New Approaches to Tonal Theory

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Two new and much-anticipated books by young American theorists, Steven Rings's *Tonality and Transformation*[2] and Dmitri Tymoczko's *A Geometry of Music: Harmony and Counterpoint in the Extended Common Practice*,[3] reexamine the fundamental tenets of how we think about tonal music. Reading these books in close succession, what's most striking is that although they seem to depart from a similar premise—the rethinking of tonal theory from a mathematical perspective—their emphases are decidedly different, revealing significant philosophical divergences in their approaches to theory and analysis.

Each author wrestles in his own way with the legacy of David Lewin, arguably the most influential theorist of the last thirty years. Lewin's research, particularly his magnum opus *Generalized Musical Intervals and Transformations*, has led to a variety of mathematical formalizations and analytical tools, including 'neo-Riemannian' theory, which reframes chromatic progressions of triads as transformations in a mathematical space based on Riemann's *Schritte* and *Wechsel.* Rings's *Tonality and Transformation* is explicitly framed as continuation of Lewin's project both from a technical and methodological angle, particularly in the focus on analytical close reading and the use of a variety of transformations to model different 'hearings' of a passage. And though Tymoczko has been critical of several aspects of Lewin's theories, his 'geometry of music' is unthinkable without the precursor of neo-Riemannian theory, which similarly emphasizes close voice-leading connections between chords.

The two authors draw on different branches of mathematics: Tymoczko on geometry, and Rings (like Lewin) on group theory, a branch of abstract algebra. One of the main differences between the approaches is that Rings's groups of operations relate discrete points, while Tymoczko's geometries describe a continuous space. Intriguingly, this same opposition was essential to Boethius's classification of the mathematical arts of the *quadrivium:* while music and arithmetic dealt with discrete quantities (multitudes), geometry and astronomy dealt with continuous quantities (magnitudes). The apparently abstract and mathematical choice between geometry and group theory brings with it tendencies towards specific philosophical and methodological stances.

As Rings notes (38), the choice of a transformational viewpoint encourages a pluralist, 'prismatic' approach, 'in which phenomenologically rich local passages are refracted and explored from multiple perspectives.' Any single conception of a musical interval is insufficient to model the many different, contextually dependent ways it may be experienced; the variety of these experiences can begin to be expressed, however, by combining the many interval systems offered by group theory. Rings illustrates such 'apperceptive multiplicity' by demonstrating different ways of conceptualizing a single major tenth from the opening of Bach's Cello Suite in G, BWV 1007: as a span in a diatonic scale, a traversal of four steps in a tonic arpeggio, a skip between overtones of a Rameauian fundamental bass, and so on. The idea that an interval is not a single thing but rather a multitude of intervallic experiences in different conceptual spaces focuses our attention on the heterogeneity of experience, not the immanent properties of 'the music itself'. Rings avoids the temptation (as described by Henri Bergson) of

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[2] 272 pp. (Oxford and New York: Oxford University Press, 2011, £22.50. ISBN 978-0-19-538427-7.)
[3] 432 pp. (Oxford and New York: Oxford University Press, 2011, £27.50. ISBN 978-0-19-533667-2.)

flattening this heterogeneity into a single, homogenous space. This concept is one of Rings's many inheritances from Lewin: 'we do not really have one intuition of something called "musical space". Instead, we intuit several or many musical spaces at once.'[4]

As his title implies, Tymoczko's book is heavily vested in the *geometrical* modeling of musical structures. Tymoczko makes the argument that the essential property of musical spaces is their ability to consistently and quantitatively measure the voice-leading distance between any two chords. Such measurements do not engage the range of subjective experience that Rings seeks to model, but take a more immanent and objective approach to musical events: Tymoczko professes that he is 'primarily concerned with what composers do, rather than what listeners hear' (8). Instead of the many co-existing, 'prismatic' intervallic spaces proposed by Rings, Tymoczko focuses on the single class of spaces which meets his criteria for consistency in measurement: metric spaces in various numbers of dimensions. Depending on the number of pitch classes in the chords at hand, Tymoczko's spaces can occupy two, three, four, or more mathematical dimensions. Because they are conceived so abstractly, these spaces apply broadly to disparate musical repertoires, and give Tymoczko scope to pursue his interest in musical universals. He argues that the 'components of tonality', some 'common to virtually all human music' (7), constrain music to move within these spaces in certain ways. Ultimately, Tymoczko's goal is to draw a wide range of music under the umbrella of an 'extended common practice', many aspects of which can be explained as controlled motion in geometrical pitch space.

One can see a striking difference between these two approaches. Rings's approach is 'bottom-up', starting from the carefully observed tonal intuitions ('apperceptions') of a highly trained and acculturated listener—the result is close attention to the qualitative details of musical experience, modeled through a variety of intervallic spaces. Tymoczko's approach, by contrast, is 'top-down'; he arrives at his metric spaces based on abstract criteria, then seeks to explain a wide range of tonal phenomena by reference to such spaces and a few basic 'components of tonality'. For Tymoczko, the historical practice of tonal music is only one of a number of possible realizations of these abstract relations. As one would expect, Tymoczko's approach never approaches the level of close analytical engagement as Rings; the strengths of his theory in making broad generalizations are balanced by a difficulty in handling detail convincingly. These methodological differences are symptomatic of the different goals of the authors; the following pages examine the details of the two theories in the context of these goals and the larger aesthetic and philosophical values they imply.

Rings, *Tonality and Transformation*

In the introduction, Rings describes how his book, originally conceived as an attempt to bridge the gap between recent neo-Riemannian ideas and traditional tonal theory, became instead 'an exploration of the ways in which transformational and GIS [generalized interval system] technologies may be used to model diverse tonal effects and experiences' (1). Unlike neo-Riemannian theory, which (unlike the theories of Riemann himself) is essentially non-tonal, Rings is concerned with integrating a transformational perspective with the experience of tonal centricity. The emphasis on experience is crucial here; one of the strengths of the book is its focus—one might even call it an ethical stance—on the importance of *listening.* This is not listening as passive reception (as might be modeled by music psychology), but listening as an ongoing quest to 'hear the music better', which Lewin identified as the true goal of analysis.[5] Rings shares with Lewin an essential pragmatism; theoretical machinery is to be

[4] David Lewin, *Generalized Musical Intervals and Transformations* (New Haven: Yale University Press, 1987; reprinted Oxford: Oxford University Press, 2007): 250.
[5] David Lewin, 'Behind the Beyond', *Perspectives of New Music,* 7 (1968–9), 59–69: 63.

valued for its utility in focusing and sharpening musical perception and conceptualization.[6] Analysis can 'engage and shape aural experience' (3); in fact, both Rings and Lewin engage in the idea that analysis is a poetic activity of interpretation. In a well-known essay, Lewin approvingly quotes Harold Bloom: 'the meaning of a poem can only be a poem, but *another poem, a poem not itself.*'[7]

Some background on Lewin's theories is essential to an appreciation of Rings's ideas. (The opening chapter of *Tonality and Transformation* is an accessible and admirably clear introduction to the mathematics necessary for understanding Lewin's work.) Put briefly, Lewin's *Generalized Musical Intervals and Transformations* outlines two ways of conceptualizing musical intervals. The first, a 'generalized interval system' or GIS, defines a highly abstract space within which a specific interval spans any pair of points. Certain criteria based on group theory ensure consistency within the system. Different GISs can model a variety of intuitions about interval (reflecting Rings's 'apperceptive multiplicity'), depending on the musical context at hand; these can include different ways of conceptualizing relationships between pitches or chords, but also intervals in time or any other domain.

An essential part of the organization of Lewin's book is the shift in the latter half of the book from an intervallic to a transformational 'attitude'. If the principal action of applying a GIS is calculating (from a disinterested remove) the intervallic distance between a pair of objects, the transformational perspective reimagines such intervals as 'the active performance of some characteristic musical gesture, which transforms one musical element into another' (27). Transformational theorists after Lewin have been divided over how different these two perspectives actually are. Henry Klumpenhouwer has claimed that the distinction between the 'Cartesian' and 'transformational' attitudes is essential to Lewin's overarching 'anti-Cartesianism',[8] while Julian Hook argues that the distinction between the Cartesian and transformational attitudes has been overemphasized. In his assessment, 'a Lewinian transformation is nothing more or less than what mathematicians call a *function*.' A function is such a basic mathematical concept, Hook argues, that to quibble over the 'attitude' that one takes to it is like arguing over the meaning of addition:

> 'When he writes 'x+y', does he mean that y is being adjoined to x? That y is extending x? That x is growing by an amount equal to y? That x and y are both constituents in the makeup of some larger entity? Is x+y a static element or a dynamic one?'[9]

All these interpretations are superfluous to the essential mathematical meaning of addition. Similarly, for a mathematician, the use of a function is simply 'a precise way of making a statement about two objects *x* and *y* and how they relate to each other,'[10] regardless of the attitude anyone takes towards it; the idea of a 'transformational attitude' towards such functions in Lewin's work is merely a metaphorical surplus applied on top of the mathematical formalisms. The relationship between math and musical intuition in Lewin's writings (as in Rings's) is a complex one. The mathematical formalisms are not an end in themselves, but rather in the service of a larger musical conception.

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[6] Nicholas Cook has written eloquently on the pragmatic, 'performative turn' underlying much twentieth-century theory in his essays 'Epistemologies of Music Theory' (in *The Cambridge History of Western Music Theory,* ed. Thomas Christensen (Cambridge: Cambridge University Press, 2002), 78–105) and 'Music Theory and "Good Comparison": a Viennese Perspective', *Journal of Music Theory,* 33 (1989), 117–41.

[7] David Lewin, 'Music Theory, Phenomenology, and Modes of Perception', *Music Perception,* 3 (1986), 327–92. Reprinted in *Studies in Music with Text* (New York: Oxford University Press, 2006), 53–108: 100.

[8] Henry Klumpenhouwer, 'In Order to Stay Asleep as Observers: The Nature and Origins of Anti-Cartesianism in *Generalized Musical Intervals and Transformations*', *Music Theory Spectrum,* 28 (2006), 277–89.

[9] Julian Hook, 'David Lewin and the Complexity of the Beautiful', *Intégral,* 21 (2007), 155–90: 175.

[10] Ibid., 176.

Lewin represents his dynamically conceived transformations as graphic arrows, which are used in network diagrams to connect nodes which can contain notes, pitch-classes, chords, or virtually any other musical entity. In this aspect of Lewin's work, one can again note a significant tension between strict mathematical formalism and the larger uses to which that formalism is put. As John Rahn has noted, Lewin's networks are more than dry mathematical abstractions: 'The Lewin network is a communicative tool, or poetic medium. The analyst can also use the display of the network in some space—a page—to communicate diacritically, as the display is independent of the network itself.'[11] While from the perspective of group theory, the design of a network on the page is immaterial (as long as the same connections of nodes and arrows are preserved), in Lewin's analyses the spatial arrangement of nodes and arrows often takes on considerable meaning. (As both Lewin and Rings note, such arrangements can be studied in greater detail using tools from another mathematical field, graph theory.) The arrangement can reflect the temporal flow of a passage ('figural' networks) or a systematic regularity or symmetry ('formal' networks).[12] Frequently, the interpretation of a network in prose implies that the arrows are not merely mathematical functions, but energetic vectors capable of modeling a wide range of musical intuitions. This idea of the arrow as a carrier of directional energy is expanded in Rings's approach to tonality, where the transformational arrow acts as a theoretical reflection of the 'gravitational' attraction of pitches towards a tonic.

The conflict of goals between a desire for mathematical consistency and the ability to construct poetically suggestive networks comes to a head when analysts produce graphs that are musically interesting but technically malformed. This malformation is most often a violation of what Julian Hook terms the 'path consistency condition': different transformational paths from one node to another do not yield the same result, creating a logical contradiction.[13] Lewin himself, in a public reconsideration, revised an analytical network for Wagner's *Das Rheingold* from *Generalized Musical Intervals and Transformations* to ensure its path consistency.[14] The original example, Lewin notes, 'is technically malformed by the criteria of GMIT.' Elsewhere in the book, as Rings observes (115), Lewin leaves a similarly malformed graph without commentary or correction, suggesting a certain ambivalence about the issue. Rings takes the stance that graphs can still be useful if they are merely 'realizable', even if they do not meet the stricter path-consistency requirement.

All of this underscores the complexity of Lewin's (and later Rings's) approach to the relationship between theory and analysis. While the initial impression of Lewin's writing is often of systematic mathematical formalism, his analyses are often surprising in their inventiveness and even playfulness. A cynic might suspect that the formalism is an attempt at legitimization of a less rigorously theoretical and more aesthetic, critical approach, one that might not otherwise meet the strictures of disciplinary acceptance. Like Lewin, Rings is particularly concerned with the critical application of transformational ideas, choosing to emphasize the 'reciprocal interaction… between formal ideas and musical

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[11] John Rahn, 'The Swerve and the Flow: Music's Relation to Mathematics', *Perspectives of New Music,* 42 (2004), 130–48. Some of these issues have also been addressed in recent papers by Michael Buchler and John Roeder. Michael Buchler, 'Are there any Bad (or Good) Transformational Analyses?' Paper presented at the Society for Music Theory annual meeting, Indianapolis, IN, November 5, 2010. John Roeder, 'Constructing Transformational Signification: Gesture and Agency in Bartók's Scherzo, Op. 14, No. 2, measures 1–32', *Music Theory Online,* 15 (2009), http://www.mtosmt.org/issues/mto.09.15.1/ mto.09.15.1.roeder_signification.html.

[12] David Lewin, *Musical Form and Transformation* (New Haven: Yale University Press, 1993; reprint Oxford: Oxford University Press, 2007): 45–53.

[13] Julian Hook. 'Cross-Type Transformations and the Path Consistency Condition', *Music Theory Spectrum,* 29 (2007), 1–39.

[14] David Lewin, 'Some Notes on Analyzing Wagner: *The Ring* and *Parsifal*', *19th-Century Music,* 16 (1992): 49–58. Reprinted in Lewin 2006, 201–11.

experience' (ix) rather than the intensive development of mathematical concepts for their own sake—his real interest is clearly in the analytical suggestiveness of transformational concepts, not in their underlying mathematics.

The technical details of Rings's theory are laid out in Chapters 2 and 3. Chapter 2, 'A Tonal GIS,' lays out an interval system for 'heard scale degrees', which takes into account both a tone's pitch class and its mental representation as a scale degree in relation to some tonic. These two measurements, one objective and one subjective, reflect Rings's characterization of tonality as something not inherent in sounding music, but rather projected onto it during the experience of listening. Both are linked together in a 'direct-product GIS'; as an example, the interval between A (pitch class 9) heard as the third scale degree of F major (^3, 9) and B-flat heard as the fourth degree of the same scale (^4, 10) is a single scale step upwards in both scale degree and semitonal pitch-class space (2^{nd}, 1). The model can easily incorporate common features of tonal music like the change in function of a pitch in the course of a modulation: the 'pivot interval' between E as the fifth of A major (^5, 4) and the same pitch as the tonic of E major (^1, 4) is (4^{th}, 0). The joining of two parallel ways of measuring interval can lead to insights not reflected by either GIS on its own.

Rings acknowledges that similar constructions have appeared before in the theoretical literature, particularly in articles by Alexander Brinkman and Eytan Agmon; this is perhaps unsurprising, since all these writings are based on concepts already inherent in staff notation and tonal practice.[15] The formalization of the model using Lewin's generalized intervals is new in Rings's approach, as is his chosen focus on the idea of scale degrees as qualia: the ineffable and incommunicable qualities of 'what it feels like' to experience something. A classic example of a quale is the experience of seeing a color: I can experience 'seeing the color red', but redness is not an inherent property of the light waves that reach my eye—nor can I communicate the nature of this inner experience in language to someone else. The experience of a sound as representing a scale degree is similar: the idea that scale degree qualia are not inherent in the sounds that we hear, but rather exist only as part of our mental representation of tonality, is essential to Rings's overall approach to tonal hearing. The idealist focus on the mental representation of pitches is reminiscent of Hugo Riemann's late essay 'Ideen zu einer "Lehre von den Tonvorstellungen"'. Such an approach meshes particularly well with Lewin's multiple musical spaces and pragmatic approach to analysis: the spaces allow different (but complementary) representations of 'the same' pitch, and consciously pursuing new representations can suggest new ways of 'hearing a piece better'.[16]

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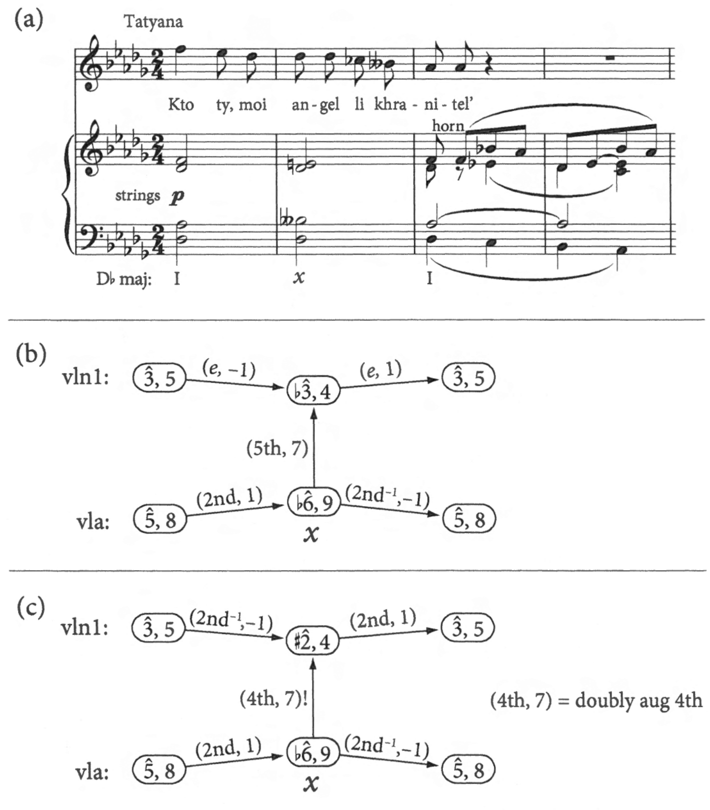
[15] Alexander Brinkmann, 'A Binomial Representation of Pitch for Computer Processing of Musical Data', *Music Theory Spectrum,* 8 (1986), 44–57; Eytan Agmon, 'A Mathematical Model of the Diatonic System' *Journal of Music Theory,* 33 (1989), 1–25; 'Coherent Tone-Systems: A Study in the Theory of Diatonicism', *Journal of Music Theory,* 40 (1996), 39–59.
[16] The multiple perceptions of an apparently single phenomenon are explored in detail in Lewin's 'Music Theory, Phenomenology, and Modes of Perception,' an essay which also considers issues related to qualia when exploring the question 'What is it like to be an F-sharp?' in Beethoven's Fifth Symphony.



EXAMPLE 1: An analysis of an excerpt from Tchaikovsky's *Eugene Onegin* using Rings's 'GIS for heard scale degrees'[17]

Example 1 illustrates the kind of distinction which can be effectively modeled in Rings's scale degree/pitch class GIS. In the excerpt from Tchaikovsky's *Eugene Onegin* shown in (a), the unusually spelled second harmony (marked *x* in Rings's example) is open to two different hearings depending on whether the listener hears the pitch class 4 as an F-flat or E-natural. Network (b) models the F-flat hearing; here the chord is a familiar flat-VI (a B double-flat major triad) borrowed from the parallel minor. Network (c) takes Tchaikovsky's spelling seriously; the top note of the string chords is a sharp second degree (E natural), and the chord is a dissonant collection of scale degrees flat-6, 1, and sharp-2, including a doubly augmented fourth between the B-double-flat and E-natural. Networks (b) and (c) also show different scale-degree interpretations of the descending semitone in the top voice. In (b), the interval between pitch classes 5 and 4 is a chromatic alteration (*e,* -1): *e* is the mathematical symbol for identity (*Einheit*), indicating no change in scale degree between F and F-flat. But in (c), the analogous interval between F and E-natural is a minor second ($2nd^{-1}$, -1). Though this type of observation is not new—composers' choices between different enharmonic spellings have typically invoked exactly this type of distinction—Rings's GIS structure convincingly provides convincing formal model for our experiences of shifting tonal qualia and musical reinterpretations.

Rings extends his discussion of this GIS to fill out some additional theoretical possibilities: these include the careful definition of inversion and transpositions of various kinds, followed by an exploration of how the system might interact with Lewin's 'Generalized Set Theory,' which emphasizes how the particular choice of a canonical group of operations determines the equivalence classes for a

[17] Rings, Figure 2.29, 77.

given system. In this case, Rings's examination of this topic is suggestive but remains only an introductory exploration of the relevant issues—particularly promising is the subtle but musically relevant differentiation between the equivalence classes created by diatonic versus chromatic transpositions.

While the scale degree qualia explored in Chapter 2 depend on a notion of tonal centers for their labeling system (in order to correctly assign scale degree 1 to the tonic pitch), Rings's GIS does not model any kind of *attraction* to that tonic: the intervals themselves do not express the 'gravitational pull' of tonality. Modeling such attraction with the nodes and transformational arrows of Lewin's networks is Rings's goal in Chapter 3, 'Oriented Networks'. This is a complex issue in the application of transformation theory to tonal music; nothing in group theory explicitly deals with such dynamic forces, leaving theorists to incorporate them into the system as added elements (often through the kind of metaphorical surplus discussed above, which assigns additional meaning beyond the mathematical formalities). Lewin himself expended considerable thought over how to direct the arrow in a transformational graph between a tonic and its dominant, revising his notation between his first description of tonal transformations and the eventual formulation in *Generalized Musical Intervals and Transformations*.[18] Lewin was concerned to rectify what he read as a weakness in Riemann's function theories: 'his dominants, other than secondary dominants, do not point to their tonics via implicit DOM arrows. Rather the tonics point to their dominants, generating them by implicit DOM' arrows. Then the dominants just sit around, not going anywhere.'[19] Group theory is neutral on the meaning of the arrows: from the perspective of the mathematics involved, there's no essential difference between a DOM arrow from the dominant to its tonic or a DOM' (inverse of DOM) arrow from the tonic to its dominant. In Lewin's formulation, though, the arrows take on an energeticist meaning, with DOM reconceived as a dynamic transformation that 'urges' the dominant towards its tonic. As a result, the arrows 'drive the network in a natural musical way.'[20]

Like Lewin, Rings uses the energeticist metaphor of the arrow to describe the 'pull' from the dominant toward the tonic (his preferred abbreviation for the transformation that takes a dominant to its tonic is D, not DOM):

> 'to hear a given harmony as a dominant is mentally to perform the dominant transformation, linking the sounding harmony to an understood tonic via D: it is our mental performance of D that invests the dominant with its special energetic charge, as we hear "through" the sounding chord, so to speak, toward the tonic via D.' (105)

For Rings, centricity is modeled through the arrows that connect any event to a root or tonic. His models take the form of *oriented digraphs* (short for 'directed graphs'), graphs with directed arrows between their nodes. The digraphs express the intuition (which Rings calls 'tonal intention') that all tonal chords or pitches (graphs can include either) eventually lead to the tonic; the tonic 'root node' (indicated by a double border) has arrows leading to it but no arrows leading from it, and there is at least one path from every other node to the root node (111). In an energeticist interpretation of the arrow, the arrows can be said to 'trace the flow of "tonal energy" in the music' (104): 'We can interpret an arrow pointing to a node as granting that node a certain degree of hierarchical stability, while an arrow departing from a node destabilizes it, directing tonal energy elsewhere' (114).

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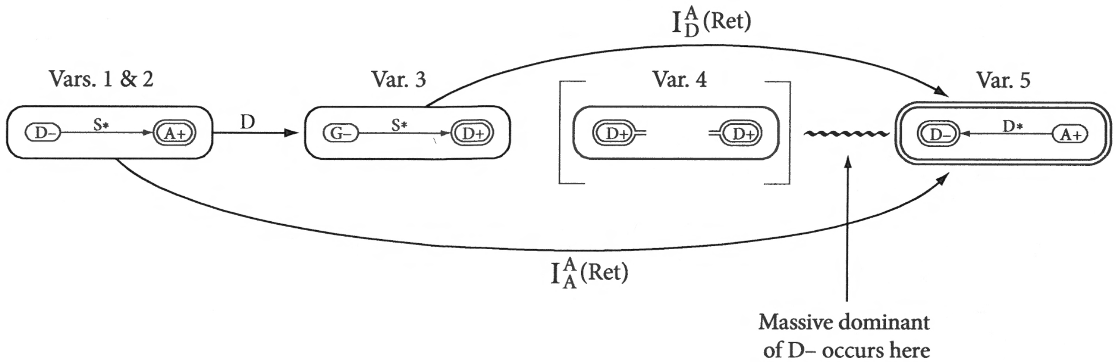
[18] Compare Lewin's 'Transformational Techniques in Atonal and Other Music Theories', *Perspectives of New Music,* 21 (1982), 312–71: 329–31 and *Generalized Musical Intervals and Transformations*, 175–80.
[19] Lewin, *Generalized Musical Intervals and Transformations,* 177.
[20] *Generalized Musical Intervals and Transformations*, 176–77.



EXAMPLE 2: 'An oriented network of oriented networks' describing various tonal intentions of the thematic motto in the Adagio of Brahms's String Quintet, op. 111[21]

One can get a sense of some of the analytical finesse of this approach from Example 2, which reproduces Rings final graphic example from the chapter on the Adagio of Brahms's op. 111 String Quintet. Rings reads the movement as a set of variations, choosing to call the opening fourteen measures the first variation instead of a theme. In Example 2, arrows show the tonal orientation of the ambiguous opening motto in each variation, which can take on 'tonal intentions' toward either D minor or A major. In the opening pair of variations (measures 1-14 and 15-32), the first harmony of the motto, D minor, is heard as a subdominant, progressing to the tonic A major (double border) by the transformation S* (defined here as the motion from a subdominant to a tonic of the opposite mode). The motto of the first two variations is related by D to the third variation (measures 33-51), where the motto appears a fifth lower, but still with the same S* transformation towards tonic (this time, D major). The fourth variation starting at measure 52 presents an unambiguously D major version of the motto, leading to a 'massive dominant' of D minor. The effect of this dominant is to change the 'intentional interpretation' of the motto in Variation 5; even though it is identical in pitch to the version in Variations 1 and 2, D minor is now heard as tonic, with the subsequent A major interpreted not as tonic, but as a Schenkerian 'back-relating dominant' (205-06) indicated by the leftward arrow for the transformation D* (which takes a dominant to its opposite-mode tonic).[22] Since all arrows point towards their tonic, arrows directed forward in time (from left to right) represent motion towards a tonic, while arrows directed backward in time (from right to left) indicate motion *away from* a tonic (103-04). In addition to invoking Schenkerian ideas, this analysis also draws in Riemannian dualism and the twelve-tone concept of inversion. The curved 'I' arrows represent retrograde inversions applied to the chords of the network: I^A_A inverts A major to D minor and vice versa across the central pitch A, which is the Riemannian dual generator of both A major (by overtones) and D minor (by undertones). I^A_D is a similar operation, with a changed axis of inversion that reflects the D major of Variation 3 into the D minor of Variation 5.

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21 Rings, Figure 7.15, 219.

22 Rings is an advocate of Schenkerian methods, and frequently throughout the book seeks ways to integrate his new theories with Schenker. He adopts a pragmatically 'dialogic' approach between the two, focusing on how they can be used together rather than on their contradictions. Transformational theory, he writes, 'is at its most powerful in the pluralistic exploration of phenomenologically rich local passages' (an analytical or 'prismatic' approach), while Schenkerian graphs work instead to *synthesize* many musical features into a single hierarchical whole (38). Related issues are discussed in Rings's 'Perspectives on Tonality and Transformation in Schubert's Impromptu in E-flat, op. 90, no. 2 (D. 899)', *Journal of Schenkerian Studies* 2 (2007), 33–63.

It quickly becomes apparent is that Rings in no way intends the new conceptual tools presented in Chapters 2 and 3 to replace traditional theories; in this Brahms analysis, the reader will encounter not only Rings's scale-degree/pitch-class networks and tonally oriented networks, but also Roman numerals, Schenker graphs, Riemannian functions and dualism, atonal inversion operations, and even a nod to Rameau's idea of the 'characteristic dissonance'—all of these disparate technologies are combined in a virtuosic and wide-ranging discourse, which nonetheless never loses sight of the experience of listening to the piece. Rings's own theoretical contributions work well with this ensemble of historical theories; they convincingly model certain intuitions which (while long a valued part of analytical discourse) have often been conveyed through detailed prose rather than the compellingly lucid network diagrams used here. These include issues of temporal succession in interaction with tonal hierarchies (as noted above, Rings deals particularly sensitively with the Schenkerian 'back-relating dominant'), the identification of implied or potential tonal centers, even when these are never made manifest (in such cases, implied tonics are shown with a double dashed outline), and subtle changes in tonal orientation, including different 'hearings' of the same figure. Rings's scale degree/pitch class GIS proves especially useful for modeling aspects of musical experience in which the same figure gives rise to more than one tonal interpretation: 'Brahms's movement teaches, more eloquently than any theoretical monograph could, that tonal qualities are not given in musical materials, but arise in the encounter between those materials and a listening subject' (220).[23]

In addition to the Brahms analysis summarized above, the second half of the book includes three more analytical essays, on Bach's Fugue in E major from WTC II, Mozart's 'Un'aura amorosa' from *Così fan tutte,* and Brahms's Intermezzo in A major, op. 118, no. 2. These are much more than just illustrations of the theory, and arguably the heart of the book's argument; for a theorist of Rings's pragmatist orientation, the value of his theories lies in how they lead the reader to 'hear the piece better'. The reader who perseveres with these detailed analyses will find that they contain considerable musical insights, reminiscent of Lewin's analytical writing and the hermeneutics of Edward T. Cone. The ethic is one of deep respect for the music as Rings patiently teases out different strands of interconnectedness and the changing hearings that they imply: in a memorable paraphrase of Whitehead, Rings notes that music is 'patient of interpretation'. The pluralism of these essays indicates a critical, humanistic approach to the practice of music theory, a field that is often unfairly characterized as dry, impersonal, and unremittingly formalist. Through his close attention to the experience of listening and engagement with a wide variety of theoretical technologies, Rings illuminates the works under discussion from a range of different but complementary viewpoints.

Tymoczko, *A Geometry of Music*

The overall aim of Tymoczko's book is not, as in Rings's, the development of analytical close-reading tools for the expression of musical intuitions. Rather, Tymoczko's project is to 'understand tonality afresh' (xvii) by conceptualizing an 'extended common practice', stretching from medieval polyphony into the twentieth century to include jazz and the composers of the 'scalar tradition' (Debussy, Ravel, Prokofiev, Steve Reich, and many others). The guiding principles of this extended common practice are largely derived from just a few simple precepts, drawing on an elegant geometrical model of set-to-set voice leading applicable to both chords and scales.

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[23] This is in keeping with Lewin's 'meta-methodology' as described in 'Music Theory, Phenomenology, and Modes of Perception': Lewin cautions the analyst to avoid statements like 'the ___ is ___', as they inevitably entail the fixing of one meaning at the expense of others, often as the result of an erroneous supposition 'that we are discussing one phenomenon at one location in phenomenological space-time, when in fact we are discussing many phenomena at many distinct such locations' (79).

One of the motivating factors for Rings's pluralist approach is a sensitivity for the 'apperceptive multiplicity' of musical experience. Tymoczko avoids such multiplicity by concerning himself with verifiable and unambiguous musical events rather than their more elusive and varied mental representations. As noted above, Tymoczko's intent is to study 'what composers do, rather than what listeners hear' (8); rather than a historical examination of composers' methods, though, he draws conclusions from scores to argue that composers, whether consciously or not, adopted solutions based on the inherent geometry of pitch space. Mathematical models, Tymoczko proposes, can reflect composers' subconscious knowledge of the musical constraints within which they work: for example, he claims that a significant aspect of Chopin's understanding of chromatically-connected seventh chords can be formally represented by paths on a four-dimensional hypercube. Tymoczko has characterized this as a 'causal-explanatory' approach to theory, as opposed to Lewin's 'aestheticism' or the historicist approach advocated by Richard Taruskin: such an approach attempts to divine the underlying principles which lead composers to make the choices they do. While Tymoczko's ability to locate similar principles underlying tonal music in a wide range of styles is arguably a strength of his book, the focus on the 'big picture' and reluctance to engage with the complexity and multiplicity of listeners' experience can result in a loss of satisfying analytical detail, particularly for the tonal repertoire we're accustomed to studying with more focused, customized tools. One notices that the geometrical descriptions of music are often nothing more than the translation of the notes on the page into the author's geometric pitch-class space, losing in the process details of doubling, register, and melodic profile with little analytical return. A complex and 'phenomenologically rich' (Rings, 38) musical surface is reduced to the relatively superficial spatial motion from point to point in the model.[24]

Like Rings's book, Tymoczko's is divided into two large parts, one theoretical and one devoted primarily to history and analysis. The first chapter of *A Geometry of Music* lays out the basic features of Tymoczko's broad conception of tonal music. Tymoczko lists five components of tonality, which mesh well with most musicians' intuitive definition of the term: conjunct melodic motion, acoustic consonance, harmonic consistency (harmonies of similar structure), limited macroharmony (the local use of subsets of the total chromatic, usually scales), and centricity. Significantly, these are stated in a way that does not privilege the standard practices of the 18th- and 19th-century tonality, which Tymoczko considers a special case within a much larger tonal universe.

These components interact in various ways. For example, 'Harmony and counterpoint constrain one another' (12-15), as is the case in triadic tonality, where the triad's near-equal division of the octave makes it especially well suited to stepwise voice leading. (Tymoczko notes that the triad is doubly fortunate in that this near-equal division of the octave allows it to project acoustic consonance as well as convenient voice-leading possibilities.) Linkage between different scales or macroharmonies (modulation) can be understood using the same basic idea of voice leading: for example, a C major scale leads smoothly to a G major scale by semitonal alteration of a single pitch. Tymoczko stresses the independence of macroharmony and centricity; this allows for a 'dazzling proliferation of "generalized keys"' (17), including the diatonic modes and altered, octatonic, whole-tone, and pentatonic scales. Such a profusion of scalar possibilities is essential to his idea of an 'extended common practice'. As noted above, centricity is one of the issues which Tymoczko's theory has the most difficulty explaining; this dissociation of centricity from scale helps to separate this problematic aspect of tonality from the more easily explained concept of scales as unordered and uncentered pitch collections.

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[24] Tymoczko claims that 'stripping away musical details' is actually an analytical strength of the theory, 'allowing us to gaze directly upon the harmonic and contrapuntal relationships that underlie much of Western contrapuntal practice' (79).

The essential features of Tymoczko's geometrical model are presented in Chapter 3, which develops the idea of 'chord spaces'. The number of dimensions of these spaces varies depending on the number of pitches in each harmony; a two-dimensional space is sufficient for modeling voice leadings between harmonic dyads, but three-note chords require three dimensions, and so on.[25] The result is that these spaces favor connections between chords with the same number of notes; there are considerable difficulties in linking a triad in three-dimensional chord space to a seventh chord represented in four dimensions. The chord space is an abstraction of considerable explanatory power and flexibility: the spaces can be configured to reflect different combinations of the 'OPTIC symmetries' (octave shift, permutation, transposition, inversion, cardinality change), and thus different ways of defining equivalence classes. For example, Forte's notion of set class embraces all five symmetries, but the standard idea of a 'chord' (as in 'a G dominant seventh chord') refers to a set of objects which can be transformed into one another by changes in register (octave shift), reordering of pitches (permutation), and note repetitions (cardinality change) but not transposition or inversion. In his geometrical models, Tymoczko chooses to deal with chords of this type, which are equivalent to traditionally defined pitch-class sets. (Unfortunately, this focus on pitch-class rather than pitches-in-register tends to gloss over distinctions between different chordal inversions, an important feature of tonal music.) Tymoczko has dealt with many of these technical formalities in professional journal articles,[26] and has clearly designed this book to be accessible for a broad audience; the presentation of complex mathematical ideas is clear and patient in explaining new terms and concepts.

Tymoczko's chord spaces accurately model voice-leading distances between pitch-class sets; as he convincingly demonstrates, the chord spaces are essentially the only models that meet this criterion. The formalization of these spaces is no small accomplishment—while on the surface it may sound like a simple problem, a consistent geometric model of voice-leading requires a complex and multidimensional approach which expands on the work of theorists including John Roeder, Richard Cohn, Jack Douthett and Peter Steinbach, and Clifton Callender. One might ask if voice-leading distance is really such a central musical property; certainly many musical passages are based on minimal voice-leadings between harmonies, but functional tonality includes a host of other significant relationships for which voice-leading alone does not offer an adequate explanation. In an appendix, Tymoczko notes that the familiar neo-Riemannian *Tonnetz,* which connects triads by a mathematical group of contextually defined inversions, is unable to consistently represent voice-leading distances between chords. Here Tymoczko seems reluctant to grant that the *Tonnetz,* while failing to meet his own criteria, is nonetheless a powerful and suggestive way of organizing a certain transformational relationships between triads.[27]

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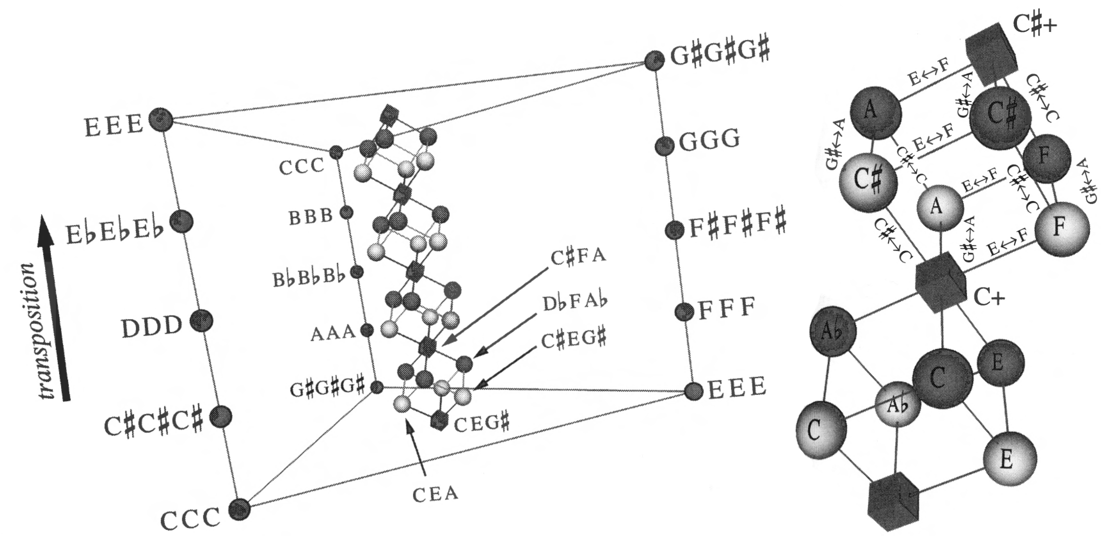
[25] On his own website, Tymoczko offers a downloadable software application, 'ChordGeometries,' for the visualization of this type of structure (http://dmitri.tymoczko.com/ChordGeometries.html). In addition, a companion website from Oxford University Press includes considerable online support materials, many designed to make the book's material accessible to a broader audience (particularly scientists and mathematicians) who might be unable to read musical notation.

[26] Dmitri Tymoczko, 'The Geometry of Musical Chords', *Science,* 313 (2006), 72–74; Clifton Callender, Ian Quinn, and Dmitri Tymoczko, 'Generalized Voice-Leading Spaces', *Science,* 320 (2008), 346–48; Dmitri Tymoczko, 'Generalizing Musical Intervals', *Journal of Music Theory,* 53 (2009), 227–254.

[27] Elsewhere, Tymoczko has suggested that the analytical utility of the *Tonnetz* may in fact be due to its relatively close (yet imperfect) correlation to a truly accurate voice-leading metric, not to the its underlying transformational structure; see 'Three Conceptions of Musical Distance', in *Mathematics and Computation in Music,* ed. Elaine Chew, Adrian Childs, and Ching-Hua Chuan (Heidelberg: Springer, 2009): 258–273. He explores the tension between Lewin's triadic transformations and his voice-leading approach in the essay 'Dualism in the Beholder's Eye: Inversional Symmetry in Chromatic Tonal

The left side of Example 3 illustrates Tymoczko's three-note chord space, a three-dimensional triangular prism including a point for every collection of three pitch classes. Though Tymoczko has labeled points which correspond to certain equal tempered chords, it should be kept in mind that non-tempered pitch-class sets can also be found within the space. Maximally uneven chords ('multisets' with three instances of the same note) appear at each corner of the prism: for example, EEE, CCC, and G#G#G# in the top tier. If we follow the tripled pitch-classes up the left edge from CCC to EEE, the continuation of that chromatic progression appears at the bottom right corner, and continues from EEE to G#G#G#. To continue still further (and to complete the 'abstract circle' back to CCC), one must begin at the G#G#G# corner at the rear of the figure. Augmented triads, the maximally even chords in twelve-tone temperament (an important class in Tymoczko's theory), are arranged in a vertical line in the center of the prism; those augmented triads that fit into equal temperament are indicated by shaded cubes. Each of the nearly even major and minor triads is one semitone away from some augmented triad; in the illustration, Tymoczko indicates the positions of equal temperament major triads (dark grey spheres) and minor triads (light grey spheres). The lines connecting these three types of triads produce a voice-leading graph or lattice. They represent minimal voice leadings between chords: voice leadings 'in which only a single voice moves, and it moves by only a single semitone' (86). The right side of Example 3 zooms in to show a segment of this triadic voice-leading lattice more clearly.



EXAMPLE 3: Two depictions of 'three-note chord space'[28]

As Tymoczko notes, this discrete lattice is identical with the structure that Douthett and Steinbach call 'Cube Dance'.[29] Each cubic substructure of the lattice, a set of eight triadic vertices bounded at top and bottom by two augmented triads a semitone apart, contains one of Richard Cohn's hexatonic cycles. The main difference between this conception and previous discrete representations of such hexatonic systems is the situation of the triads in a larger chord space which models *all* three-note chords and is continuous rather than discrete, allowing for greater consistency in measures of voice-leading distance from one point to another. The continuous space also makes possible the tracing of many different

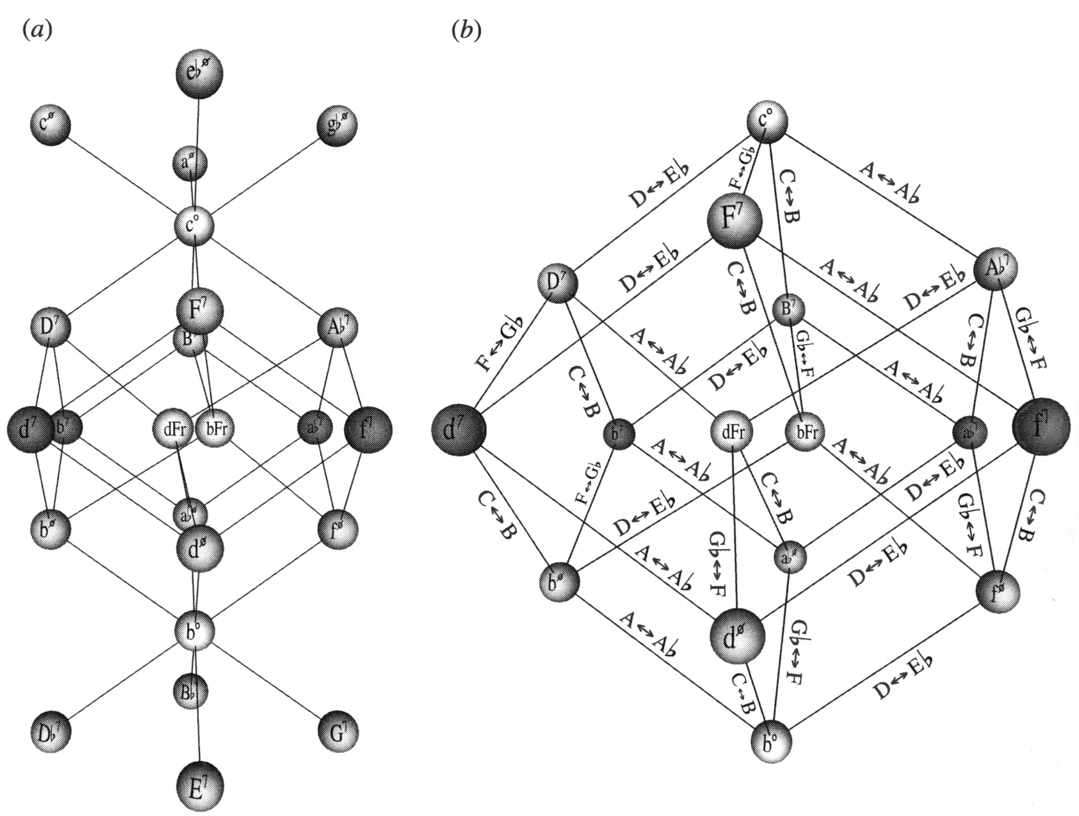
Music', in *The Oxford Handbook of Neo-Riemannian Music Theories,* ed. Edward Gollin and Alexander Rehding (Oxford: Oxford University Press, 2011): 246–67.

[28] Example 3 reproduces Tymoczko's Figures 3.8.2 (left, p. 86) and Figure 3.11.2a (right, p. 105).

[29] Jack Douthett and Peter Steinbach, 'Parsimonious Graphs: A Study in Parsimony, Contextual Transformations, and Modes of Limited Transposition', *Journal of Music Theory,* 42 (1998), 241–63.

paths between any two points: each path can be thought of as a multi-voice glissando between chords, passing through all intermediate chordal points. Tymoczko makes relatively little use in *A Geometry of Music* of the parts of this space that do not correspond to equal-temperament scales, triads, and seventh chords, but the formalization is suggestive and may lead to interesting developments in future research.[30]

This space offers a powerful way of conceptualizing relationships between three-note chords, but chords with four notes require a four-dimensional space; whether such complex spaces still offer the conceptual advantage of clarifying musical structure by reference to familiar spatial analogies is debatable. In four dimensions, the nearly even chords in the center of the space are half-diminished, minor, and dominant seventh chords as well as French augmented sixths; these are located on the sixteen vertices of a four-dimensional hypercube or tesseract. While such a structure is difficult to visualize, mathematicians have long represented it with two-dimensional projections (much as a three-dimensional cube can be illustrated with a line drawing). Example 4 reproduces Tymoczko's use of such a projection to illustrate a segment of the lattice showing the nearly even four-note sonorities. Like the cubes in three-dimensional space, the tesseracts are joined by vertices representing maximally even sets—in this case, diminished seventh chords.[31]



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[30] The use of similar continuous spaces to model shades of microtonal inflection has been explored by Clifton Callender, who has applied such models to microtonal music by Kaija Saariaho and György Ligeti. See 'Continuous Transformations', *Music Theory Online,* 10 (2004), http://www.mtosmt.org/issues/mto. 04.10.3/ mto. 04.10.3.callender.pdf.

[31] Related but differently conceived spaces for four-note chords are explored in Edward Gollin, 'Some Aspects of Three-Dimensional "Tonnetze"', *Journal of Music Theory,* 42 (1998), 195–206 and Adrian Childs, 'Moving Beyond Neo-Riemannian Triads: Exploring a Transformational Model for Seventh Chords', *Journal of Music Theory,* 42 (1998), 181–93.

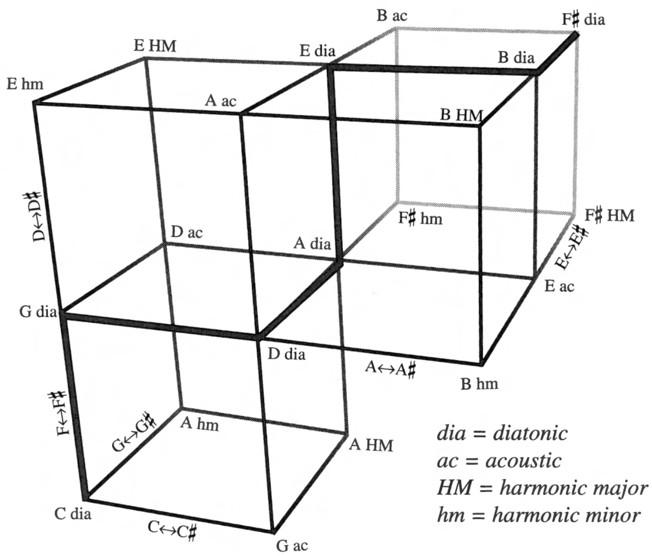
EXAMPLE 4: A four-dimensional lattice of nearly even four-note chords[32]

Such a four-dimensional space is invoked in Chapter 8 to describe voice-leading motions in Chopin's E minor Prelude and F minor Mazurka (284-93). Both pieces, Tymoczko writes, trace different paths downward through the lattices of tesseracts, producing sequences of dominant seventh chords descending by semitone or fifth and joined by semitonal voice leading. At its best, this type of analysis can illustrate elegantly some of the constraints encountered by any composer who wishes to connect four-note tertian sonorities with close voice leading. It could be argued, of course, that the observation that 19th-century composers often used chromatic voice leading between dominant seventh chords is nothing new—one wonders if the four-dimensional model is really necessary to make these claims. If applied carelessly, the geometrical approach can lead to superficial and facile analyses: a 'follow the bouncing ball' approach which skims over the phenomenological complexity of musical experience. There's no distinction, for example, between the relative structural weight of tones or their different tonal implications (features emphasized by the multiple technologies of Rings's theory as well as more traditional approaches like Schenkerian analysis).

One of the most interesting applications of Tymoczko's geometry is a voice-leading lattice (Example 5) illustrating relationships between the four seven-note scales which most evenly divide the octave: diatonic, acoustic (the same chord type as ascending melodic minor but with a tonal center a fourth higher), 'harmonic major' (a major scale with a flatted sixth), and harmonic minor.[33] The traditional note name labels (A harmonic minor, etc.) are offered for convenience only; this model remains neutral on the question of tonal centricity within these scales. This line of investigation emerges from the commonplace observation that scales adjacent on the circle of fifths differ by a single semitone, but expands that idea into an elegant display of relationships between many of the scales frequently used by twentieth-century composers ranging from Debussy and Prokofiev to Steve Reich and John Adams. As Tymoczko points out, this is a repertoire that has been studied relatively little by music theorists. He makes the intriguing suggestion that the shared principle of close-voice leading at the chord and scale levels makes tonal music 'both self-similar and hierarchical, exploiting the same procedures at two different time scales' (17).

[32] Tymoczko's 3.11.3, p. 106.

[33] An interest in scalar approaches to analysis has marked much of Tymoczko's work: see particularly 'The Consecutive Semitone Constraint on Scalar Structure: A Link Between Impressionism and Jazz', *Intégral,* 11 (1997), 135–79; 'Stravinsky and the Octatonic: A Reconsideration', *Music Theory Spectrum,* 25 (2003), 185–202; and 'Scale Networks in Debussy', *Journal of Music Theory,* 48 (2004), 219–294.



EXAMPLE 5: A three-dimensional lattice of seven-note scales[34]

In his final chapter, Tymoczko draws a connection between the classical 'scalar tradition' and jazz—this is a convincing link given jazz theory's basis in the same kind of chord-scale relationships that Tymoczko uses to describe music by composers from Ravel and Debussy to Reich. In fact, one of Tymoczko's recurring strategies in *A Geometry of Music* is to analyze classical music with the tools of jazz theory, drawing both into the same 'extended common practice'. The idea that harmonies are primarily to be considered as pitch class sets instead of as pitches-in-register is familiar from jazz lead sheet notation, and the shift from one scale to another as a structural feature is an essential concept for jazz improvisers. The chapter largely parallels jazz theory texts like Mark Levine's 1989 *The Jazz Piano Book,* but reinterprets standard jazz voicings and progressions against the backdrop of the geometrical model of chords and scales. For example, a geometrical approach offers insights into the efficient voice leadings underlying the practice of tritone substitution: that is, the replacement of a dominant seventh chord with its transposition by a tritone, which preserves (but reinterprets) the chordal third and seventh. In such substitutions, two notes are held in common between both chords, while the remaining two can be related by semitone—this efficient voice leading is predicted by characteristics of Tymoczko's four-note chord space. The analyses of jazz transcriptions in this section (most notably a close look at Bill Evans's performance of Sonny Rollins's 'Oleo') are sensitive and thorough, but one is often tempted to ask if the geometrical theory is really necessary to make these analytical points, which are couched in a familiar vocabulary of chord and scale labels.

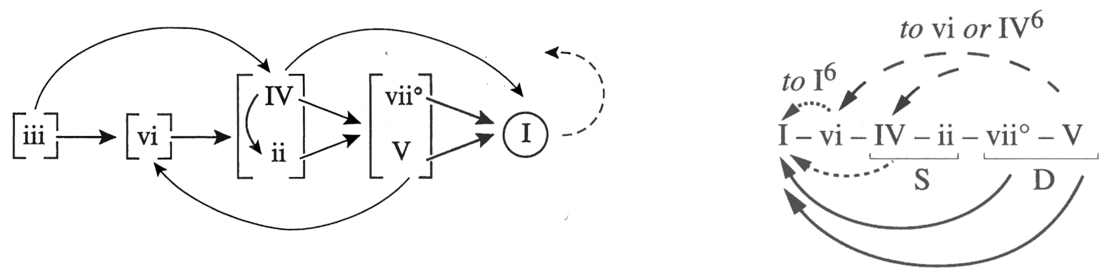
Tymoczko's idea of an 'extended common practice' including jazz and twentieth-century tonal music is defined in part by the exclusion of atonal music, which typically does not exhibit (or exhibits only weakly) Tymoczko's five components of tonality. For Tymoczko, the lack of these features is a central reason that the audience for atonality has remained minute in comparison to the much larger audience for tonal music, broadly defined: 'for the foreseeable future, the majority of successful Western music will continue to exploit acoustic consonance, small melodic motions, consistent harmonies, clear tonal centers, and identifiable macroharmonies' (392). As a demonstration of how atonal works reject these five components of tonality, Tymoczko statistically compares Schoenberg's Piano Piece, op. 11, no. 1 to

[34] Tymoczko's Figure 3.11.9, p. 111.

a sampling of random pitches, considering 'pitch-class circulation' (a measure of how many distinct pitch classes are heard within a given number of attacks), 'pitch-class distribution' (the total occurrences of each pitch class), and set class types; he concludes that 'statistically speaking, atonal music is often remarkably similar to random notes, and listeners perceive this fairly accurately' (183-85).

Lovers of atonal music are likely to bristle on reading this, since this generalizing statistical approach excludes the close motivic readings that have offered the most convincing analytical engagements with this repertoire. Is Tymoczko loading the deck against atonality by using coarse statistical measures instead of more detailed analyses that could do justice to the complexity of these works? The larger rhetorical point of this section is not, however, an attack on atonal music, but a consideration of its fundamental differences from tonal music in its impact on listeners. By learning to hear beyond the superficial 'randomness' of atonality, fans of atonal music have 'managed to acquire a taste for highly chromatic musical textures: like the taste for clam chowder ice cream, this is one that people often do not care to cultivate.' Tymoczko clarifies this position in a recent publication: the fact that atonality is not immediately appealing to most listeners need not be seen as a negative aesthetic judgment; rather, atonal music is 'wonderfully perverse and unnatural'.[35] Seen in this light, his point is well-taken that atonal music is an acquired taste: after all, not every pleasure needs to be 'natural', and in this age of molecular gastronomy, clam chowder ice cream might well make its way onto restaurant menus.

As is inevitable for any contemporary theorist writing about tonality, both Rings and Tymoczko spend considerable time recasting older theory into new molds. In Tymoczko's book, this takes a surprising turn: advocacy for the continued relevance of 'traditional harmonic theory'—essentially the Roman numeral model familiar from textbooks, and originating in the nineteenth century with Vogler and Weber—in the face of 'a challenge from Schenker'. As he himself notes, his model closely resembles the one presented in Kostka and Payne's textbook *Tonal Harmony:* these two illustrations of common progressions in major are presented side by side in Example 6.[36] Although this model of common Roman numeral progressions has indisputable utility as a rule of thumb, theory pedagogues have long tried to supplement such a mechanical view of root motion with more sophisticated voice-leading concepts, largely drawn from Schenkerian theory: Aldwell and Schachter's *Harmony and Voice Leading* and Laitz's *The Complete Musician* are among the textbooks that adopt such a mixed approach.



EXAMPLE 6: Comparison of Kostka/Payne (left) and Tymoczko (right)[37]

[35] 'Hey, Wait a Minute!' (response to review of *A Geometry of Music* by David Headlam), forthcoming in *Music Theory Spectrum.*
[36] Stefan Kostka and Dorothy Payne, *Tonal Harmony,* fourth ed. (New York: Alfred A. Knopf, 2003).
[37] Tymoczko, Figure 7.1.1, p. 227.

Tymoczko's harmonic model for major keys is shown in his Figure 7.1.1, reproduced on the right in Example 6. The chords in the diagram descend by third from left to right. An allowable chord progression ('harmonic cycle') can progress to the right by any distance, but must return to the left only through the indicated arrows. A note in the text allows the addition of a secondary dominant before any major or minor triad, and for a root-position V chord to be preceded by a 'I^6_4'.[38] This 'purely harmonic' theory is linked to the geometrical models developed in the first section of the book by the observation that root movement by thirds minimizes voice-leading distance between triads in diatonic space. (Note, however, that the model allows rightward motions of arbitrary length, which will not necessarily exhibit close voice leading.) Given the universally recognized importance of fifth progressions, Tymoczko's emphasis on motion by thirds will surprise some readers: 'falling thirds are more *fundamental* than falling fifths, even though falling fifths may be more *common*.' In his view, any rightward motion by descending fifth within the model of Example 6 can be conceptually subdivided into two thirds. (The layout of the model, with V on the extreme right, avoids unidiomatic progressions like vii°–V–iii or V–iii–I.)

While chord spaces work elegantly to model relative voice leading distances, they do not reflect the dynamic tonal forces of centricity or directedness. After all, Western music has long been based not merely on close voice leading but rather on *directed* voice leading.[39] But rather than trying to model (as does Rings) the experience of this 'gravitational attraction' (241), Tymoczko is content to describe it through a statistical analysis of root progressions. The centricity essential to tonal experience is a relatively superficial addition to the core geometrical theory: as just one of many possible manifestations of an extended tonal geometry, common-practice tonality happens to use certain standard progression types which can be expressed statistically. One can't help but feel that such measures offer a hopelessly etic or 'outsider' view, telling us much about the statistical norms and typical paths of tonal progressions, but little about what it means to hear tonally or the experience of tonal tension and resolution that is so essential to tonal music.[40]

Having argued that 'tonal music obeys purely harmonic principles that specify how chords can move' (258), Tymoczko considers how such principles might coexist with Schenkerian positions that demand a consideration of counterpoint as well as harmony. He concludes that unless one takes the dogmatic position that harmonic explanations are essentially inferior to contrapuntal ones, 'pluralist Schenkerians' can admit the coexistence of both a local harmonic organization and a hierarchical, contrapuntal structure. A distinction is drawn here between two value systems for music theory that is essential to the methodological differences between Tymoczko's work and the analytically focused writings of Rings and Lewin. The first approach aims for a theory that efficiently accounts for practice in a certain repertoire, while the second values theories based on their ability to illuminate through analysis the details of music as experienced. Tymoczko recognizes this distinction, noting that 'the theoretical project of characterizing the grammar of elementary tonal harmony is completely distinct

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[38] The use of this label instead of V^6_4 may be intended to tweak the sensibilities of Schenkerian theorists, but it is also indicative of the geometrical theory's general indifference to chord inversion.

[39] See David E, Cohen, '"The Imperfect Seeks Its Perfection": Harmonic Progression, Directed Motion, and Aristotelian Physics', *Music Theory Spectrum,* 23 (2001), 139-69.

[40] Tymoczko argues elsewhere in the book that the experience of centricity arises in large part from specific musical usages of pitches, such as more frequent repetition, greater length, etc., not from 'internal features' of a given scale. (180) Though certainly such contextual features can work to give one pitch or another of a collection greater prominence, whether this prominence and tonic centricity are really the same thing is debatable.

from the analytical project of *saying interesting things about particular pieces*' (263, emphasis in original).

The first approach is behind Tymoczko's advocacy of his 'purely harmonic theory' over Schenkerian methods—why describe pieces as 'massively recursive structures, analogous to incredibly complex sentences' when a majority of their harmonies can be fit within the simple Roman-numeral model of Example 6? Readers who side with Tymoczko on this methodological question will likely welcome his turn away from Schenkerianism to advocate a minimal grammar that is 'more modest—and perhaps empirically grounded'. One should not discount, though, that there are very real reasons that so many theorists have been dissatisfied with such 'purely harmonic' theories. Tymoczko doesn't give Schenkerian theory credit for what it can achieve: a far more dynamic and persuasive account of large-scale tonal form than that offered by the labels of Roman numeral analysis.

The idea that theories prove themselves through their utility in constructing sensitive and musically compelling analyses—and not just by accounting for brute statistical facts—is part of the pragmatic school of thought identified by Nicholas Cook. Cook ties Schenker (who famously wrote 'my theory … is and must remain itself art') into this pragmatist tradition, which is invested in 'the idea that analysis is performative, in the sense that it is designed to modify the perception of music—which in turn implies that its value subsists in the altered experience to which it gives rise'. Cook's formulation is reminiscent of William James's pragmatism ('ideas (which themselves are but parts of our experience) become true just in so far as they help us to get into satisfactory relation with other parts of our experience'), and also Lewin's goal for analysis: to 'hear the piece better'.[41] It is not unreasonable to demand from our theories that they 'say interesting things' about pieces—in fact, if they do not we should be troubled. Music theory has long maintained a precarious balance between the science and art, and its ends include the aesthetic as well as the scientific.

The contrasts between these two books throw these issues into relief. For Rings, analysis is conceived as a kind of refined connoisseurship, based on the Lewinian/Bloomian conviction that analysis is primarily an aesthetic act ('the meaning of a poem can only be a poem'). If the goal of analysis is 'to hear the piece better', a case can be made for combining diverse theories to make the altered musical experience richer—though of course such combinations also raise the risk of self-contradiction. For Rings, contrasting theories like neo-Riemannian and Schenkerian techniques are not in competition for a position of unassailable truth, but can instead complement one another.[42] His approach is pessimistic about finding overarching theoretical explanations, but it revels in the complexity and depth offered by a play of multiple perspectives.

While analytically driven work like Rings's tends to rule out the possibility of unearthing a composer's intentions, Tymoczko searches for the underlying principles that might, whether consciously or not, have shaped compositional choice. He seeks to describe 'what composers do' by outlining a few principles and tracing their repercussions in different technical and stylistic domains. This is arguably a more scientific approach to theorizing, which seeks to account for observed data with a minimum of explanatory machinery. Tymoczko's top-down explanations of tonality are most compelling at a highly

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[41] See Nicholas Cook, 'Epistemologies of Music Theory', op. cit., 95; Heinrich Schenker, *The Masterwork in Music*, vol. iii (Cambridge: Cambridge University Press, 1997): 8; William James, 'What Pragmatism Means' in *Pragmatism, a New Name for Some Old Ways of Thinking: Popular Lectures on Philosophy* (New York and London: Longmans, Green, and Co., 1922): 2.

[42] See 'Perspectives on Tonality and Transformation', 44-45.

generalized level, where they outline some basic possibilities of music common to all manifestations of the ‘extended common practice’. This approach is effective at tracing commonalities between apparently different styles, showing the links between impressionism and jazz or triadic voice leading and twentieth-century scales. Yet if one seeks a close engagement with a specific style or work, the very breadth of the approach often seems to lead to relatively superficial readings; existing, specialized theoretical tools already have a level of refinement that the comparatively blunt tools of geometrical theory are as of yet unable to equal. Certainly there’s room for development here; as these new technologies become familiar, analytical applications of voice-leading spaces and scale lattices may take on greater depth and subtlety, complementing their considerable generalizing power with a deeper exploration of the messy yet beautiful details of real musical experience.