrachordal primary collections are both subsets of one or more of the larger primary collections; and 2) for that reason, they tend to function differently in Bartók's music than the larger collections, as will be seen shortly.

transformation is possible using only semitone motion.[25] Open noteheads are common tones, and filled noteheads denote pitch-classes which move.

There are two key voice-leading moves in these transformations. For a pair of primary collections of the same cardinality, non-common tones move in a voice-leading wedge: if one pitch-class moves by semitone, its inversional complement moves by semitone in the opposite direction, preserving the symmetry of both collections around the same axis. Where the two collections differ in cardinality, there may or may not be a wedge, but there are always one or more split functions (the difference in cardinalities equals the number of split functions required): one pitch-class splits to two pitch-classes a semitone higher and lower, which form ic2. Its inverse operation would involve two pitch-classes a tone apart converging to the pitch-class between them.

As these transformations demonstrate, when one symmetrical collection is transformed via symmetrical voice-leading into another symmetrical collection sharing the same axis, the set of pitch-classes common to both collections must also be inversionally symmetrical about the same axis. On figure 10, these common subsets are notated with open noteheads, and their label is given in brackets above the example. It is in this role that the primary collection tetrachords (along with other key tetrachord subsets of the larger primary collections) find their greatest utility in Bartók's music.

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25. It should be noted that the hexatonic scale is the only primary collection which does not participate in a symmetrical transformation with one of the other primary collections, though there are some interesting non-symmetrical transformations involving the hexatonic scale.

One also begins to see clearly the potential for the whole-tone collection and its subsets to act as bridges between the other primary collections. The whole-tone can engage in a symmetrical wedge/slide transformation with any of the other large primary collections (i.e., primary collections of cardinality 5 or greater), except for the hexatonic scale, which cannot engage in such a transformation with any of the other primary collections. Additionally, many whole-tone subsets can be commonly found in the other large primary collections. In particular, of three key whole-tone subsets—(026), the Y-cell (0246), and the French-sixth (0268)—at least two can be found in every large primary collection except the two which are least common in Bartók's music: the hexatonic and the pentatonic scales (and since the pentatonic is a subset of both the diatonic and acoustic scales, which each contain several whole-tone subsets, the connection between whole-tone and pentatonic can be made without much difficulty).

The acoustic collection also exhibits similar transformational possibilities. Like the whole-tone collection, it can engage in a symmetrical wedge/slide transformation with any of the other large primary collections (except the hexatonic). Additionally, it contains many subsets which typically imply whole-tone, diatonic, or octatonic (such as (0246), (0268), (0134), (0358), et al.). Thus its significance in the compositions of Bartók can be better explained by its transformational potential with the other primary collections than by any Golden Section or Fibonacci theory, and it can do so without compromising the significance of the diatonic collection.

Because of the versatility (and the resulting ambiguity) of the whole-tone and acoustic collections and their subsets, Bartók frequently uses whole-tone and acoustic music as pivotal material in his compositions. Acoustic scale material is often extended or transformed into other primary collections; whole-tone fragments also frequently bridge other primary collections, even when there is a strong symmetrical relationship between those primary collections. In fact, these relationships are so common that Antokoletz dedicates roughly one-fifth of his book to the interaction of the whole-tone, acoustic, octatonic, and diatonic collections.[26] With that in mind, I will now attempt to answer the final question posed at the beginning of this paper by exploring some of Bartók's compositions which are cited by Antokoletz in his discussion regarding the relationships between these primary collections.

How are these relationships and transformations manifest in the literature? Part I: The Whole-Tone Collection

As previously mentioned, pan-symmetrical collections do not lend themselves well to interesting melodic formations or, especially, to the establishment of a tonal center. However, because of its ambiguity, the whole-tone is a prime candidate for a multitude of transformational possibilities. To reconcile these two issues, Bartók frequently uses whole-tone subsets, such as a gapped Y-cell (set-class (026)), to achieve both ambiguity and melodic interest.

For example, Antokoletz's analysis of Bartók's Bagatelle No. IX demonstrates use of the gapped Y-cell (the cell which receives prominence at the piece's opening) to spawn both whole-tone and octatonic extensions at significant cadential moments.[27] For instance, in bars 4-5, the gapped Y-cell [E-flat, G, A] is extended by the dyad [C-sharp, E-sharp] to form a whole-tone

26. Elliott Antokoletz, *The Music of Béla Bartók: A Study of Tonality and Progression in Twentieth-Century Music* (Berkeley: University of California Press, 1984), 204-270.

27. Ibid., 212-213.

pentachord [C-sharp, E-flat, E-sharp, G, A]. In bars 17-18 of the first variation, however, the gapped Y-cell [D, F-sharp, G-sharp] is extended to a complete octatonic collection [D, E-flat, F, F-sharp, G-sharp, A, B, C]. According to Antokoletz, "such links appear to be a primary means of melodic progression throughout this as well as other bagatelles."[28]

This gapped Y-cell can extend to more than just whole-tone and octatonic collections. For instance, at the end of the third movement of the Fourth String Quartet, Bartók extends the gapped Y-cell [D, E, G-sharp] to a complete diatonic collection [A, B, C-sharp, D, E, F-sharp, G-sharp].[29] This cell can also extend to the acoustic scale, as the whole-tone pentachord (which it produces in Bagatelle No. IX) is a subset of both the whole-tone and the acoustic collections.

The complete Y-cell is another whole-tone subset useful for generating other primary collections. It is clear how the Y-cell can be extended in the above fashion to generate the whole-tone, diatonic, or acoustic scales. However, more interesting is the way in which Bartók uses two Y-cells a fifth apart to generate a dual-diatonic system.[30] The whole-tone scale, and thus the Y-cell, can be viewed as every-other-note of the chromatic scale. However, in pitch-class space, it can also be viewed as every-other-note of the circle of fifths. Thus, two Y-cells a fifth apart generate eight contiguous members of the circle of fifths, or two diatonic collections a fifth apart.[31] Even better is the fact that the boundary notes of two Y-cells a fifth apart (and thus the boundary notes of the two diatonic collections on the circle of fifths) yield a Z-cell. Thus in

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28. Ibid., 213.
29. Ibid., 235.
30. Ibid., 229 ff.
31. In light of the properties observed concerning the diatonic and acoustic scales on the circle of fifths, this dual-diatonic collection can play an interesting role in the relationship of diatonic to acoustic.

one network, the Z-cell, Y-cell, and diatonic collections (and potentially the octatonic and whole-tone collections, by implication of the Z- and Y-cells) come together.

An example of this can be seen in Antokoletz's analysis of the first movement of Bartók's Fourth String Quartet, bars 40-42.[32]

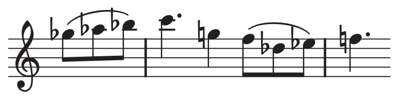

Figure 11: Fourth String Quartet, I., mm. 40-42, Violin I

Here two Y-cells—[G-flat, A-flat, B-flat, C] and [G, F, E-flat, D-flat]—are bound by the Z-cell [G-flat, G, C, D-flat] and produce the dual-diatonic collection [G-flat, D-flat, A-flat, E-flat, B-flat, F, C, G], D-flat major overlapping A-flat major.

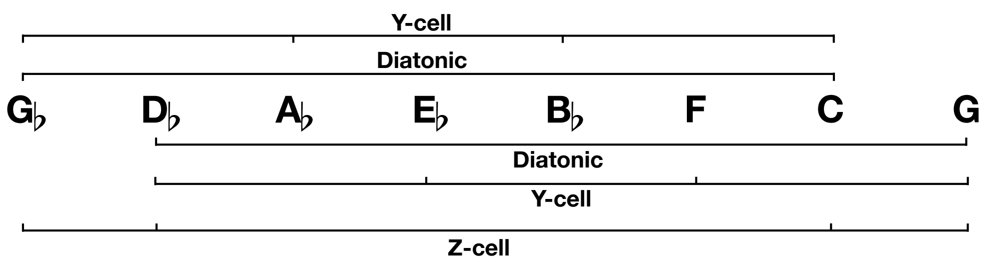

Figure 12: Overlapping Y-cells on the Circle of Fifths and the Dual-Diatonic Collection

Though this example may seem extreme, its construction in the musical foreground is very salient, and it clearly portrays the synergy possible between the primary collections when they are extended only slightly.

32. Elliott Antokoletz, *The Music of Béla Bartók: A Study of Tonality and Progression in Twentieth-Century Music* (Berkeley: University of California Press, 1984), 229-230.

How are these relationships and transformations manifest in the literature? Part II: The Acoustic Collection

Unlike the pan-symmetrical whole-tone collection, the acoustic scale contains only one axis of inversional symmetry and no axes of rotational symmetry. Thus, its potential for interesting melodic construction, and especially its potential ability to establish a tonal center, is much greater than the whole-tone collection. It, therefore, more often appears in its complete form, and its transformational potential (not any tonal ambiguity, like the whole-tone) is the driving force behind its utility.

Bartók's *Cantata Profana* is a wonderful example of this collection's utility, not only on an analytical level, but on a dramatic level as well. Antokoletz does a good job of tracing this collection's metamorphosis through the work, and noting the parallel transformations in the drama, but he strangely does not recognize this collection as an acoustic collection. I will now walk through his analysis,[33] noting elements of transformational interest.

Cantata Profana is based on Rumanian folk song texts, and thus the the predominant mode in question, according to Antokoletz, is a folk mode: [D, E, F, G, A-flat, B-flat, C]. Though Antokoletz does not point it out, this is a rotation of the acoustic scale, which typically with these pitches would find its tonal center on B-flat. Of course, the most characteristic element of the folk mode is the diminished fifth scale degree, which is not present in the acoustic collection's typical ordering.

33. Ibid., 241-246.

The dramatic elements which concern this analysis are simple. A group of brothers is hunting, following the tracks of a stag. During the course of their hunt, they are transformed into stags, after which they then wander the forest.

The drama begins on the aforementioned folk mode. According to Antokoletz, during the part of the work where the brothers are transformed into stags, two key modal transformations occur. First, the original acoustic mode is transformed into an octatonic collection. This is a symmetrical split, exactly like the abstract model given above for a symmetrical transformation between acoustic and octatonic:

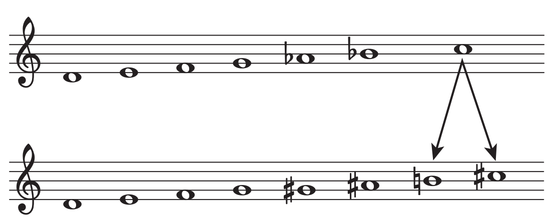

Figure 13: Acoustic-Octatonic Split

Secondly, Antokoletz notes that the original acoustic mode is transformed into a diatonic collection (F Aeolian). Though this does not utilize the symmetrical model given above, this transformation embodies a smooth, asymmetrical double-semitone-slide:

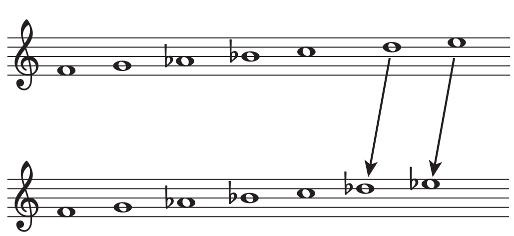

Figure 14: Acoustic-Aeolian Double-Slide

Later in the work, depicting the wandering of the stag brothers, Bartók uses the whole-tone collection, whose lack of tonal centricity, Antokoletz points out, easily portrays the idea of wandering. Bartók does this, however, not by transforming the acoustic, octatonic, or diatonic collections into the whole-tone collection, but by highlighting the whole-tone pentachord already contained in the acoustic scale. Thus he returns to the mode of the beginning—[D, E, F, G, A-flat, B-flat, C]—but he gives the violins and harp only the pitches of the whole-tone pentachord [G-sharp, A-sharp, C, D, E], drawing attention to their ambiguity without leaving the original mode.[34]

This passage provides a wonderfully dualist sense of closure: the work has returned to the mode of its inception, but not everything is the same. In fact, the drama that has taken place will not allow the music to return exactly where it began, and thus Bartók employs both closure and ambiguity via his orchestrational and modal choices.

Toward a Unified Approach

By applying principles of transformational theory, one can take a significant step towards a systematic and unified approach to mode and collection in Bartók's music. Such a system is not without subjectivity, but by privileging the issues of symmetry and modality (two issues which were clearly important to Bartók), perhaps one can come closer to understanding the essence of his modal choices and their underlying relationships.

34. Ibid., 241-246.

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