# Current Trends in Music Theory

Jason Hooper
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*With contributions by Charity Lofthouse, Noriko Manabe and Andrew Pau.*

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## § 1.0 DIATONIC SET THEORY AND SCALE THEORY

- John Clough. 1979. "Aspects of Diatonic Sets." *Journal of Music Theory* 23: 45-61.

  - Clough's goal is to move from a set-theoretical approach dealing with the twelve pitch-class universe to the seven **diatonic letter-class universe**. Any alteration to a letter class is ignored (i.e., accidentals). The result is that [A, C, E] and [A, C#, E] are both equivalent to [024] modulo 7. For convenience, C=0, D=1, etc.

  - A **set** is labeled using square brackets with entries separated by commas, as in [C, E, G] or [0, 2, 4] for a C-major triad.

  - A **chord** (i.e., like a set class, but unordered) is a series of ascending diatonic intervals modulo 7 with a "wrap-around" feature that repeats the first note. Thus, set [0, 2, 4] is a member of chord (223). Chords are put in rounded brackets with no commas.

  - **Interval normal form:** Place a chord in a rotation where the largest intervals are to the right and descend as you move to the left. So, chord (232) may be expressed in INF as (223) (i.e., this is like a set class where order matters).

  - There are only three distinct **interval classes** modulo 7 (four, if you count ic 0): 1≡6; 2≡5; 3≡4. The interval-class vector thus only has three arguments. Interval-class vectors are expressed in square brackets without commas, so chord (223) has an interval-class vector of [021].

  - To **invert** a chord, simply reverse its sequence (e.g., (124) becomes (421)). Since diatonic sets are so abstract, the may also be expressed on staff notation without the use of clefs.

  - There are 30 **ordered diatonic trichords**, which reduces to nine under T, I, R, and RI equivalence.

  - **Trichord chains:** Chains of diatonic pitch classes that result from altering two diatonic intervals. If the intervals are equal to each other, then they begin to repeat in seven moves; if the intervals do not equal each other, then they begin to repeat in fourteen moves. **Example:** Alternate diatonic intervals (1, 1) and you get an ascending diatonic scale. Alternate diatonic intervals (1, 6) and you get a chain of an ascending second followed by an ascending seventh.

- John Clough and Gerald Myerson. 1985. "Variety and Multiplicity in Diatonic Systems." *Journal of Music Theory* 29: 249-70.

  - **Goal:** To show connections between the specific modulo-12 universe and the generic modulo-7 universe.

  - {B, D, F} is a specific instantiation of a "diminished triad" in **specific** modulo-12 space; {B, D, F} is also an instantiation of a "triad" in a **generic** modulo-7 space.

- Three ways of classifying:

  - Genus chords: e.g., (16) modulo 7
  - Species chords: e.g., (1 11); (2 10)
  - Literal chord: (BC) and (EF) ε species (1 11) ε genus (16)

- **Partitioning:** Each species belongs to only a single genus.

- **Cardinality Equals Variety** (CV): K-note chords come in K-species for all diatonic chords with 1-6 notes. For example, there are two specific kinds of generic diatonic step, three species of generic triads, and so on.

- **Structure Yields Multiplicity** (SM): Using fifths (generic or specific, depending on context) instead of seconds to determine chord structure for both specific and generic chords, the ICV by fifths equals the number of sets of each species within that genus.

  - E.g., [C, E, G]= chord (223); but in fifths it equals (133) so that C→G= 1 fifth; G→E= 3 fifths; E→C= 3 fifths [Remember, these are diatonic fifths modulo 7!]. The result is that there is one (336) species; 3 (345) species; 3 (435) species that belong to this genus.

- **Myhill's Property** (MP): If a scale has CV, then every interval in particular has a two-element spectrum (i.e., there are two kinds of second, two kinds of third, etc.); **MP↔CV!**

- **Uniqueness:** Given c and d coprime (no common divisor is greater than one), where c is the cardinality of the "chromatic" universe and d is the cardinality of the "diatonic" scale, there exists a scale with MP, and that a scale is unique to within transposition and reduction (deletion of "excess" chromatic notes).

- **Deep Scale Property:** Every interval class in the ICV has a unique number of occurrences (e.g., the diatonic collection); defined in a 1967 *JMT* article by Carlton Gamer; first mentioned with regard to the diatonic collection by Milton Babbitt.

❖ John Clough and Jack Douthett. 1991. "Maximally Even Sets." *Journal of Music Theory* 35/1-2: 93-173.

- This article consists of 80 pages of mathematical proofs, and is not easily summarized.

- The gist is this:

  - In a c-note chromatic universe, c is the **chromatic cardinality**.
  - In a d-note diatonic universe, d is the **diatonic cardinality**. d is a subset of c.
  - Diatonic sets some in two varieties: c=2d-1; c=2d-2 where d is odd.
  - The embedding of a diatonic set into a chromatic universe is notated $\mathbf{M}_{c,d}$.

- **Maximally Even** (ME): A set whose elements are distributed as evenly as possible around the chromatic circle (cf. Quinn's dissertation).

❖ John Clough. 1994. "Diatonic Interval Cycles and Hierarchical Structure." *Perspectives of New Music* 32/1: 228-253.

- Notes are "extracted" and "interpolated" from mostly diatonic melodies and assigned to various hierarchical levels; analyzes passages according to "hidden" diatonic cycles. Hierarchical decisions are based on skipping some number of notes at one level (e.g., skipping every four notes in the sequence) and promoting the remainder of the notes to the next hierarchical level. This is about as "analysis oriented" as Clough ever gets. Here are two examples:



❖ John Claough, Nora Engebretsen and Jonathan Kochavi. 1999. "Scales, Sets, and Interval Cycles: A Taxonomy." *Music Theory Spectrum* 21/1: 74-104.

- **Goal:** Create a taxonomy of pcsets that correspond to the interval cycles. Also, there is a desire to explore spaces defined by the usual diatonic scale.

- **Generated sets** (G): Those sets generated by a single interval.
  G (c, d, g) where c=chromatic cardinality; d=diatonic cardinality; g=generating interval

Example 1. Features of scales/sets

*Features defined for rational or irrational generators*

| Feature | Defining characteristic | Example(s) |
|---|---|---|
| **G**<br>generated | Generated by a single interval. | G(12, 7, 5) = {0, 5, 10, 3, 8, 1, 6}<br>= {0, 1, 3, 5, 6, 8, 10}<br>(the usual diatonic)<br>G(7, 3, 4) = $\{0, 4, 1\}_7$ = $\{0, 1, 4\}_7$<br>(a stack of 5ths in 7-space) |
| **WF**<br>well-formed | G-set where each generating interval spans a constant number of scale steps. | G(12, 5, 7) = {0, 7, 2, 9, 4}<br>= {0, 2, 4, 7, 9}<br>(the usual pentatonic) |
| **MP**<br>Myhill property | Each generic interval (2d, 3d, etc.) comes in two specific sizes. | G(8, 5, 3) = $\{0, 1, 3, 4, 6\}_8$<br>$\langle 1\rangle = \{1, 2\}$, $\langle 2\rangle = \{3, 4\}$ |
| **DE**<br>distributionally even | Each generic interval comes in either one or two specific sizes. | {0, 1, 6, 7}<br>$\langle 1\rangle = \{1, 5\}$, $\langle 2\rangle = \{6\}$ |

*Features defined for rational generators only*

| Feature | Defining characteristic | Example(s) |
|---|---|---|
| **ME**<br>maximally even | Each generic interval comes in either one integer size or two consecutive integer sizes. | {0, 1, 3, 4, 6, 7, 9, 10}<br>$\langle 1\rangle = \{1, 2\}$, $\langle 2\rangle = \{3\}$,<br>$\langle 3\rangle = \{4, 5\}$, $\langle 4\rangle = \{6\}$.<br>(the usual octatonic)<br>$\{0, 2, 4\}_7$<br>$\langle 1\rangle = \{2, 3\}$<br>(the triad in 7-space) |
| **DP**<br>deep | Every interval class has unique multiplicity. | G(12, 6, 5) = {0, 2, 4, 5, 7, 9}<br>[143250]<br>G (11, 5, 4) = $\{0, 1, 4, 5, 8\}_{11}$<br>[20341] |
| **DT**<br>diatonic | ME-set with $c = 2(d - 1)$ and $c \equiv 0$, mod 4. | G(12, 7, 5) = {0, 1, 3, 5, 6, 8, 10}<br>(the usual diatonic)<br>G(16, 9, 9) = $\{0, 2, 4, 6, 7, 9, 11, 13, 15\}_{16}$<br>(the next larger diatonic) |
| **BZ**<br>Balzano | ME-set with $c = k(k + 1)$ and $d = g = 2k + 1$, $k \geq 3$. | {0, 1, 3, 5, 6, 8, 10}<br>(k = 3; the usual diatonic)<br>$\{0, 3, 5, 7, 9, 12, 14, 16, 18\}_{20}$<br>(k = 4) |

**Some scale categories.**

(1) BZ implies ME.

(2) BZ implies MP.

(3) ME implies DE.

(4) WF implies G.

(5) DT implies ME.

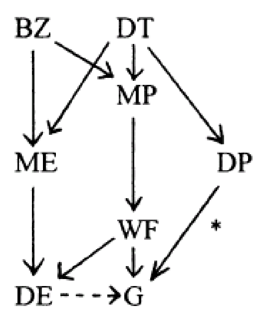
(6) DT implies MP.

(7) MP implies WF.

(8) WF implies DE.

(9) DT implies DP.

(10) DP implies G (if the set is not a form of $\{0, 1, 2, 4\}_6$).

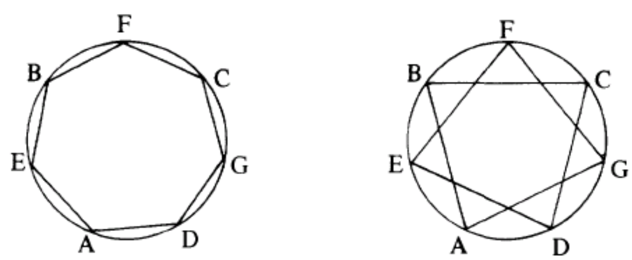



**Some implications.**

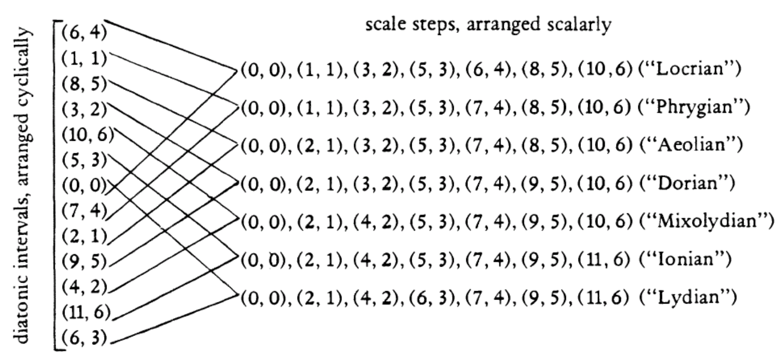
| F-set number | G | DE | WF | ME | MP | DP | BZ | DT | Number of features | Example |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | ★ | ★ | 8 | {0, 2, 4, 5, 7, 9, 11} (usual diatonic) |
| 2 | ✔ | ✔ | ✔ | ✔ | ✔ | ✔ | | ★ | 7 | $\{0, 2, 3, 5, 7\}_8$ (diatonic in 8-space) |
| 3 | ✔ | ✔ | ✔ | ✔ | ✔ | | ★ | | 6 | $\{0, 2, 5, 7, 9, 11, 14, 16, 18\}_{20}$ (BZ, k=4) |
| 4 | ✔ | ✔ | ✔ | ★ | ★ | ★ | | | 6 | $\{0, 2, 4\}_7$ (triad in 7-space) |
| 5 | ✔ | ✔ | ✔ | ★ | ★ | | | | 5 | {0, 3, 5, 8, 10} (usual pentatonic) |
| 6 | ✔ | ✔ | ★ | ★ | | ★ | | | 5 | $\{0, 2\}_4$ |
| 7 | ✔ | ✔ | ✔ | | ★ | ★ | | | 5 | $\{0, 1, 4, 5, 8\}_{11}$ |
| 8 | ✔ | ✔ | ✔ | | ★ | | | | 4 | $\{0, 5, 6, 11, 12\}_{13}$ |
| 9 | ✔ | ✔ | ★ | ★ | | | | | 4 | $\{0, 1, 2, 3, 4, 5, 6\}_7$ (total chromatic) |
| 10 | ✔ | | | | | ★ | | | 2 | $\{0, 2, 3, 6\}_7$ (DP, 3 step sizes) |
| 11 | | ✔ | | ★ | | | | | 2 | {0, 1, 3, 4, 6, 7, 9, 10} (octatonic) |
| 12 | | ★ | | | | | | | 1 | {0, 1, 4, 5, 8, 9} (hexatonic, DE alone) |
| 13 | ★ | | | | | | | | 1 | {0, 3, 5, 10} (G alone) |

**Feature sets.**

- ❖ Norman Carey and David Clampitt. 1989. "Aspects of Well-Formed Scales." *Music Theory Spectrum* 11: 187-206.
  - Scales generated by consecutive fifths in which symmetry is preserved by scale ordering are called **well-formed scales.**




- ❖ Eyton Agmon. 1989. "A Mathematical Model of the Diatonic System." *Journal of Music Theory* 33/1: 1-25.
  - I read this article all the way through and I still don't know what a "diatonic system" is. This seems to rehearse much of the same ideas in earlier Clough and Clough & Myerson articles, although cast in new terminology.




**A gratuitous and hard-to-read example to ensure a more aesthetically pleasing pagination.**

❖ Eyton Agmon. 1996. "Coherent Tone-Systems: A Study in the Theory of Diatonicism." *Journal of Music Theory* 40/1: 39-59.

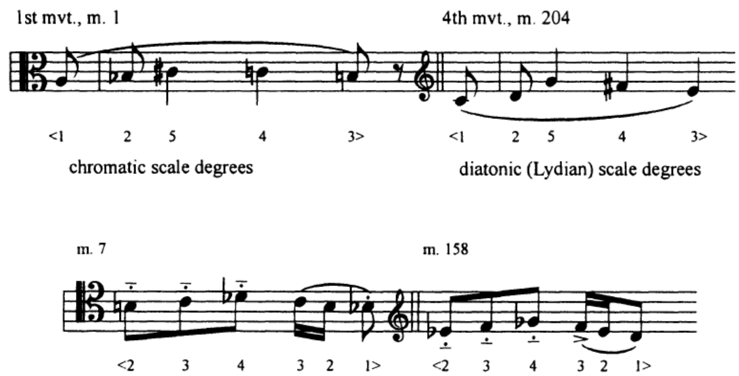
- See, I told you so. Here is Agmon's list of similarities between his work and C&D.

*Table 1:* Comparison between Clough and Douthett (1991) and Agmon (1989)

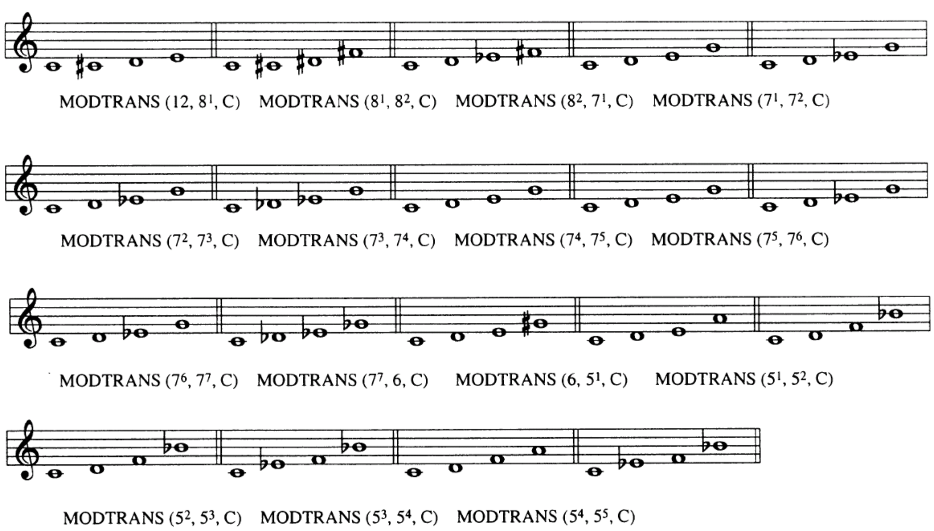
| *Clough and Douthett* | *Agmon* |
|---|---|
| **ASSUMPTIONS** | |
| (A1)<br>(a) $D_{c,d}=\{D_0, D_1, \ldots, D_{d-1}\}$ is a set of d distinct elements out of $U_c=\{0, 1, \ldots, c-1\}$, $d\leq c$;<br>(b) "generally," $D_{c,d}$ satisfies $D_0<D_1< \ldots < D_{d-1}$ (Def. 1.2) | (A1)<br>(a,b)=1 (Def. 1)<br><br>(A2)<br>Existence of a cyclic generator (q,r) (Def. 2) |
| (A2)<br>"Maximal evenness" (Def. 1.7; but see also Theorems 1.2 and 1.5)<br><br>(A3)<br>The spectrum of $M_{c,d}$ is the smallest spectrum including all clens while containing at least one ambiguity (pp. 134–35; see also Def. 2.6) | (A3)<br>"Efficiency" (p. 12):<br>(a) Any set of scale steps {(s,t)} is the smallest set of its type that contains any t=0, 1, . . . , b-1 at least once;<br>(b) The set of diatonic intervals {(u,v)} is the smallest set of its type that contains any u=0, 1, . . . , a-1 at least once<br><br>(A4)<br>"Coherence" (p. 14) |
| **RESULTS** | |
| (R1)<br>$M_{c,d}$ contains no contradiction (Lemma 2.1) | (R1)<br>Number of scale steps is b (Prop. 1) |
| (R2)<br>Equivalence of:<br>(a) Mc,d has precisely one ambiguity;<br>(b) c=2d-2 and **(c,d)=1**;<br>(c) c=2d–2 and c≡0 (mod 4), etc. (Theorem 2.2) | (R2)<br>(a) a=2b–1 or<br>(b) a=2b–2 (Prop. 1)<br><br>(R3)<br>If a is even, existence of exactly one pair of enharmonically equivalent diatonic intervals (Prop. 2) |
| (R3)<br>Equivalence of:<br>(a) **(c,d)=1**;<br>(b) existence of a cyclic generator g satisfying $g = \frac{cl\pm1}{d}$, etc. (Theorem 3.1A) | (R4)<br>$q = \frac{ar\pm1}{b}$ (from Prop. 1 and the theorem on p. 14)<br><br>(R5)<br>If a is even, a=8+4n, n=0, 1, . . . (p. 17) |

❖ Matthew Santa. 1999. "Defining Modular Transformations." *Music Theory Spectrum* 21/2 (1999): 200-229.

- Here, a way of mapping scale degrees in one collection to the scale degrees of another collection is generalized.




- **MODTRANS (x, y, z)** is a transformation that maps each step class of a musical entity in a modular system x onto a corresponding step class in modular system y, where z represents the "point of synchronization."




- **M-types:** Sets with the same prime form in various "generic spaces," but with different possible "specific realizations." In whole-tone land, generic sc (012) equals specific sc (024), while in chromatic land, generic sc (012) is the same as specific sc (012). [I am using Clough & Myerson's terminology here. Sanata does not use this terminology in his article.]

### § 2.0 SIMILARITY RELATIONS

- Similarity relations try to answer the following question: Given set class X and set class Y, how similar (or dissimilar) are these entities with respect to their harmonic content, relative to all the other possible pair-wise comparisons in the given set-class universe?

- Similarity relations come in four varieties: Those that use subsets to determine similarity (e.g., RECREL or Lewin's EMB); those that use the interval-class vector to determine similarity (e.g., IcVSIM); those that use relative evenness to determine similarity (e.g., Quinn's Fourier balances); those that use voice-leading distance to measure similarity (e.g., Straus's offset).

- One of the perennial problems with similarity relations is figuring out how to measure the similarity between sets of unequal cardinality. This is known as the "cardinality problem."

### § 2.1 SET COMPLEXES AND PROTO-SIMILARITY RELATIONS

❖ Allen Forte. 1973. *The Structure of Atonal Music.* New Haven: Yale University Press.

- **Set complex K**= S and (complement S) ε K(T, (complement T)) iff S can contain or be contained in T; **or**, if S can contain or be contained in (complement T).

- **Set subcomplex Kh**= S and (complement S) ε K(T, (complement T)) iff S can contain or be contained in T; **and**, if S can contain or be contained in (complement T).

- Similarity measures:

  - **Rp (S1, S2)** iff S1 and S2 are both supersets of S3, where the cardinality of S1=S2=n and the cardinality of S3 is n-1.
  - **R1 (S1, S2)** iff V1 and V2 must share the same digits; four of which must correspond. (Essentially, four entries are invariant in the ICV, the other two switch; common to M5-related sets).
  - **R2 (S1, S2)** iff same as R1, but without the interchange feature. Four arguments in the ICV are simply invariant.
  - **R0 (S1, S2)** when two sets' ICVs are maximally dissimilar.

❖ Allen Forte. 1988. "Pitch-Class Set Genera and the Origin of Modern Harmonic Species." *Journal of Music Theory* 32/2: 187-270.

- Forte is primarily concerned with the classification of tonal material and tracing the development of how that material is deployed compositionally over time.

- Forte begins with the interval content of SCs, primarily trichords. He notes that some trichords have three distinct ICs, some have two distinct ICs, and one trichord has only one distinct IC (i.e., (048)). If two trichords share two ICs, they are called **interval-class congruent** (e.g., (012) and (013)).

- Trichords with **unique interval-class representation** are those unique trichords that have the unique combination of two interval classes. For example, (016) is the only trichord with both ic 1 and ic 6.

- Trichordal **progenitors** are those trichords that satisfy either the interval-class congruency criteria or the unique interval-class representation criteria.

- To form a genus, each member of the genus or its complement must embed the progenitor(s). Also, each pentachord must embed one of the tetrachords from the genus, while each hexachord must embed one of the pentachords and one of the tetrachords from the genus.

### § 2.2 MODERN SIMILARITY MEASURES

- Robert Morris. 1979. "A Similarity Measure for Pitch-Class Sets." *Perspectives of New Music* 18: 445-60.

  - **SIM:** Measures the absolute value of the difference between each argument of the ICVs for set X and set Y. This measure should only be used to compare sets of the same cardinal number.

  - **ASIM:** The SIM value generated when comparing two SCs is divided by the total number of entries in both ICVs. The result is an output between 0 and 1; the smaller the output the more similar two sets are said to be. This was the first similarity measure that allowed one to compare sets of different cardinalities in any meaningful way.

- Michael Buchler. 2000. "Broken and Unbroken Interval Cycles and their Use in Determining Pitch-Class Set Resemblance." *Perspectives of New Music* 38/2: 52-87.

  - Interval cycles are used to determine how well a particular set class "projects" various interval classes. For example, 6-z28 and 6-z49 both have the same interval-class vector, but since 6-z28 embeds subsets 3-12 and 4-28, which may be expressed as segments along interval cycles 3 and 4, respectively, 6-z28 is able to project these intervals better than 6-z49, which does not embed either 3-12 or 4-28. This is so, despite the fact 6-z28 and 6-z49 have the same interval-class vector; interval-class based similarity measures are unable to distinguish between these two set classes.

  - "Rather than judging resemblance by comparing interval classes or all available subset classes, I will propose a method that is based upon how each set is partitioned with respect to the six distinct interval-cycles." (C.f. Quinn 2004 in this regard.)

| | |
|---|---|
| 1-cycle distribution of 6-*Z*28: | (01-3-56--9--) |
| 2-cycle distribution of 6-*Z*28: | (0--6--) (135-9-) |
| 3-cycle distribution of 6-*Z*28: | (0369) (1---) (-5--) |
| 4-cycle distribution of 6-*Z*28: | (0--) (159) (-6-) (3--) |
| 5-cycle distribution of 6-*Z*28: | (05-3-16--9--) |
| 6-cycle distribution of 6-*Z*28: | (06) (1-) (--) (39) (--) (5-) |

EXAMPLE 3: DISTRIBUTION OF (SET CLASS) 6-*z*28 [013569] AMONG THE SIX DISTINCT *n*-CYCLES

- Michael Buchler. 1999. "Relative Saturation of Subsets and Interval Cycles as a Means for Determining Set-Class Similarity." Ph.D. diss., University of Rochester.

  - Buchler's work is largely based on Morris's early similarity measures, but tries to take more context into consideration. For example, Buchler's **PSATSIM** is very similar to Morris's ASIM, but it does not compare ICVs directly. Instead, it takes into account the possible saturation with respect to what is maximally possible for each IC given the cardinality of a set and adjusts accordingly, resulting in the **PSATV**. In other words, PSATSIM works just like ASIM, but uses the PSATV rather than a simple ICV.

  - Buchler makes further extensions, where he is largely interested in contiguous interval cycles in pc-space. A contiguous cycle of IC5 in pc-space better "projects" IC5 than various "broken" cycles separated by other ICs. The result is **CSATSIM**. In other words, set classes are compared by looking at their various contiguous interval cycles.

- Eric J. Isaacson. 1990. "Similarity of Interval-Class Content between Pitch-Class Sets: The IcVSIM Relation." *Journal of Music Theory* 34/1: 1-26.

  - **IcVSIM** derives its comparisons by taking the standard deviation of the difference between two ICVs and is considered by Buchler to be particularly "cardinality neutral."

- Marcus Castrén. 1994. *RECREL: A Similarity Measure for Set-Classes*. Studia Musica 4. Helsinki: Sibelius Academy.

  - **RECREL** (recursive relation) compares the subsets of SC X and SC Y. In addition, it measures the subsets of the mutually exclusive subsets of SC X and SC Y in a recursive fashion using $\%REL_n$. For #6 SCs, this would be done at the pentachord, tetrachord, trichord, and dyad levels; all calculated recursively.

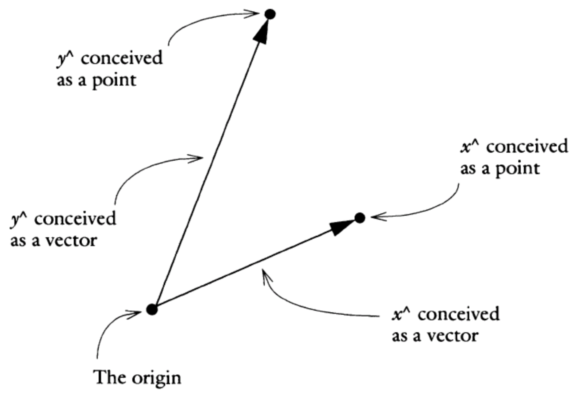
  - In summary, RECREL uses a recursive comparison of subsets. This is like a hybrid between the subset-embedding measures and the measures based on interval content. The results are then weighted, averaged and combined to get a single numerical output. It is perhaps the most mathematically dense of all the similarity relations.

- Damon Scott and Eric Isaacson. 1998. "The Interval Angle: A Similarity Measure for Pitch-Class Sets." *Perspectives of New Music* 36/2: 107-42.

  - Preliminaries:

    - X= SC X
    - Y= SC Y
    - X^ (read: "X hat")= ICV of X represented as coordinates in 6-D space
    - Y^ (read: "Y hat")=ICV of Y represented as coordinates in 6-D space
    - O=origin of space
    - $\mathbf{R}^6$=name of the 6-D space

  - To measure the similarity between X and Y, X^ and Y^ are treated as coordinate points in a 6-D space ($\mathbf{R}^6$). The angle measured between the vectors emanating from the origin of the space and intersecting with points X^ and Y^ determines the similarity between X and Y. The result is an angel between 0 and 90 degrees; the larger the angle, the more dissimilar X and Y are said to be.




**§ 2.3 PROTOTYPES AND BALANCE**

- Ian Quinn. 2001. "Listening to Similarity Relations." *Perspectives of New Music* 39/2: 108-58.

  - Quinn claims that these sundry similarity measures are basically telling us the same thing. Scholars are focusing too much on the subtle differences between the similarity measures. They are missing the forest for the trees.

  - **Natural Kinds Hypothesis:** Whatever similarity relations are telling us, the similarity relations are not creating these relationships, but are simply uncovering *a priori* relationships inherent in the 12-pc tonal system. Many of these relationships are described by other branches of atonal theory. Similarity relations are largely telling us things we already know and largely conform to our intuitions.

  - Quinn draws the distinction between **equivalence** and **similarity**, noting that maximum similarity is often commensurate with some equivalence class. Note that the idea of similarity is closely related to the field of **fuzzy logic**.

  - Three myths of similarity relations:

    - **Transitivity.** Similarity relations are not transitive. Just because A is similar to B and B is similar to C, this does not entail that A is similar to C. [By the way, equivalence relations *are* transitive.]
    - **Complexity.** Similarity relations are not staggeringly complex. There is a basic shape to the data when perceived in its entirety, and we are not relegated to studying numerous pair-wise bits.
    - **Intensions.** Similarity relations are identified with their intensions. We should focus less on the mathematical "guts" of similarity relations and more on their results (i.e., their extensions).

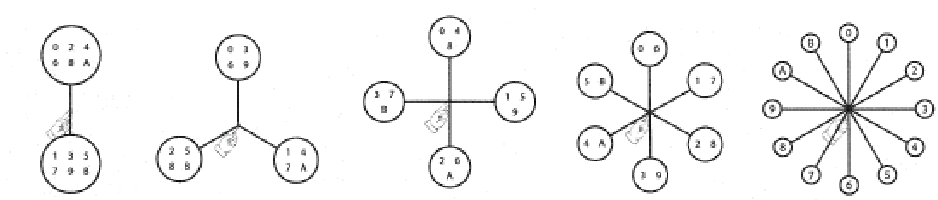
  - Quinn concludes that subset-based and ICV-based similarity relations basically tell us the same story under cluster analysis. Set classes tend to cluster into six groups, each associated with an interval cycle. The M operation is particularly significant because a set modified by M largely holds its original similarity relations with other sets (cf. Forte's R1). Interval cycles and the generalization of similarity to n-tone equal temperament are further avenues which need exploration.

❖ Ian Quinn. 2004. "A Unified Theory of Chord Quality in Equal Temperaments." Ph.D. diss., University of Rochester.

- Quinn is largely interested in the categorization of set classes into prototypes and their intergeneric and intrageneric affinities. Quinn takes as his starting point the concept of **maximal evenness** (ME) as a means for determining the prototypes.

- **Intervallic half-truth:** A fallacious concept which says that the interval content of a chord is the cause rather than a symptom of its qualitative relationships with other chords.

- **Fourier balances:** Note that FBn equals the number of pitch classes in each "pan."



FB6 FB4 FB3 FB2 FB1

- Fourier balances and chord quality: The more imbalanced a chord is on some Fourier scale, the more prototypical that chord is said to be. For instance, using FB6, a whole-tone collection would be most imbalanced, and therefore, most prototypical. In other words, maximal *unevenness* on a Fourier balance results in prototypicality. The degree of balance versus imbalance is calculated using **vector addition**.

- **lewin:** A unit of measurement. A lewin (lw) is equal to the force of one pitch class tipping one pan. The more lewins a set exerts, the more imbalanced it is.

## § 2.4 PARSIMONIOUS VOICE LEADING AS SIMILARITY

❖ Joseph N. Straus. 2003. "Uniformity, Balance, and Smoothness in Atonal Voice Leading." *Music Theory Spectrum* 20/2: 175-208.

- Straus claims that his graphs of optimal offset between set classes measures something approximating similarity. The claim is that closeness in voice-leading space results in sets that are similar in their harmonic content.

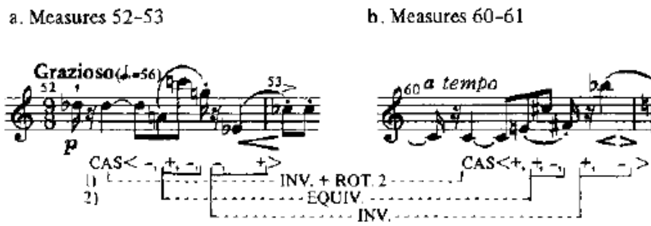
## § 3.0 CONTOUR THEORY

- Michael L. Friedmann. 1985. "A Methodology for the Discussion of Contour: Its Application to Schoenberg's Music." *Journal of Music Theory* 29/2: 223-48.

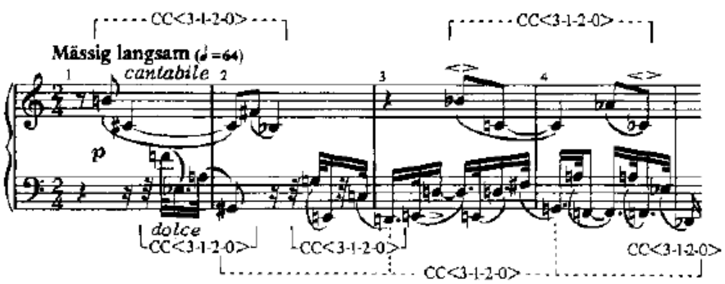
  - Friedmann claims that contour is one of the most salient features of post-tonal music. He invents a number of constructions to model this domain.

    - **Contour adjacency series** (CAS): An ordered series of +s and –s corresponding to moves upward and downward in a musical unit.
    - **Contour adjacency series vector** (CASV): A two-digit summation of the +s and –s in the CAS of a musical unit. The first digit signifies the number of upward moves in a musical unit; the second digit signifies the number of downward moves in a musical unit. For example, the CAS <+,+,-> has a CASV of <2,1>.
    - **Contour class** (CC): An ordered series that indicates what registral position a pitch occupies in a musical unit. If n=the number of pitches in a musical unit, then the highest pitch in that unit is signified in the CC by n-1. The lowest pitch is signified by 0.
    - **Contour interval** (CI): The distance between one element in a CC and a later element as signified by the signs + or – and a number. For example, in CC <0-1-3-2>, the CI of 0 to 3 is +3.
    - **Contour interval succession** (CIS): A series which indicates the order of CIs in a given CC. For example, the CIS for CC <0-1-3-2> is <+1,+2,-1>.
    - **Contour interval array** (CIA): An ordered series of numbers that indicates the multiplicity of each CI type in a given CC. If there are n elements in a CC, then there are n-1 possible ascending (+) CI types and n-1 descending (-) interval types. The ascending series separated by a slash (/) correspond to the positive and negative CI types. For CC <0-1-3-2> there are two instances of CI type +1, two instances of CI type +2, and one instance of CI type +3; there is 1 instance of CI type -1, and o instances of CI types -2 and -3. In summary, the CIA for CC <0-1-3-2> is <2,2,1/1,0,0>.
    - **Contour class vector I** (CCV I): A two-digit summation of the degrees of ascent and descent expressed in a CIA. The first digit is the total of the products of the frequency of the contour interval types found on the left side of the slash in the middle of a CIA. The second digit is the total of the products of the frequency and contour interval types found on the right side of the slash in the middle of a CIA. For example, the first digit of CCV I for CIA <2,2,1/1,0,0> is 2(1)+2(2)+1(3); the second digit is 1(1). CCV I in this case is <9,1>.
    - **Contour class vector II** (CCV II): A two-digit summation of the degrees of ascent and descent expressed in a CIA. The first digit is the total of the frequency of contour interval types found on the left side of the slash in the middle of a CIA. The second digit is the total of the frequency of contour interval types found on the right side of the slash in the middle of a CIA. For example, the first digit of CCV II for CIA <2,2,1/1,0,0> is 2+2+1; the second digit is 1. CCV II in this case is <5,1>.

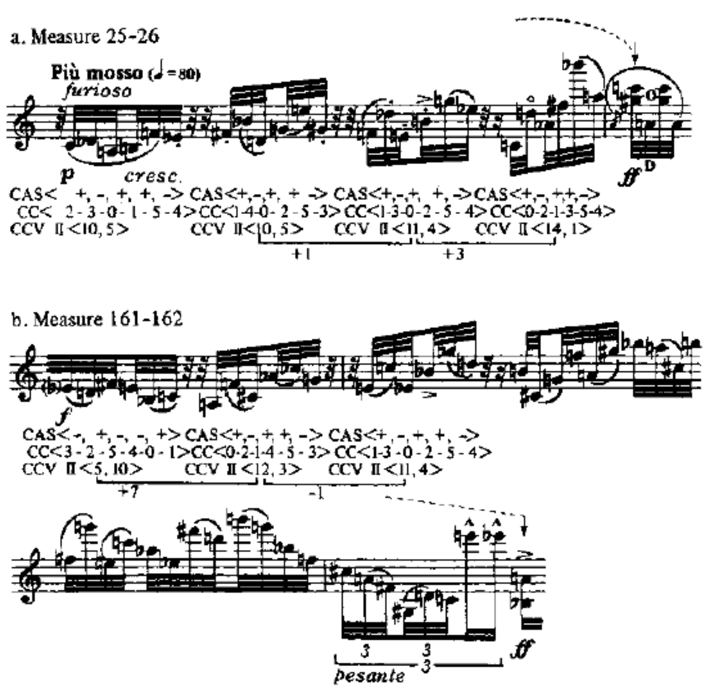
- Here are a few representative examples from Friedmann's article. Notice how a CAS may be inverted and rotated.




Example 4. Schoenberg, Phantasy, op. 47




Example 5. Schoenberg, Klavierstueck, op. 33b, measures 1–4




Example 8. Schoenberg, Phantasy, op. 47

- Elizabeth West Marvin and Paul A. Laprade. 1987. "Relating Musical Contours: Extensions for a Theory of Contour." *Journal of Music Theory* 31/2: 225-67.

  - **Glossary of Terms**

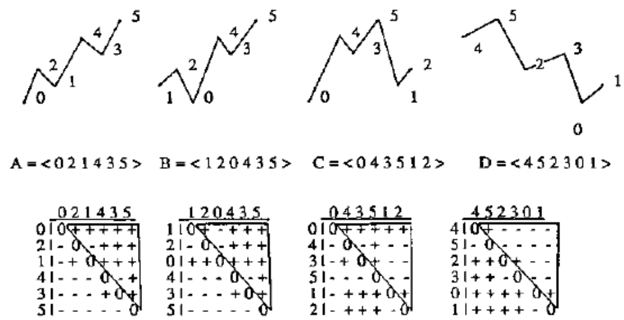
    - **COM-matrix** (comparison matrix): A two-dimensional array that displays the results of the comparison function, COM(a, b) for any two c-pitches in c-space. If b is higher than a, the function returns "+"; if b is the same as a, the function returns "0"; and if b is lower than a, COM(a, b) returns "-".
    - **C-pitches** (cps): Elements in c-space, numbered in order from low to high, beginning with 0 up to (n-1), where n equals the number of elements.
    - **C-segment** (cseg): An ordered set of c-pitches in c-space.
    - **C-space** (contour space): A type of musical space consisting of elements arranged from low to high disregarding the exact intervals between elements.
    - **C-space segment class** (csegclass): An equivalence class made up of all csegs related by identity, translation, retrograde, inversion, and retrograde-inversion.
    - **C-subsegment** (csubseg): Any ordered subgrouping of a given cseg. May be comprised of either contiguous or non-contiguous c-pitches from the original cseg.
    - **$INT_n$:** Any of the diagonals to the right of the main diagonal (upper left-hand to lower right-hand corner) of the COM-matrix, in which n stands for the difference between order position numbers of the two cps compared; that is, $INT_3$ compares cps that are 3 positions apart.
    - **Inversion:** The inversion of a cseg S comprised of n distinct cps is written IS, and may be found by subtracting each c-pitch from (n-1).
    - **Normal form:** An ordered array in which elements in a cseg of n distinct c-pitches are numbered from 0 to (n-1) and listed in temporal order.
    - **Prime form:** A representative for identification of cseg classes, derived by the following algorithm: (1) if necessary, translate the cseg so its content consists of integers from 0 to (n-1); (2) if (n-1) minus the last c-pitch is less than the first c-pitch invert the cseg; (3) if the last c-pitch is less than the first c-pitch, retrograde the cseg.
    - **Translation:** An operation through which a csubseg is renumbered from 0 for the lowest c-pitch to (n-1) for the highest.

  - **Contour Similarity Measurements**

    - **ACMEMB (A,B):** Counts the total number of mutually-embedded csegs of cardinality 2 through the cardinality of the smaller cseg and adjusts this to a decimal value by dividing by the total number of possible subsegs of A and B (excluding the null set for each and the one-note csubsegs).
    - **CEMB (A,B):** Counts the number of times cseg A is embedded in cseg B, then divides this sum by the total number of csubsegs of the same cardinality as A possible, to return a value that approaches 1 for csegs of greater similarity.
    - **$CMEMB_n$ (X,A,B):** Counts the number of times the csegs, X (of cardinality n), are mutually embedded in both csegs A and B. (The variable X may successively represent more than one cseg-type during the course of the function.) Each cseg X must be embedded at least once in both A and B; then, all instances of X are counted in both A and B. The total number of mutually-embedded csegs of cardinality n is then divided by the number of n-cardinality csubsegs possible in order to return a decimal number approaching 1 as csegs A and B are more similar.

- **CSIM (A,B):** Measures the degree of similarity between two csegs of the same cardinality by comparing specific positions in the upper right-hand triangle of the COM-matrix for cseg A with the corresponding positions in the matrix of cseg B in order to total the number of similarities between them. This sum is divided by the total number of positions compared to return a decimal number that signifies greater similarity between csegs as the value approaches 1.

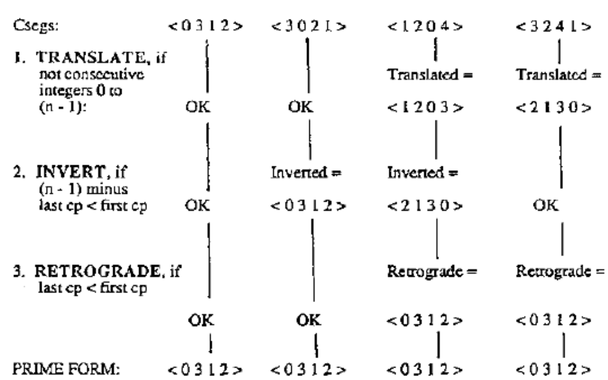
## Selected Examples




Each contour has $INT_1$ = < + - + - + >.

As shown by contour graphs, contours A and B are most similar; A and D most dissimilar.

Figure 5. Comparisons Among Selected Csegs Where $INT_1$ = < + − + − + >




**All four csegs belong to the same c-space segment class.**

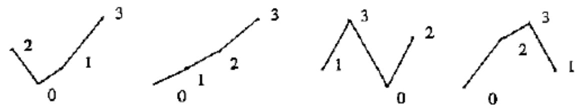
Operations:

To translate, renumber the cseg with consecutive integers from 0 to (n - 1), where n equals the cardinality of the cseg.

To invert, subtract each cp from (n - 1).

To retrograde, place the cps in reverse order.

Figure 7. Prime Form Algorithm




A = < 2 0 1 3 >    B = < 0 1 2 3 >    C = < 1 3 0 2 >    D = < 0 2 3 1 >

| | 2 | 0 | 1 | 3 |
|---|---|---|---|---|
| 2 | 0 | - | - | + |
| 0 | + | 0 | + | + |
| 1 | + | - | 0 | + |
| 3 | - | - | - | 0 |

| | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| 0 | 0 | + | + | + |
| 1 | - | 0 | + | + |
| 2 | - | - | 0 | + |
| 3 | - | - | - | 0 |

| | 1 | 3 | 0 | 2 |
|---|---|---|---|---|
| 1 | 0 | + | - | + |
| 3 | - | 0 | - | - |
| 0 | + | + | 0 | + |
| 2 | - | + | - | 0 |

| | 0 | 2 | 3 | 1 |
|---|---|---|---|---|
| 0 | 0 | + | + | + |
| 2 | - | 0 | + | - |
| 3 | - | - | 0 | - |
| 1 | - | + | + | 0 |

CSIM(A,B) = 4/6 = .67
CSIM(A,C) = 3/6 = .50
CSIM(A,D) = 2/6 = .33

Figure 8. CSIM as Similarity Measurement for Csegs of the Same Cardinality

**CEMB(A,B)**

**A = < 0 1 2 > = c3-1**
**B = < 4 5 2 3 6 1 > = c6-96**

A - MATRIX OF c3-1:

| | 0 | 1 | 2 |
|---|---|---|---|
| 0 | 0 | + | + |
| 1 | - | 0 | + |
| 2 | - | - | 0 |

< 0 1 2 >

B - MATRIX OF c3-1 EMBEDDED AS CONTIGUOUS SUBSET OF c6-96:

| | 4 | 5 | (2) | (3) | (6) | 1 |
|---|---|---|---|---|---|---|
| 4 | 0 | + | - | - | + | - |
| 5 | - | 0 | - | - | + | - |
| (2) | + | + | (0) | (+) | (+) | - |
| (3) | + | + | (-) | (0) | (+) | - |
| (6) | - | - | (-) | (-) | (0) | - |
| 1 | + | + | + | + | + | 0 |

< 2 3 6 > = < 0 1 2 >

C - MATRIX OF c3-1 EMBEDDED AS NON-CONTIGUOUS SUBSET OF c6-96:

| | (4) | (5) | 2 | 3 | (6) | 1 |
|---|---|---|---|---|---|---|
| (4) | (0) | (+) | - | - | (+) | - |
| (5) | (-) | (0) | - | - | (+) | - |
| 2 | + | + | 0 | + | + | - |
| 3 | + | + | - | 0 | + | - |
| (6) | (-) | (-) | - | - | (0) | - |
| 1 | + | + | + | + | + | 0 |

< 4 5 6 > = < 0 1 2 >

D - UPPER RIGHT-HAND TRIANGLE:

| | 0 | 1 | 2 |
|---|---|---|---|
| 0 | 0 | + | + |
| 1 | - | 0 | + |
| 2 | - | - | 0 |

| | 4 | 5 | 2 | 3 | 6 | 1 |
|---|---|---|---|---|---|---|
| 4 | [0] | (+) | - | - | (+) | - |
| 5 | - | 0 | - | - | + | - |
| 2 | [+] | [+] | 0 | + | (+) | - |
| 3 | + | + | - | 0 | + | - |
| 6 | [-] | [-] | - | - | [0] | - |
| 1 | + | + | + | + | + | 0 |

| | 4 | 5 | 2 | 3 | 6 | 1 |
|---|---|---|---|---|---|---|
| 4 | [0] | (+) | - | - | (+) | - |
| 5 | - | 0 | - | - | + | - |
| 2 | + | + | 0 | + | + | - |
| 3 | [+] | [+] | - | 0 | (+) | - |
| 6 | - | - | - | - | 0 | - |
| 1 | [+] | [+] | + | + | [+] | 0 |

Figure 10. CEMB(A,B)

A: CSEGS OF EQUAL CARDINALITY

A = <0 1 2 3>  B = <0 2 1 3>

| Csubsegs of A: | | Csubsegs of B: | |
|---|---|---|---|
| | <0 1> = <0 1> | | <0 2> = <0 1> |
| | <0 2> = <0 1> | | <0 1> = <0 1> |
| | <0 3> = <0 1> | | <0 3> = <0 1> |
| | <1 2> = <0 1> | | <2 3> = <0 1> |
| | <2 3> = <0 1> | | <1 3> = <0 1> |
| | <1 3> = <0 1> | | <2 1> = <1 0> |
| | <0 1 2> = <0 1 2> | | <0 2 1> = <0 2 1> |
| | <0 1 3> = <0 1 2> | | <0 2 3> = <0 1 2> |
| | <0 2 3> = <0 1 2> | | <0 1 3> = <0 1 2> |
| | <1 2 3> = <0 1 2> | | <2 1 3> = <1 0 2> |
| | <0 1 2 3> = <0 1 2 3> | | <0 2 1 3> = <0 2 1 3> |

17 csegs mutually embedded in both csegs; ACMEMB(A, B) = 17/22 = .77

B: CSEGS OF UNEQUAL CARDINALITY

C = <0 2 1 3 4>

| Csubsegs of C: | | | |
|---|---|---|---|
| | <0 2 1 4> = <0 2 1 3> | <0 2 1> = <0 2 1> | <0 2> = <0 1> |
| | <0 2 3 4> = <0 1 2 3> | <0 2 3> = <0 1 2> | <0 1> = <0 1> |
| | <0 1 3 4> = <0 1 2 3> | <0 2 4> = <0 1 2> | <0 3> = <0 1> |
| | <0 2 1 3> = <0 2 1 3> | <0 1 3> = <0 1 2> | <0 4> = <0 1> |
| | <2 1 3 4> = <1 0 2 3> | <0 1 4> = <0 1 2> | <2 3> = <0 1> |
| | | <2 1 3> = <1 0 2> | <2 4> = <0 1> |
| | | <2 1 4> = <1 0 2> | <1 3> = <0 1> |
| | <0 2 1 3 4> = <0 2 1 3 4> | <2 3 4> = <0 1 2> | <1 4> = <0 1> |
| | | <1 3 4> = <0 1 2> | <3 4> = <0 1> |
| | | <0 3 4> = <0 1 2> | <2 1> = <1 0> |

29 csegs mutually embedded in csegs A and C; ACMEMB(A, C) = 29/37 = .78
33 csegs mutually embedded in csegs B and C; ACMEMB(B, C) = 33/37 = .89

Figure 13. ACMEMB(A,B) for Sets of Equal Cardinality

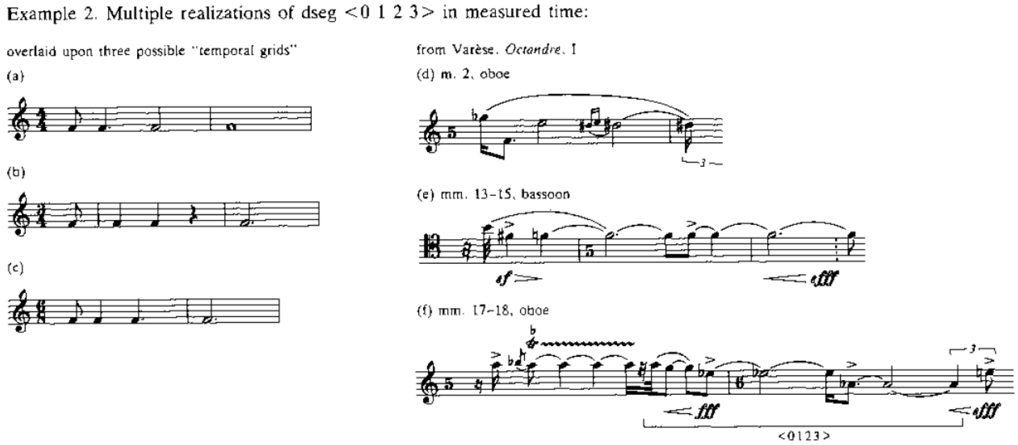
- Elizabeth West Marvin. 1991. "The Perception of Rhythm in Non-Tonal Music: Rhythmic Contours in the Music of Edward Varèse." *Music Theory Spectrum* 13/1: 61-78.

  - "This study proposes a theory for analysis of nonbeat-based rhythms, one which differs from most previous work in that it models relative, rather than absolute, measured durations. These patterns of relative durations, here termed **rhythmic contours**, are based upon perceptual strategies that listeners use in the absence of a beat framework," p. 62.

  - **Duration space** (d-space): Analogous to contour space (after Morris); models relative duration in the same way contour space models pitch height; a type of temporal space consisting of elements arranged from short to long.

    - **d-segment** (dseg): An ordered set of durations in d-space.
    - **d-subsegment** (dsubseg): Any ordered sub-grouping of a given dseg.

Example 2. Multiple realizations of dseg <0 1 2 3> in measured time:



Example 3. Dsegs and dsubsegs in duration space:
Varèse, *Octandre*, I, oboe, mm. 8–12


<210354>

Dsubsegs:

(a) 

<210>

(b) 

<035> = <012>*

(c) 

<0354> = <0132>*

(d) 

<1035> = <1023>*

* = by translation

Example 5. Dseg equivalence

(a)

(1) 

<314> in sixteenth-note durations = <102> in d-space

(2) 

<628> in sixteenth-note durations = <102> in d-space

matrices:

(1)

| | 3 | 1 | 4 |
|---|---|---|---|
| 3 | 0 | - | + |
| 1 | + | 0 | + |
| 4 | - | - | 0 |

(2)

| | 6 | 2 | 8 |
|---|---|---|---|
| 6 | 0 | - | + |
| 2 | + | 0 | + |
| 8 | - | - | 0 |

(b)

 <102> in d-space

 <102> in d-space

(c)

Varèse, *Octandre*, I, oboe, mm. 9–12

(3) 


<0132>

Varèse, *Octandre*, I, oboe, m. 1

(4) 


<0354>=<0132>

matrices:

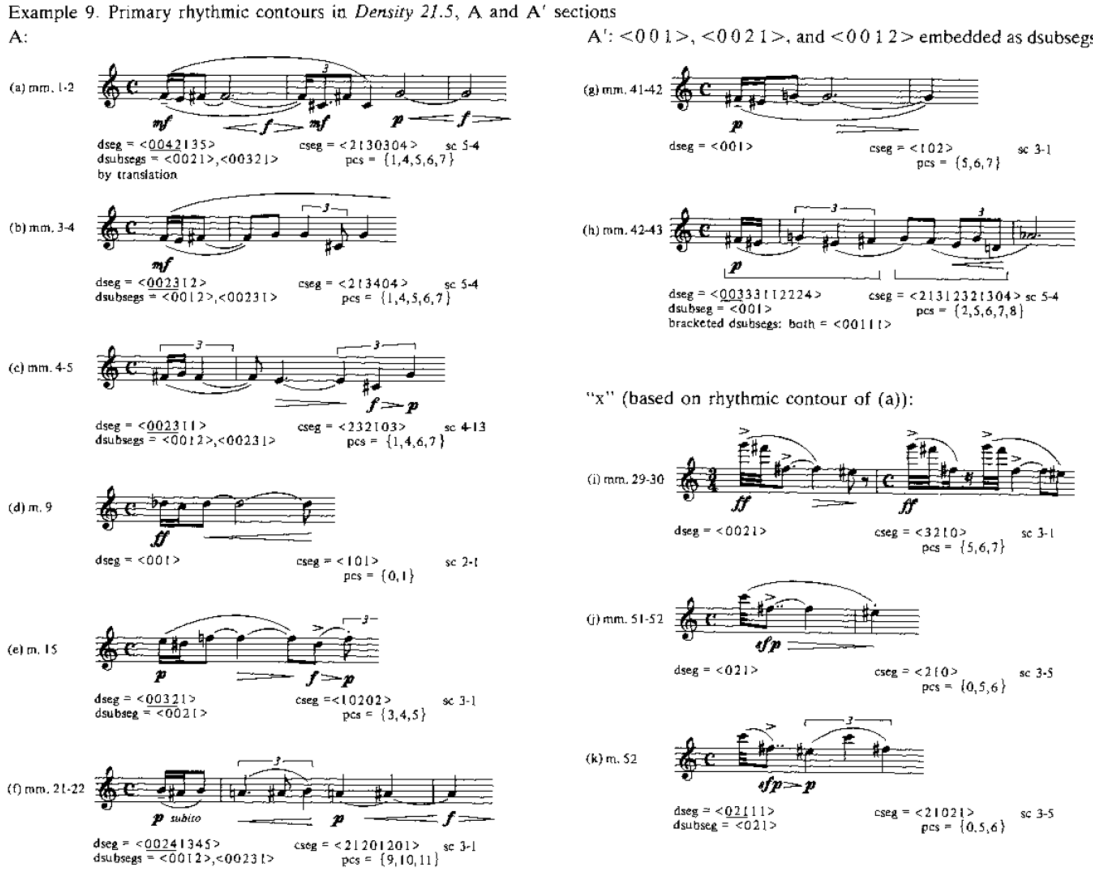
(3)

| | 0 | 1 | 3 | 2 |
|---|---|---|---|---|
| 0 | 0 | + | + | + |
| 1 | - | 0 | + | + |
| 3 | - | - | 0 | - |
| 2 | - | - | + | 0 |

(4)

| | 0 | 3 | 5 | 4 |
|---|---|---|---|---|
| 0 | 0 | + | + | + |
| 3 | - | 0 | + | + |
| 5 | - | - | 0 | - |
| 4 | - | - | + | 0 |

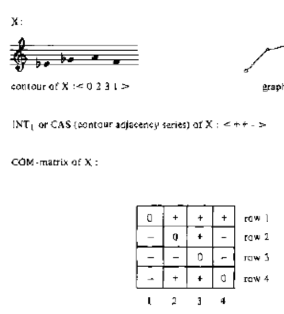
Example 9. Primary rhythmic contours in *Density 21.5*, A and A′ sections



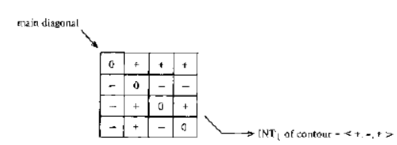

- ❖ Robert D. Morris. 1993. "New Directions in the Theory and Analysis of Musical Contour." *Music Theory Spectrum* 15/2: 205-28.

    - This article extends work by others—especially Marvin and Friedmann—in the area of contour. Here, a contour may become manifest in many different domains including pitch space, dynamics, and rhythm. This article is particularly known for its introduction of a **contour reduction algorithm** (see below).

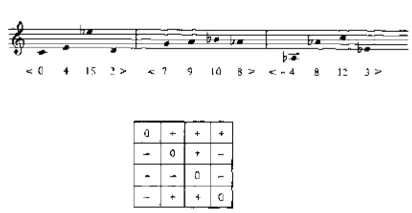
Example 1. Contours: notation and concepts



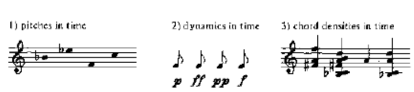

Example 3. COM-matrix of < 0 3 1 2 >



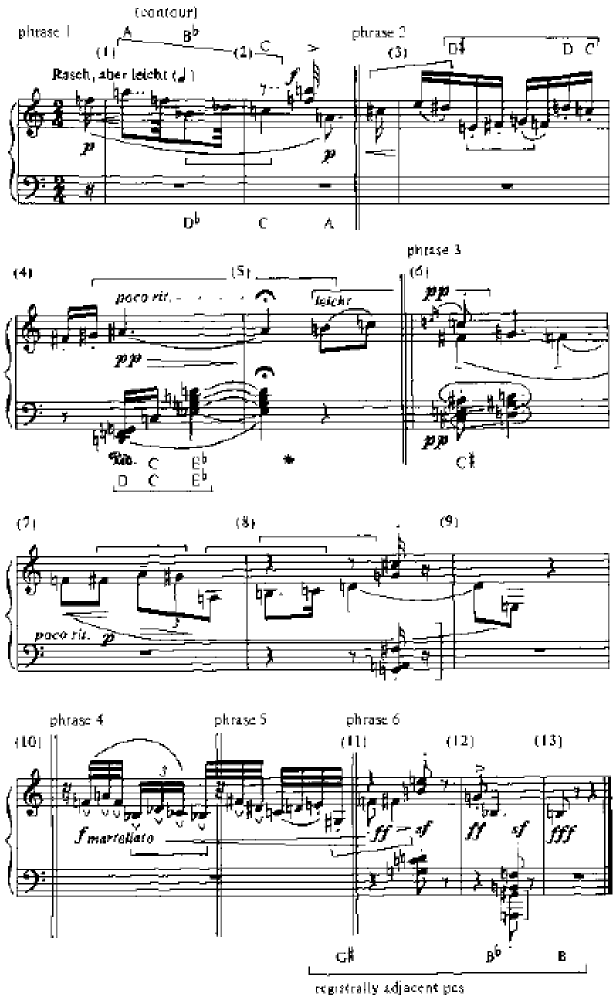

Example 4. A cseg: equivalent contours with the same COM-matrix (C4 = 0)



Example 2. Contour < 1 3 0 2 > interpreted as . . .

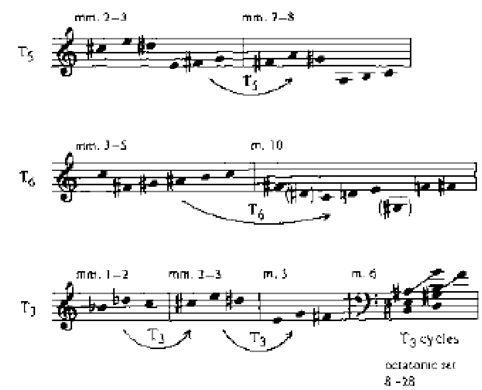


Example 10. 3-2 [0,1,3] set classes in Schoenberg's Piano Piece, Op. 19 No. 4




Example 11a. Set classes in Op. 19 No. 4


Example 11b. Transformations in Op. 19 No. 4



Example 13. Contour-Reduction Algorithm

The algorithm prunes pitches from a contour until it is reduced to a "prime."

**Definition:** *Maximum pitch:* Given three adjacent pitches in a contour, if the second is higher than or equal to the others it is a *maximum*. A set of maximum pitches is called a *maxima*. The first and last pitches of a contour are maxima by definition.

**Definition:** *Minimum pitch:* Given three adjacent pitches in a contour, if the second is lower than or equal to the others it is a *minimum*. A set of minimum pitches is called a *minima*. The first and last pitches of a contour are minima by definition.

**Algorithm:** Given a contour C and a variable N:

**step 0:** Set N to 0.

**step 1:** Flag all maxima in C; call the resulting set the *max-list*.

**step 2:** Flag all minima in C; call the resulting set the *min-list*.

**step 3:** If all pitches in C are flagged, go to step 9.

**step 4:** Delete all non-flagged pitches in C.

**step 5:** N is incremented by 1 (i.e., N becomes N + 1).

**step 6:** Flag all maxima in max-list. For any string of equal and adjacent maxima in max-list, either: (1) flag only one of them; or (2) if one pitch in the string is the first or last pitch of C, flag only it; or (3) if both the first and last pitch of C are in the string, flag (only) both the first and last pitch of C.

**step 7:** Flag all minima in min-list. For any string of equal and adjacent minima in min-list, either: (1) flag only one of them; or (2) if one pitch in the string is the first or last pitch of C, flag only it; or (3) if both the first and last pitch of C are in the string, flag (only) both the first and last pitch of C.

**step 8:** Go to step 3.

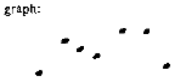
**step 9:** End. N is the "depth" of the original contour C.

The reduced contour is the prime of C, if N = 0, then the original C has not been reduced and is a prime itself.

Example 14. Worked example of contour-reduction algorithm

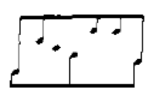
Let C = <0 4 3 2 5 5 1>

graph:



START:

steps 1 and 2: Upper beams show flagged max-list; lower beams show flagged min-list.



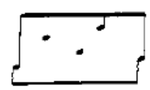
step 3. Not all pitches are flagged.

step 4. Delete 3rd (unflagged) pitch.

step 5. N = 1.

step 6. Flag maxima and delete repetition in max-list.

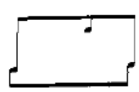
step 7. Flag minima.



step 8. Go to step 3.

step 3. Not all pitches are flagged.

step 4. Delete unflagged pitches.



step 5. N = 2.

steps 6 and 7. All pitches are flagged.

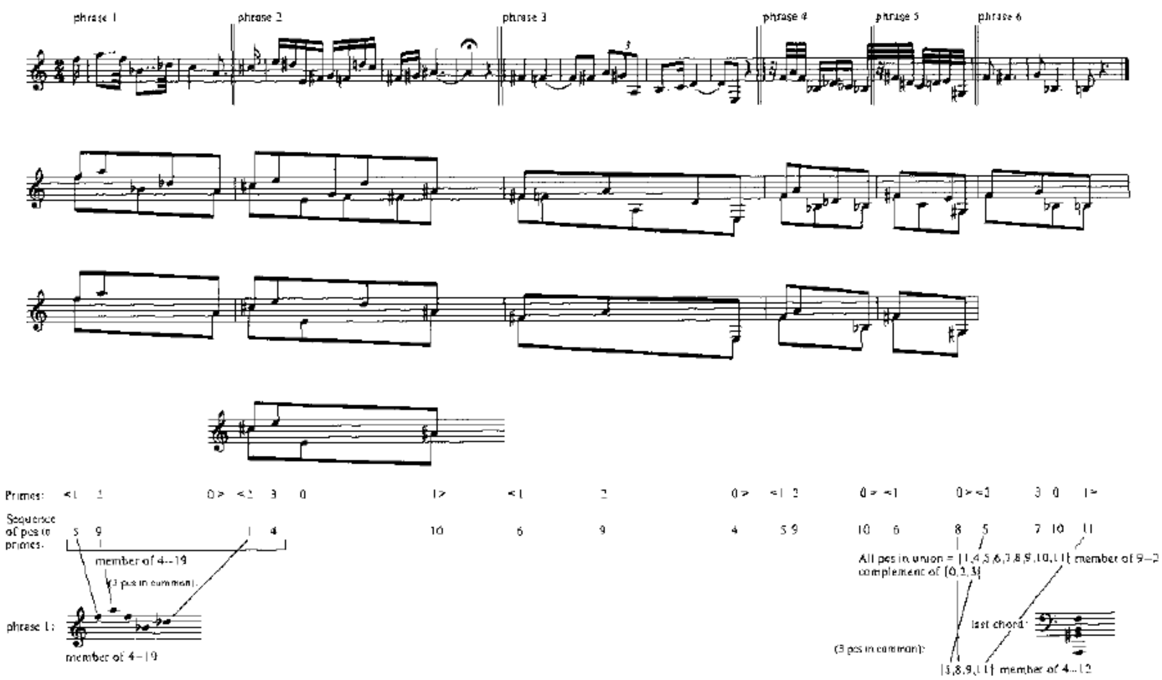
step 8. Go to step 3.

step 3. All pitches are flagged; go to step 9.

step 9. END.

<0 4 3 2 5 5 1> has a depth of 2; its prime is <0 2 1>.

Example 15. Contour-reduction analysis of Schoenberg, Op. 19 No. 4




Example 17. Contour-reduction algorithm applied to entire "melody" of Op. 19 No. 4

- ❖ Ian Quinn. 1997. "Fuzzy Extensions to the Theory of Contour." *Music Theory Spectrum* 19/2: 232-63.

  - "This article explores the fruitful marriage of contour to the theory of fuzzy sets," p. 232.

  - "The application developed in the course of this paper seem simple on the surface: Given a family **M** of highly similar n-note contours, to judge whether or not another given n-note melody is a viable candidate for inclusion in **M**.

Example 1. The sixteen melodies (collectively called M) played by the first violins and flutes in Reich, *The Desert Music*, iii (outer portions)

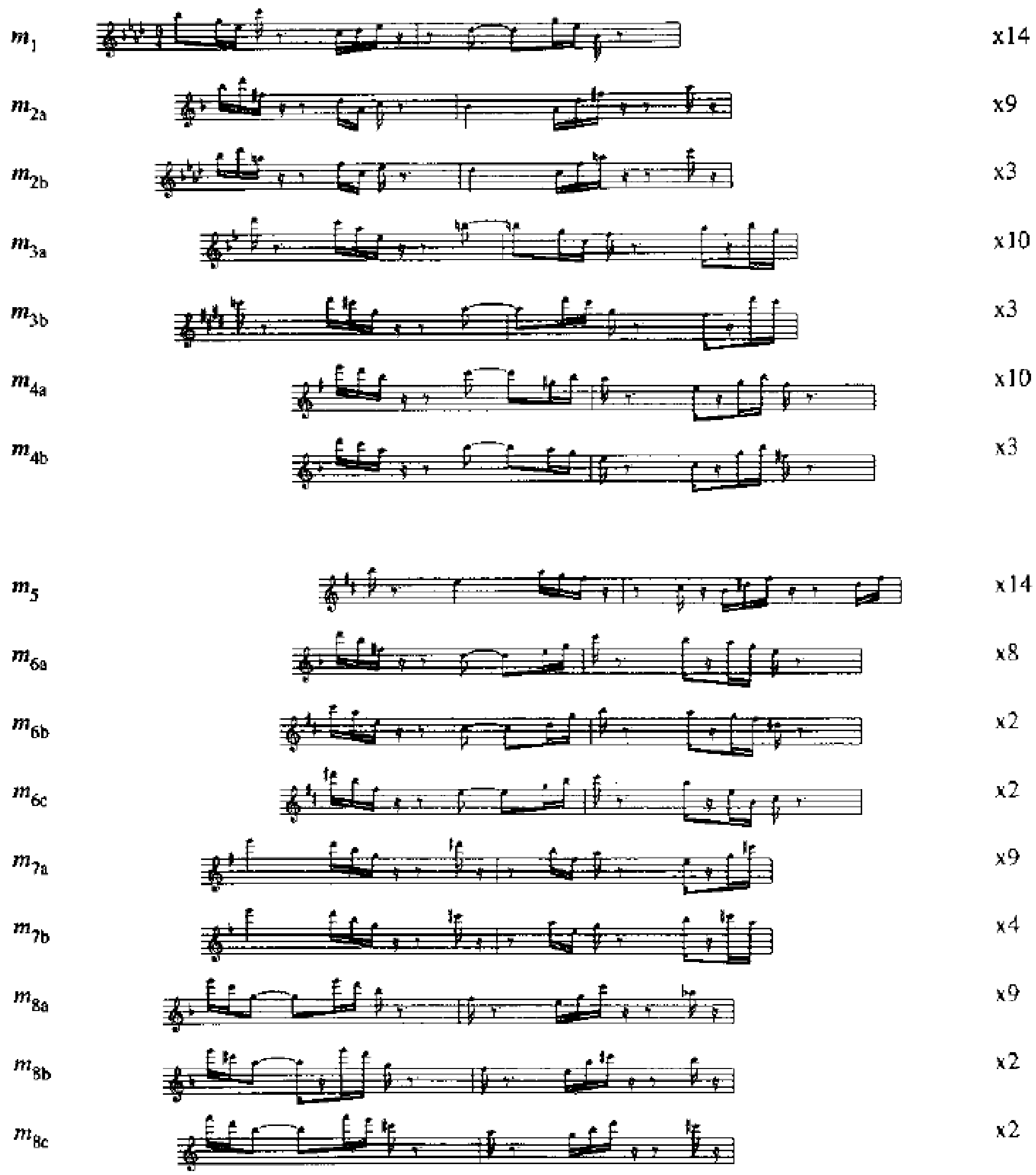


Figure 1. **M**, the set of 16 contours representing the melodies in Example 1

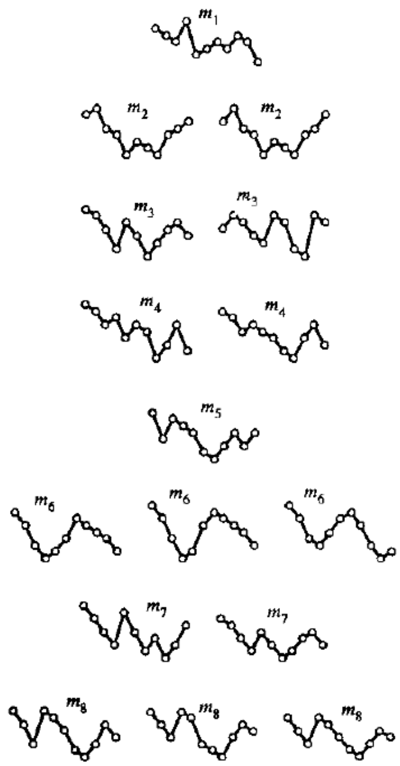



Table 1. The **M** family of melodies notated as csegs

| | |
|---|---|
| $m_1$ | <5 4 3 6 1 2 3 2 4 3 0> |
| $m_{2a}$ | <6 7 4 3 0 2 1 0 3 4 5> |
| $m_{2b}$ | <5 7 4 3 0 2 1 0 3 4 6> |
| $m_{3a}$ | <7 6 4 1 5 3 0 2 4 5 3> |
| $m_{3b}$ | <4 6 5 3 2 6 5 1 0 6 5> |
| $m_{4a}$ | <8 7 5 6 3 5 4 0 2 5 1> |
| $m_{4b}$ | <7 6 4 5 4 3 1 0 3 5 2> |
| $m_5$ | <7 3 6 5 4 1 0 2 4 2 4> |
| $m_{6a}$ | <7 5 2 0 1 3 6 5 4 3 1> |
| $m_{6b}$ | <8 6 3 0 1 5 7 6 5 4 2> |
| $m_{6c}$ | <8 6 3 2 4 6 7 5 2 0 1> |
| $m_{7a}$ | <8 6 4 2 7 4 1 3 0 2 5> |
| $m_{7b}$ | <6 5 3 1 4 2 0 1 3 4 2> |
| $m_{8a}$ | <7 5 2 7 6 4 1 0 2 5 3> |
| $m_{8b}$ | <7 5 3 7 6 2 1 0 3 5 4> |
| $m_{8c}$ | <6 4 2 6 5 3 1 0 2 4 3> |

Figure 3. The M family of melodies notated as contour reductions

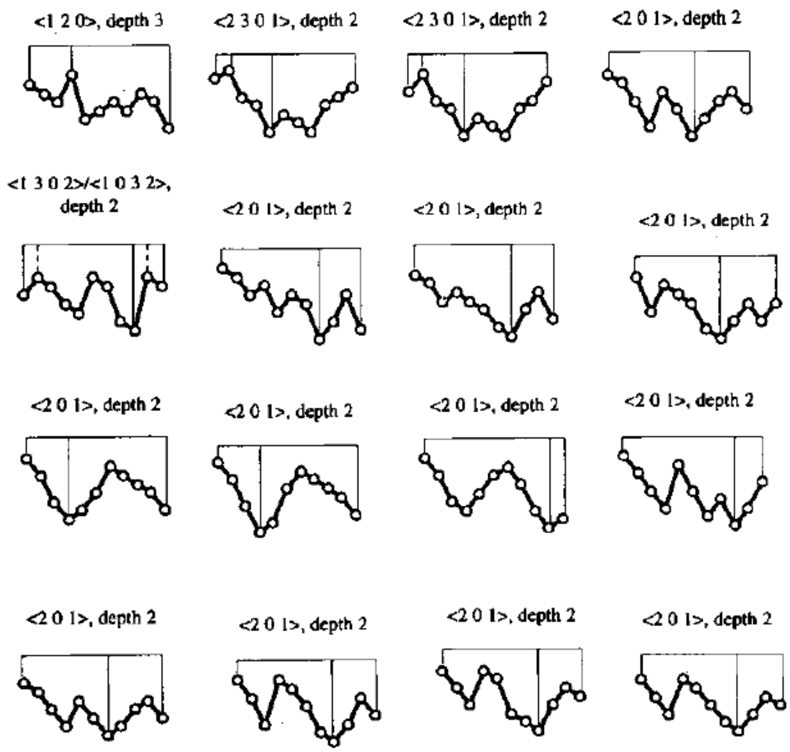



Figure 5. CSIM, Elizabeth Marvin's contour similarity index, demonstrated on two related contours

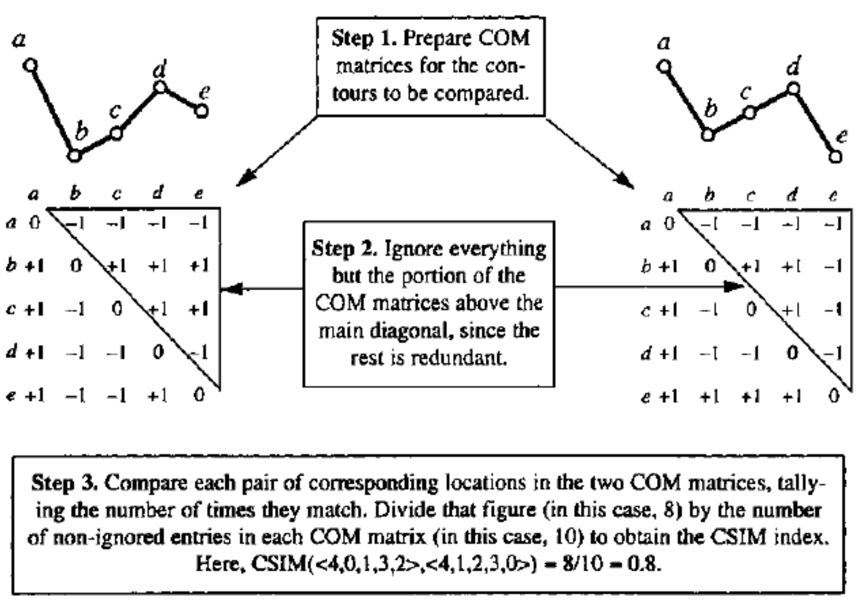


Figure 10. Averaging contours

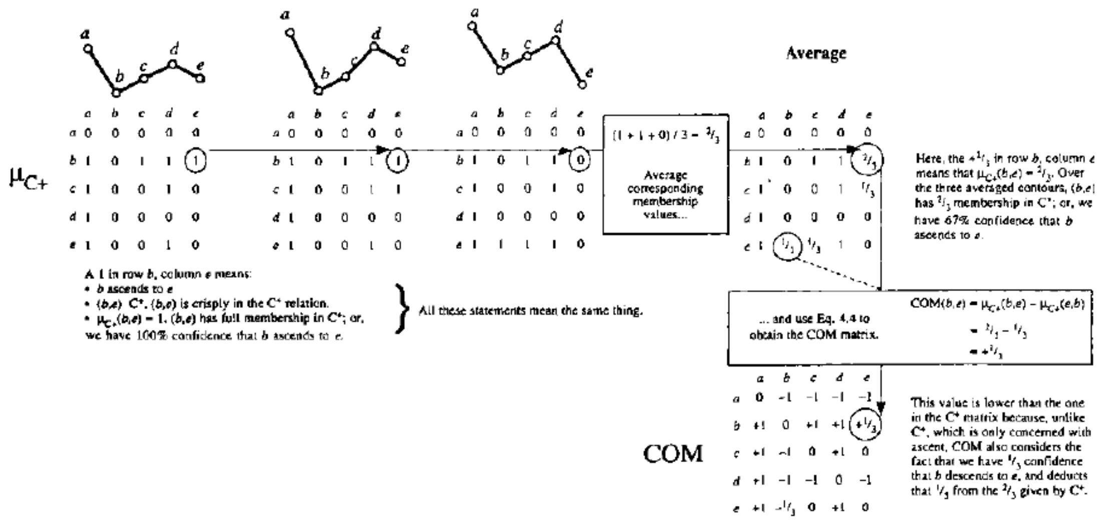



Figure 13. The solution to the Judgment Problem

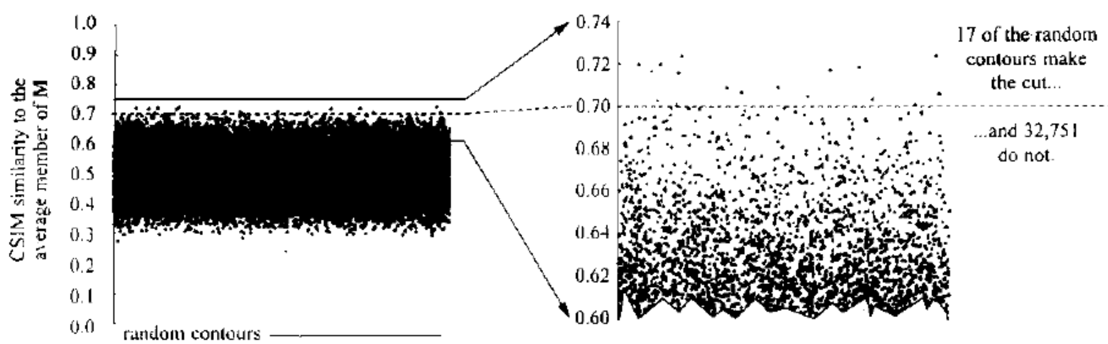
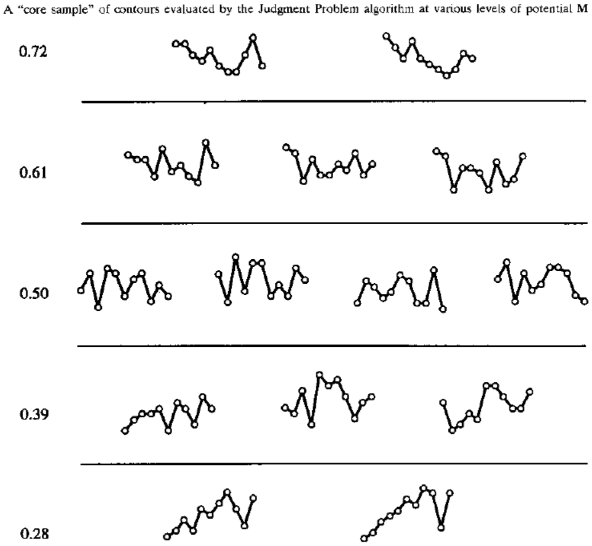



Figure 14. A "core sample" of contours evaluated by the Judgment Problem algorithm at various levels of potential M membership



## § 4.0 TRANSFORMATION THEORY

- Transformation theory models musical processes in various domains such as harmony, rhythm and contour through the use of functions, groups and their graphs.

## § 4.1 PRELIMINARIES

- **Functions:** Suppose S and T are sets. The function (i.e., transformation) f: S→T is a way of assigning to each x ε S an unique y ε T so that f(x)=y.

  Functions usually fulfill two criteria:

  - **One-to-one:** Each unique x ε S maps onto a unique y ε T.
  - **Onto:** For every y ε T there is some x ε S such that f(x)=y.

  ***If f is both one-to-one and onto, then f is a **bijection**. In this case, for every y ε T, there exists a unique x ε S such that f(x)=y. A function must be bijective in order to have an inverse.

  ***Note that in *GMIT*, Lewin requires transformations such that f: S→S; f: S→T, while a proper function, is not considered to be a proper transformation. Also in *GMIT*, by **operation**, Lewin means a bijective function.

- **Groups:** A mathematical group (G, ○) consists of a set G and some binary operation ○ defined on that set. The group must satisfy four conditions:

  - **Associative:** For all x, y, z ε G (x○y)○z=x○(y○z)
  - **Identity:** e ε G such that x○e=x for all G
  - **Inverse:** For every x ε G, there exists $x^{-1}$ ε G such that x○$x^{-1}$=e
  - **Closure:** For all x, y ε G, x○y ε G

  ***If (G, ○) and H is a subset of G, then H is a **subgroup** of (G, ○) if (H, ○) is a group.

- Given two groups (G, ○) and (H, ○), f: G→H is an **isomorphism** if:

  - f is one-to-one
  - f is onto
  - When x○y=z in G, then f(x)○f(y)=f(z) in H (In other words, f preserves the group structure.)

- **Graphs:** A graph is a set of nodes, some pairs of which are connected by edges.

    - **Directed graph:** A graph with a set of nodes some pairs of which are joined by directed arrows.
    - **Transformation graph:** A directed graph in which each arrow is labeled with a transformation from specified group of transformations.
    - **Transformation network:** A transformation network is a transformation graph in which each node is labeled with an object from specified set of objects.
    - **Isography:** Two transformation networks are isographic if their underlying transformation graphs are identical.

❖ David Lewin. 1982-83. "Transformational Techniques in Atonal and Other Music Theories." *Perspectives of New Music* 21: 312-71.

- **Transformation and the "will of the tones:"** Lewin begins by exploring the transposition and inversion of a motive in Webern, Op. 5, No. 2. Tones "search" and "lust" for other tones; they "jockey for power." The approach focuses on how one set becomes anther, rather than focusing on a set-class taxonomy (i.e., Forte).

- **Graphs:** Lewin also introduces transformation-graph notation, along with the high-tech math that comes along with it in the Appendix.

- **Proto-neo-Riemann:** Lewin also mentions the use of transformations of consonant triads. For instance, S(G)=C.

- **Proto-offset and voice leading:** This article also explores voice leading as a transformation between two chords and describes things in a "fuzzy" way. For example, a transformation may be fairly "$T_4$-ish."

- **Proto-K-Nets:** This article also includes the early seed for K-nets, modeling sets using T arrows. O'Donnell, in his dissertation, calls these "L-nets," while true K-nets include T and I arrows.

❖ David Lewin. 1987. *Generalized Musical Intervals and Transformations*. New Haven: Yale University Press.

- This book started the transformational revolution of the late eighties and early nineties. *GMIT* spells out the basic mathematical principles of transformation theory in general and describes general interval systems in particular; lobbies for analysts to adopt the "transformational attitude" of someone "inside" the music, rather than a dispassionate Cartesian observer "outside" the music; provides sundry analyses in various musical domains including rhythm, motive and harmony; and ends with a chapter on triadic transformations that also gave rise to the study of what we now know as neo-Riemannian theory. The basis of transformational theory may be summarized by a single question: If I am at s, what characteristic gesture can I perform to get to t?

- From *GMIT*, § 2.3.1: A **Generalized Interval System** (GIS) is an ordered triple (S, INVLS, int), where S, the *space* of the GIS is a family [read: set] of elements, INVLS, the *group of intervals* for the GIS, is a mathematical group, and int is a function mapping S×S into INVLS, all subject to two conditions (A) and (B) following:

    - **(A):** For all r, s, and t in S, int(r,s)int(s,t)=int(r,t)
    - **(B):** For every s in S and every I in INVLS, there is a unique t in S which lies the interval i from s, that is a unique t which satisfies the equation int(s,t)=i
    - **Theorem:** In any GIS, int(s,s)=e and int(t,s)=int (s,t)$^{-1}$ for every s ant t in S.

- A simple example of a GIS:

    - **Set S:** The 12-pc universe $\mathbf{Z}_{12}$
    - **Group G:** The set $\mathbf{Z}_{12}$ and the addition operation modulo 12
    - **Int:** The distance from one element in $\mathbf{Z}_{12}$ to some other element in $\mathbf{Z}_{12}$
    - **Example:** int(0,1)=1; int(1,0)=11

- From *GMIT*, § 7.1.1: By such thinking, we can replace the idea of GIS structure by the idea of a space S together with a special sort of operation-group on S. This special group is what mathematicians call **simply transitive** on S. The group STRANS of operations on S is simply transitive when the following condition is satisfied: Given any elements s and t of S, then there exists a unique member OP of STRANS such that OP(s)=t.

## § 4.2 SAMPLE ANALYSES

❖ David Lewin. 1993. *Musical Form and Transformation: 4 Analytic Essays*. New Haven: Yale University Press.

- *MFAT* is Lewin's rebuttal to the criticism that *GMIT*, while valuable, did not have enough analytical payoffs. It consists of four chapters centered around the transformational analysis of four works: Dallapiccola's "Simbolo," a serial work; Stockhausen's *Klavierstück III*; Webern's Op. 10, No. 4, a freely atonal work; and Debussy's piano prelude "Feux d'artifice." While the favorite chapter among most theorists is Lewin's Debussy analysis, my favorite chapter is his Webern analysis in Chapter 3. What follows is a detailed summary of that chapter.

### Set Theory, Derivation, and Transformational Structures in Analyzing Webern's Opus 10, Number 4

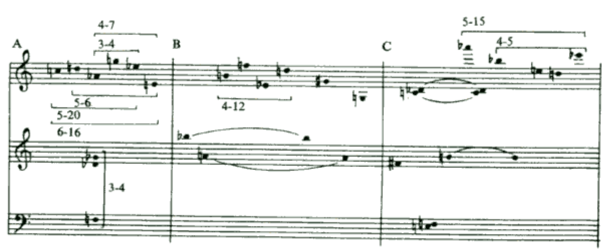



**Figure 1** (appears as Example 93 in Forte, 1973). Forte notes that "the composition divides into three sections, separated by rests in all parts."

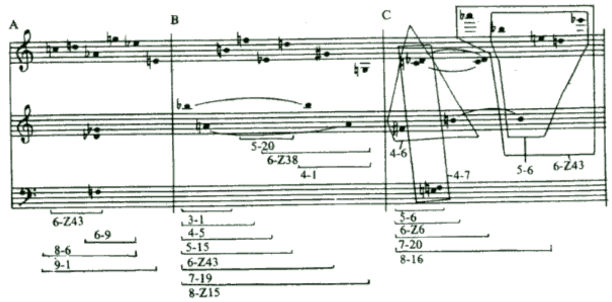



**Figure 2** (appears as Example 94 in Forte, 1973).
An example of Forte's segmentation by imbrication.

| **Transformation/ Object** | **Description** |
|---|---|
| **H** | Set {C,Db,D,F,Gb, Ab}; H is a member of set-class 6-Z43 or (012568). |
| **T9(H)** | Set {D,Eb,F,A,Bb,B}; T9(H) indicates the transposition of H by 9 semi-tones (mod 12); T9(H) is a member of set-class 6-Z43 or (012568). |
| **L(H)** | Set {D,Eb,E,Ab,Bb,B}; L(H) denotes inversion of H about D or Ab; L(H) is a member of set-class 6-Z43 or (012568). |
| **I(H)** | Set {C,D,Eb,Gb,G,Ab}; I(H) denotes inversion of H about E or Bb; I(H) is a member of 6-Z43 or (012568). |
| **X** | Set {C,Db,D,F,Gb}; X is a five-note subset of H; X belongs to set-class 5-6 or (01256). |
| **h** | Set {Eb,E,G,A,Bb,B}; h is the literal complement of H; h is a member of set-class 6-Z17 or (012478). |
| **T9(h)** | Set {C,Db,E,F#,G,G#}; T9(h) indicates the transposition of h by 9 semi-tones (mod 12); T9(h) is a member of set-class 6-Z17 or (012478). |
| **L(h)** | Set {C,Db,F,F#G,A}; L(h) denotes inversion of h about D or Ab; L(h) is a member of set-class 6-Z17 or (012478). |
| **Y** | Set {Eb,E,A,Bb,B}; y is a five-note subset of h; y belongs to set-class 5-7 or (01267). |
| **J** | Denotes inversion about Eb-and-D or about A-and-G#. |
| **K** | Denotes inversion about G-and-F# or about Db-and-C. |
| **M** | Denotes inversion about A or Eb. |
| **RICH(s)** | "Let us consider a chain of s pitches or pitch-classes $s_1$, $s_2$,…,$s_n$. RICH(s) is that retrograde-inverted form of s whose first two elements are $s_{n-1}$ and $s_n$, in that order." |
| **Q** | All-combinatorial hexachord {C,Db,D,Gb,G,Ab} derived by combining two derivation 1 trichords (see Figure 10). |
| **Q'** | The literal complement of Q. |
| **Q *bis*** | A repetition of the pitch-class content of Q. |
| **P** | Pentachord 5-15; this set-class includes the last five notes of the closing violin gesture {D,Eb,E,Ab,Bb}. |

**Table 1.**
A partial summary of objects and transformations
in Lewin's analysis of Webern Op. 10, No. 4.

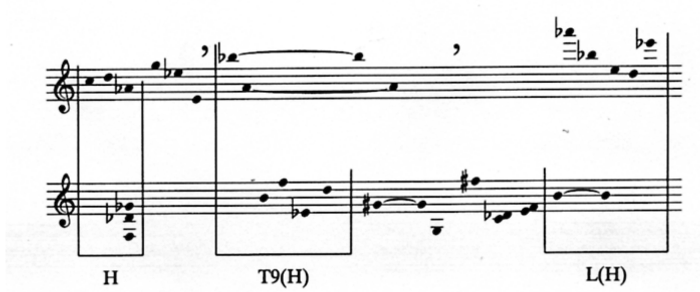



**Figure 3** (appears as Example 3.1 in Lewin, 1993).
Webern, Orchestral Piece, Op. 10, No. 4: H, T9(H), and L(H) appear at specially marked places in the composition. Breath marks are used instead of Forte's bar lines.

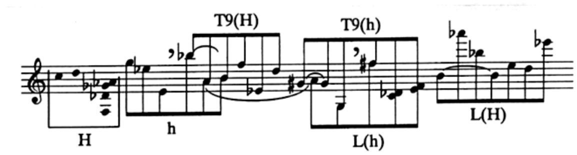



**Figure 4** (appears as Figure 3.2 in Lewin, 1993).

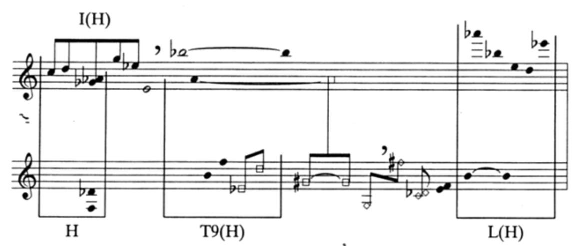



**Figure 5** (appears as Example 3.3 in Lewin, 1993).
Open note-heads denote axes of symmetry. Oval open note-heads correspond to I inversion, square open note-heads correspond to J inversion, and diamond open note-heads indicate K inversion.

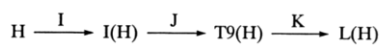



**Figure 6** (appears as Example 3.4 in Lewin, 1993).
The basic transformational progression of H-forms.

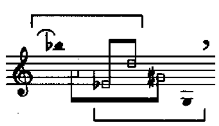


**Figure 7** (appears as Example 3.5 in Lewin, 1993).
The retrograde J-inversion of center pitches.
This structure also illustrates the transformation RICH.

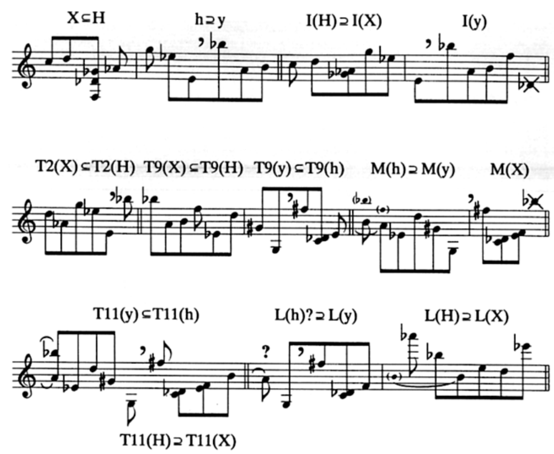



**Figure 8** (appears as Example 3.6 in Lewin, 1993).
Beams indicate X and y forms; flags indicate non-X and non-y pcs
for each H and h form, respectively. "[F]orms of X and y can be asserted
as synechdochial for the corresponding forms of H and h."

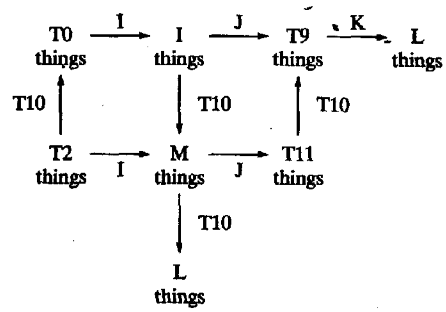



**Figure 9** (appears as Example 3.9 in Lewin, 1993).
The basic transformational progression elaborated by T10-relations and the I,J
"subplot" along the second rank. All the "things" of example 3.6 are referenced.

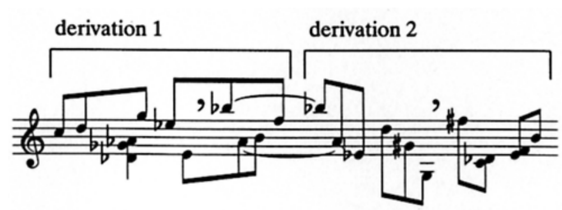



**Figure 10** (appears as Example 3.10 in Lewin, 1993).
Derived (027) and (016) trichords based on tessitura and chronology. Lewin comments that "their strictness [the derived trichords] is particularly audible in the liberating effect of the final violin solo, which breaks free from them."

| | {C, D, G} | {D♭, G♭, A♭} | {E♭, F, B♭} | {E, A, B} |
|---|---|---|---|---|
| {C, D, G} | T0, T6I | T6, I | T3, J | T9, T6J |
| {D♭, G♭, A♭} | T6, I | T0, T6I | T9, T6J | T3, J |
| {E♭, F, B♭} | T9, J | T3, T6J | T0, I | T6, T6I |
| {E, A, B} | T3, T6J | T9, J | T6, T6I | T0, I |

**Figure 11** (appears as Example 3.11 in Lewin, 1993).
Transformational relations among the unordered derivation 1 trichords.
T3 and J are "contextual synonyms", although the "music makes T3 easier to hear than J."

| | {B♭, A, E♭} | {D, G♯, G} | {F♯, C, D♭} | {E, F, B} |
|---|---|---|---|---|
| {B♭, A, E♭} | T0 | J | T3 | T6I |
| {D, G♯, G} | J | T0 | I | T9 |
| {F♯, C, D♭} | T9 | I | T0 | J |
| {E, F, B} | T6I | T3 | J | T0 |

**Figure 12** (appears as Example 3.12 in Lewin, 1993).
Transformational relations among the unordered derivation 2 trichords.


**Figure 13** (appears as Example 3.13 in Lewin, 1993).
Hexachords of Forte-type 6-7.

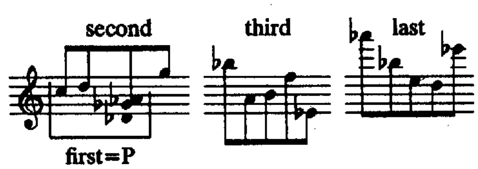



**Figure 13** (appears as Example 3.15 in Lewin, 1993).
P-forms embed in the family of Q forms.

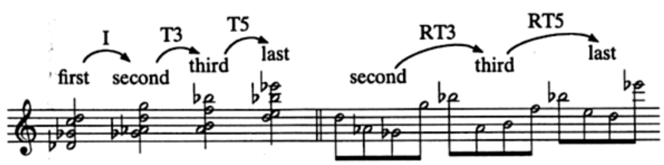



**Figure 14** (appears as Example 3.17 in Lewin, 1993).
Registrally inverted and transposed 4-5 tetrachords within the
P-forms, also temporarily retrograded.

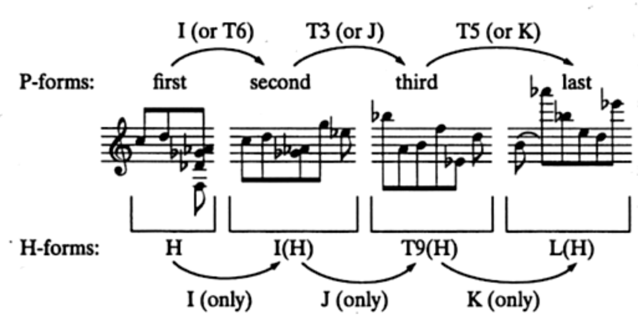



**Figure 15** (appears as Example 3.19 in Lewin, 1993).

- **Lewin comments:**

Example 3.19 [Figure 15] sheds some light on how the I, T3, T5 story can coexist with the I,J,K story. But the example, in doing so, seems to portray a paradox. If the idea is to show that the progression of P-forms is consistent with the progression of H-forms, why did not Webern lay out the pitches and temporal orderings of the P-forms so as to emphasize the J- and K-relations among them, rather than the T3 and T5 relations? Should one conclude that the I,J,K progression of H-forms--as shown in examples 3.3-5 [Figures 5-7] and 3.7-9 [Figure 9]--is an intellectual chimera without musical significance?

I do not think so. I sense the matter as somewhat as follows. The pc structures we have been studying fall into two general categories, "symmetrical" structures and "asymmetrical" ones. The symmetrical structures are the trichordal derivations of the Q forms; the asymmetrical structures are the H-forms, together with their synechdochical X/y pentachords and their pseudo-aggregates. To some extent, the P-forms belong in both symmetrical and asymmetrical camps. Abstractly, each P-form is a symmetrical pc structure: it inverts into itself. The abstract symmetry allows for the possibility of contextual synonyms, like those of example 3.18, when one is transforming P-forms one into another. P-forms can be heard as quasi-synechdochical for symmetrical Q forms in certain analytic contexts, too, as with the violin solo at the end of example 3.13 [Figure 13].

On the other hand, P-forms are more often--and more unequivocally--heard in the in the context of the H-forms that embed them in the music; this is the idea of example 3.19 [Figure 15]. Here each H-form fixes its embedded abstractly symmetrical P-form into either an unambiguous "prime" of unambiguously "inverted" ambience. The unambiguously determined asymmetrical H-forms progress through the I, J, K story, and the P-forms-as-H-forms must perforce follow that progression. The point of the I, T3, T5 story is to demonstrate the symmetry of the P-forms-in-themselves, notwithstanding the asymmetrical H-context. The P-forms have the potential to liberate themselves from asymmetrical H-contexts, to display their intrinsic symmetries, and to align themselves with other symmetric configurations in the music.

❖ David Lewin. 1997. "Some Notes on *Pierrot Lunaire*." In *Music Theory in Concept and Practice.* Eds. James Baker, David Beach and Jonathan Bernard. Rochester, NY: University of Rochester Press.

- A classic analysis of the first movement from *Pierrot Lunaire*. Lewin's method of analysis is similar to that in the third chapter of *MFAT*. Transformations are generally limited to transposition and inversion.

## § 4.3 EXTENSION AND CRITIQUE

❖ Julian Hook. 2007. "Cross-Type Transformations and the Path Consistency Condition." *Music Theory Spectrum* 29/1: 1-39.

- **Cross-Type Transformation:** A transformation that maps one set of objects into another set of objects (i.e. f: $S \rightarrow T$); for instance, the set of major and minor triads into the set of major-minor and half-diminished seventh chords. Lewin required a transformation to satisfy only f: $S \rightarrow S$ in *GMIT*.

- **Path Consistency:** Lewin requires in *GMIT* that whenever there are two different directed paths ("arrow chains") from one node to another in a graph, the products of the transformation labels along both paths must be identical. Consider the example below. RP=$T_9$ only in the case of a major triad. In the case of a minor triad, RP≠$T_9$, and the graph is therefore not path consistent.


EXAMPLE 2. *Franck, Piano Quintet in F Minor, i, mm. 26–33: score reduction and transformational analysis (after Robert Cook).*

❖ Joseph Straus. "Three Problems in Transformational Theory." Unpublished.

- **Brevity:** Transformational analyses are only able to deal with short passages of music, and when they do deal with large pieces, they are usually non-adjacent events. There is a tension between having only a few transformations (i.e., economy) and explaining lots of music (i.e., comprehension).

- **Recursion:** Often we are blinded by searching for recursion and, as a result, we overlook or discount other important musical features.

- **Abstraction:** How do we choose among different abstractions and, for example, what does hyper-I really mean?

## § 4.4 ADDITIONAL READING


Raphael Atlas and Michael Cherlin, eds. 1994. *Musical Transformation and Musical Intuition: Eleven Essays in Honor of David Lewin.* Dedham, MA: Ovenbird Press.

John Clough. 1998. "A Rudimentary Geometric Model for Contextual Transposition and Inversion." *Journal of Music Theory* 42: 297-306.

Jonathan Kochavi. 1998. "Some Structural Features of Contextually-Defined Inversion Operators." *Journal of Music Theory* 42: 307-20.

David Lewin. 1997. "Conditions Under Which, in a Commutative GIS, Two 3-Elment Sets Can Span the Same Assortment of GIS-Intervals; Notes on the Non-Commutative GIS in this Connection." *Intégral* 11: 37-66.

David Lewin. 1995. "Generalized Interval Systems for Babbitt's Lists, and for Schoenberg's String Trio." *Music Theory Spectrum* 17: 81-118.

Ramon Satyendra. 2002. "Relational Systems in the Study of Networks and Generalized Intervals." *Indiana Theory Review* 23: 133-52.

## § 5.0 ATONAL VOICE LEADING

- David Lewin. 1998. "Some Ideas About Voice-Leading Between Pcsets." *Journal of Music Theory* 42/1: 15-72.

  - Lewin treats voice leading as a function:

    - **Definition 1.1:** Given pitch-class sets X and Y, a *voice leading from X into Y* will (until further notice) mean a function V which maps each member x of X into some member y=V(x) of Y. [Notice that this function in not yet one-to-one, meaning that it does not have a well-defined inverse. Lewin revises this definition later in the article so that the function V is bijective.]

  - Lewin then explores a number of voice-leading paradigms:

    - **Maximally close voice leading:** Each mapping from X into Y moves each x in X to some y in Y by the smallest distance possible.
    - **Downshift voice leading:** Each mapping from X into Y moves each x in X to the nearest y in Y in a "downward" direction in pc-space.
    - **Upshift voice leading:** Each mapping from X into Y moves each x in X to the nearest y in Y in an "upward" direction in pc-space.

  - A voice leading may **instantiate** one of the above paradigms in pc-space, but it may not be **manifest** in a given part. [JAH: This is similar to Straus's distinction between a transformational voice and a part.]

  - A voice leading may be **maximally uniform** if it differs as little as possible from straight transposition. In other words, this is something like "near transposition."

    - **Definition 5.4.1:** Given a maximally uniform voice leading V from pcset X to pcset Y, the **pseudo transposition number** N of V is the positive or negative number of pitch semitones by which Y is "almost TN of X," in a pertinent pitch manifestation of V.
    - **Definition 5.4.2:** Given a maximally uniform voice leading V from pcset X to pcset Y, the **offset number** of V is the positive (absolute) real number of semitones (either up or down or both) by which Y differs from TN(X), in a pertinent pitch manifestation of V.

- Joseph Straus. 1997. "Voice Leading in Atonal Music." In *Music Theory in Concept and Practice*. James Baker, David Beach, and Jonathan Bernard, eds. Rochester, NY: University of Rochester Press, 237-74.

  - Straus identifies three models of atonal voice leading:

    - **Prolongational:** Based on Schenker and hierarchical levels; some tones are structural, other are embellishing.
    - **Associational:** Based on the pitch-class set theory of Allen Forte and Forte's "linear analysis."
    - **Transformational:** Based on a kind of pitch-class counterpoint (Benjamin, 1981); focus is not on the chords themselves, but the transformational connections between them.

- Makes a clear distinction between a transformational voice—generated by transformations such as T and I—and a part; similar to the distinction of part and voice in tonal-music analysis.

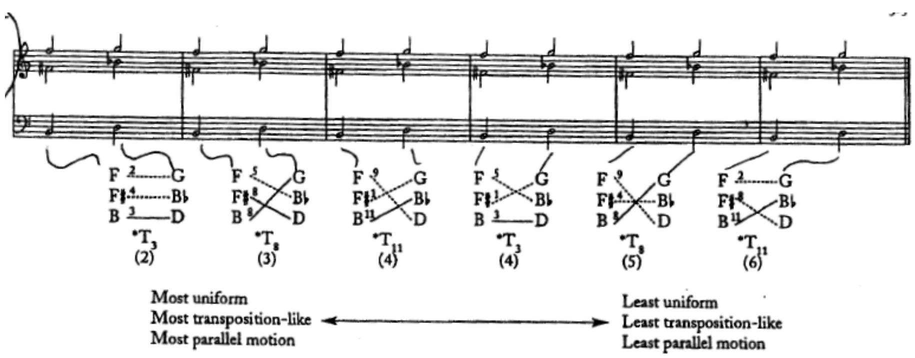
- Provides many analyses, often showing multiple "levels" of transformational voice leading. Also introduces pseudo-transposition (*T) and pseudo-inversion (*I)

❖ Joseph Straus. 2003. "Uniformity, Balance, and Smoothness in Atonal Voice Leading." *Music Theory Spectrum* 25/2: 305-52.

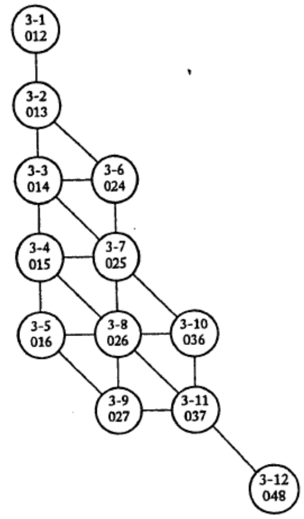
- Continues the work of Straus 1997. Transformational voices are defined by the mappings of operations, most often using T and I. Straus continues to make the distinction between transformational voice and a part.

- **Uniformity** (relates to transposition): The extent to which the transformational voices move by the same intervallic distance.

    - **Offset:** the amount of deviation from a transposition operation when voice leading between two pc-sets as measure in semitone.
    - **Consistency:** The degree to which all the voices move by the same transposition operator.
    - **Convergence point:** The transposition operator that models a given progression from one set to another with minimal offset.

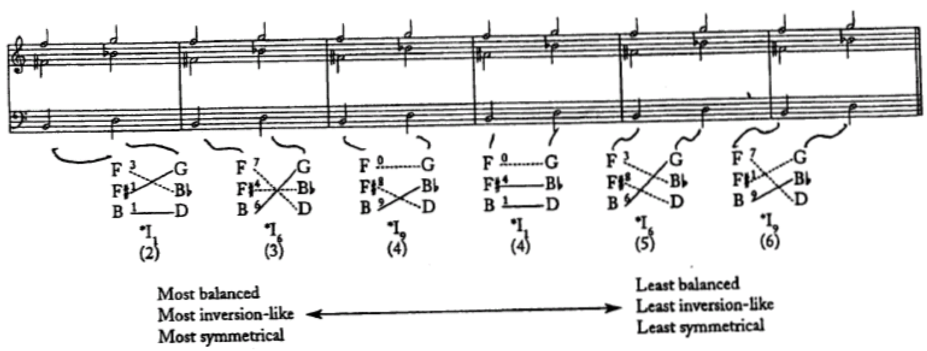



EXAMPLE 7. *Voice-leading uniformity in the progression from {F, F♯, B} to {G, B♭, D}.*




EXAMPLE 22. *Optimal offsets for trichords (as the map of a voice leading space).*

- **Balance** (relates to inversion): The extent to which the transformational voices flip around the same axis of inversion.




*Voice-leading balance in the progression from {F, F♯, B} to {G, B♭, D}.*

- **Smoothness**: A measure of the total displacement of a voice leading, or the sum of the intervals traversed in each voice to get from set X to set Y.

❖ Joseph Straus. 2006. "Atonal Pitch Space." Unpublished.

- Continues the line of thought developed in Straus 2003. Here Straus is particularly interested in voice leadings between set classes that have an offset of 1.

- Straus relates this to "parsimony" and Schoenberg's "law of the shortest way." Set classes that are closest to each other as measured by minimal offset are considered harmonically similar as well. [Cf. my earlier comments on this in § 2.4.]

- Straus uses the trichordal and tetrachordal offset spaces to model the progression of harmony and voice leading in some atonal works. (Straus later expands this to pentachords and hexachords.) He then combines these spaces using Callender's split and fuse operations to combine the tetrachordal and trichordal spaces. [**Math review:** Why aren't Callender's split and fuse operations "true" operations?]

- **Law of Atonal Voice Leading:** In the minimal offset spaces, it is easier to travel somewhere near than somewhere far; that traversing a longer distance requires more effort.

- **Law of Atonal Harmony:** Harmonies tend to move towards maximal dispersion in the available space. In other words, the move from relative unevenness to evenness correlates to something like "tension" and "release."

❖ Robert Morris. 1998. "Voice-Leading Spaces." *Music Theory Spectrum* 20/2: 175-208.

  - A voice-leading space is described as a kind of **compositional space**.

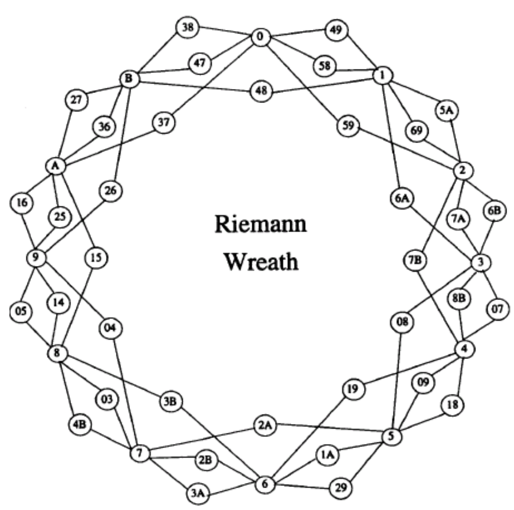
  - Voice leading may take place within certain compositional **lynes**. A lyne is some string of pitch classes that are associated through register, timbre, dynamics, contour, etc.

  - Morris describes a taxonomy of voice-leading types using the usual notions of contrary, similar, parallel, and oblique motion. This work fits in with Morris's previous work on contour theory.

  - The *Tonnetz i*s also a kind of compositional or voice-leading space. The voice leadings described on this space by P, L and R are not nearly so parsimonious as originally thought because of all the inversional mappings they imply.

  - Morris invents three new kinds of neo-Riemannian operations: L', P' an R'. These operations—instead of inverting a *Klang* around some dyad—flip a dyad about a single pc.

  - One of the big payoffs, for Morris anyway, is the construction of a "Riemann Wreath" which models voice leading by combining various dyads and singletons into consonant triads.




The content of any two connected nodes is a member of set-class 3-11[037].

### § 5.1 ADDITIONAL READING

William Benjamin. 1981. "Pitch-Class Counterpoint in Tonal Music." In *Music Theory: Special Topics*. Richmond Browne, ed. New York: Academic Press, 1-32.

Clifton Callender. 1998. "Voice-Leading Parsimony in the Music of Alexander Scriabin." *Journal of Music Theory* 42: 219-34.

Richard Cohn. 2003. "A Tetrahedral Graph of Tetrachordal Voice-Leading Space." *Music Theory Online* 9.

David Huron. 2001. "Tone and Voice: A Derivation of the Rules of Voice-Leading from Perceptual Principles." *Music Perception* 19: 1-64.

Henry Klumpenhouwer. 1991. "A Generalized Model of Voice-Leading for Atonal Music." Ph.D. diss., Harvard University.

David Lewin. 1982-83. "Transformational Techniques in Atonal and Other Music Theories." *Perspectives of New Music* 21: 312-71.

Shaugn O'Donnell. 1997. "Transformational Voice Leading in Atonal Music." Ph.D. diss., City University of New York.

John Roeder. 1994. "Voice Leading as Transformation." In *Musical Transformation and Musical Intuition: Essays in Honor of David Lewin*. Raphael Atlas ad Michael Cherlin, eds. Roxbury, MA: Ovenbird Press, 41-58.

## § 6.0 KLUMPENHOUWER NETWORKS

### § 6.1 PRELIMINARIES

- **Graphs:** A graph is a set of nodes, some pairs of which are connected by edges.

    - **Directed graph:** A graph with a set of nodes some pairs of which are joined by directed arrows.
    - **Transformation graph:** A directed graph in which each arrow is labeled with a transformation from a specified group of transformations.
    - **Transformation network:** A transformation network is a transformation graph in which each node is labeled with an object from a specified set of objects.
    - **K-net** (from Lewin 1990): Any network that uses T and/or I operations to interpret interrelations among pcs.

- **Isography:** Two transformation networks are isographic if their graph structures are isomorphic to each other (i.e., they have the same node and directed-arrow configurations).

    - **Strong Isography:** When the nodes, directed arrows and the labels of those arrows are identical between two graphs. Graphs that are strongly isographic are related by $<T_0>$ (read: hyper-$T_0$).
    - **Positive Isography:** K-nets whose $T_n$ operators are identical, but whose $I_n$ arrows differ by some constant amount. Positive isography is indicated by $<T_n>$ where n equals the difference between the $I_n$ arrows. This results in the transposition of the inversional wedge.
    - **Negative Isography:** K-nets whose $T_n$ operators are complementary and whose $I_n$ arrows all sum to the same value. Negatively isographic networks are related by $<I_n>$ where n equals the sum of the analogous $I_n$ arrows.
    - **Axial Isography** (Stoecker 2002): Trichordal K-nets that share a single $I_n$ arrow.
    - **Negative Axial Isography** (Stoecker 2002): Trichordal K-nets whose $I_n$ arrows are complementary.

### § 6.2 THEORY AND ANALYSIS

❖ David Lewin. 1982-83. "Transformational Techniques in Atonal and Other Music Theories." *Perspectives of New Music* 21: 312-71.

- This article started the whole K-net revolution. Lewin models the internal structure of a chord from Schoenberg, Op. 19, No. 6 (Figure 24) using transposition operators. (Incidentally, while the interpretation of pc-sets using transposition and isography is already in place here, it was Klumpenhouwer who introduced inversion operators, allowing for isographic relationships between chords of differing set classes. O'Donnell, in his dissertation, describes the proto-K-nets with transposition only as "L-nets," or Lewin networks.)

- Figures 23 and 24 show how the "progressive transpositions" that occupy the nodes (i.e., the "if-only" transformations that move the chords of Op. 19, No. 6 forward in time) are thematically related to the "internal transpositions" of the second chord of the piece. Note that in Figure 23, K, J and I are contextual inversions.

Figure 22

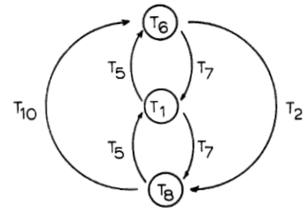



Figure 23

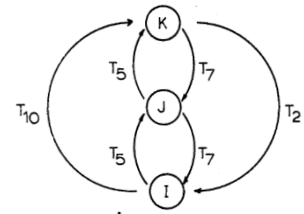
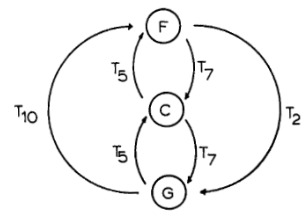


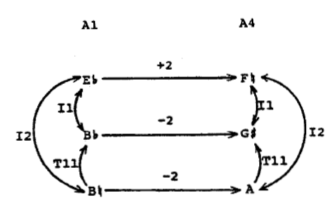

Figure 24




- ❖ Henry Klumpenhouwer. 1991. "A Generalized Model of Voice Leading for Atonal Music." Ph.D. diss., Harvard University.

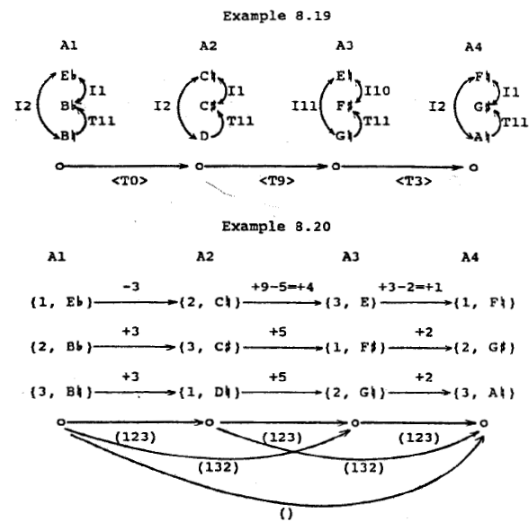
    - Chapter 8 of Klumpenhouwer's dissertation outlines the basic K-net technology and its analytical usefulness. While Lewin is often interested in recursion, Klumpenhouwer is more interested in the potential for K-nets to model voice leadings, especially those that involve contrary motion, as shown in Examples 8.8 and 8.9 below.

Example 8.8




Example 8.9

- Klumpenhouwer is also particularly interested in the relationship between voice leading as modeled by K-nets and the registral permutations entailed by these voice-leading connections.




❖ David Lewin. 1990. "Klumpenhouwer Networks and Some Isographies that Involve Them." *Music Theory Spectrum* 12/1: 83-120.

- This article was the first to introduce and formalize K-nets. (Klumpenhouwer's dissertation wasn't submitted until a year later.) It uses an analysis of Schoenberg's Op. 19, No. 6 (cf. Lewin 1982-83) as an introduction. Lewin introduces the various types of isography (strong, positive and negative isographies) and works them out in a mathematically rigorous fashion.

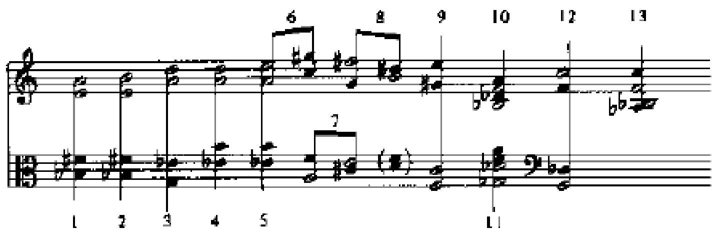
- This article is particularly important because it is the first to outline the recursive potential of K-nets. Lewin is particularly interested in recursion; Klumpenhouwer is usually more interested in voice-leading connections.

- Here is a rather lengthy quotation from Lewin describing his thoughts on recursion:

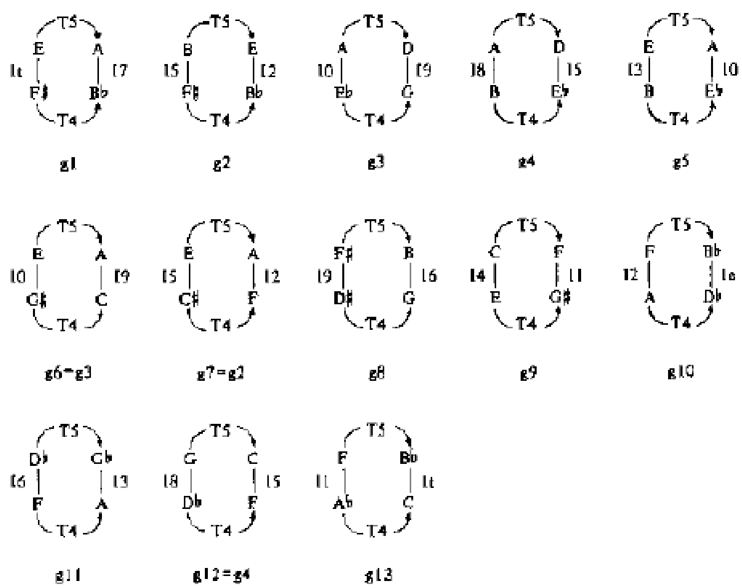
    - Not yet realizing the implications of the situation myself, I began analytic work on passages from *Pierrot*, thinking to evaluate by this means the extent to which I found Networks either suggestive or limited as analytic tools. In the course of this work I began to notice the recursive potentialities of the theoretical apparatus. When a lower-level Klumpenhouwer Network is interpreting a chord, and a higher-level network-of-Networks is interpreting a progression of chords (more precisely, of chord-interpretations), I noted that one could conceive of the higher-level network as "prolonging" the lower-level one, particularly when the given chord is part of the given progression. This potentiality of the system, observed again and again in the article, can afford an especially compelling rationale (albeit a non-phenomenological one) for asserting one particular Klumpenhouwer Network rather than another, to interpret a given chord. I found it suggestively comparable, methodologically, to the ways in which a choice among foreground readings in a Schenkerian analysis can be influenced by middleground considerations (Lewin 1990, 115).

❖ David Lewin. 1994. "A Tutorial on Klumpenhouwer Networks, Using the Chorale in Schoenberg's Opus 11, No. 2." *Journal of Music Theory* 38: 79-101.

- Lewin introduces the K-net technology (again) in the context of an analysis of the "chorale" from Schonberg, Op. 11, No. 2. Lewin is particularly interested in the recursive possibilities that K-nets afford in analyzing this chorale.

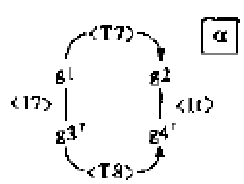



Example 9




Example 10

- An example of a recursive network utilizing the first four graphs above:



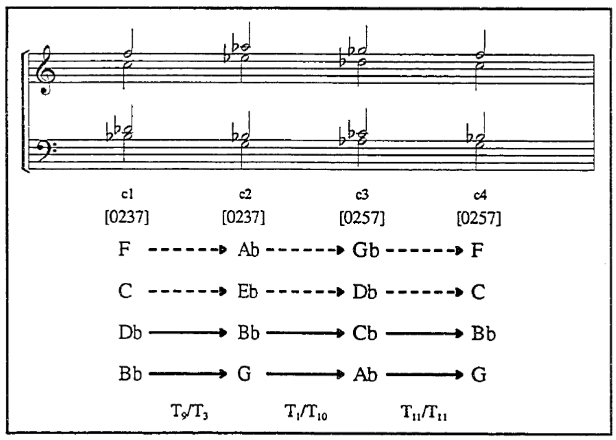

Example 13

❖ Shaugn O'Donnell. 1997. "Transformational Voice Leading in Atonal Music." Ph.D. diss., City University of New York.

- This dissertation explores atonal voice leading through the Straus-style transformational approach and the "wedge" approach suggested by K-nets—at least the K-nets that mix T and I arrows. This dissertation is particularly noted for its analytical chapters. Analyses of complete pieces are the rule, rather than the exception. Works include those by such composers as Bartók, Stravinsky, Ives, Skryabin, Webern and Babbitt.

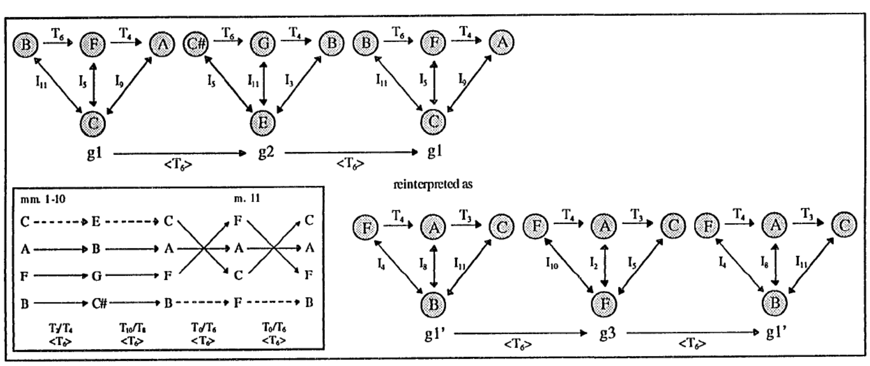
- O'Donnell's major contribution in this work is his concept of **dual transformation**. Dual transformations model the wedge-like voice leadings implied by K-nets in terns of Straus-style transformational voice leading, as the example shows below.

*Example 1.4–1: Dual transposition*




- O'Donnell's dissertation is also known for K-net ***double emploi***. This occurs when a set class is given a new K-net reinterpretation, acting like a pivot, as shown below.

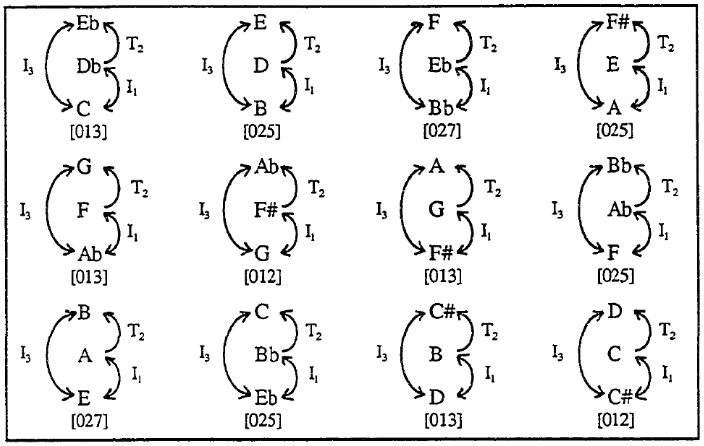
*Example 2.4–10: Double-emploi*




- O'Donnell's dissertation is also known for the **exclusivity↔promiscuity** continuum. This holds that the more available relationships between sets are (promiscuity), the less meaningful those relationships become; while the more restrictions we place on relationships (exclusivity), the more difficult it becomes to account for large spans of music. The goal is to strike a comfortable balance between the two extremes. O'Donnell also relies on an **abstract↔concrete** continuum in his dissertation.

- O'Donnell also explores **Klumpenhouwer classes** (K-classes), or the family of set classes that may be modeled by strongly isographic networks, as shown below.

*Example 1.3–9: Sample Klumpenhouwer class*




❖ Shaugn O'Donnell. 1998. "Klumpenhouwer Networks, Isography, and the Molecular Metaphor." *Intégral* 12: 53-80.

- This article distills much of the theoretical content of O'Donnell's dissertation, all organized around the "molecular metaphor." The idea is that we can imagine K-nets to be analogous to isomers from chemistry. K-nets may be modeled by three-dimensional ball-and-stick formations.

❖ Philip Lambert. 2002. "Isographies and Some Klumpenhouwer Networks Theory Involve." *Music Theory Spectrum* 24/2: 165-95.

- Lambert begins by reconstructing Lewin's analysis of Schoenberg, Op. 19, No. 6 (Lewin 1990) and continues this analysis to model the entire piece.

- Lambert then derives various K-classes through wedge progressions, as shown below.

**Example 7. Summary of strong isographies with trichord 1(a)**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A |
| 9 | A | B | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 6 | 5 | 4 | 3 | 2 | 1 | 0 | B | A | 9 | 8 | 7 |
| {6,9,B} | {A,0,5} | {B,1,4} | {0,2,3} | {1,2,3} | {1,2,4} | {0,3,5} | {4,6,B} | {5,7,A} | {6,8,9} | {7,8,9} | {7,8,A} |
| [025] | [027] | [025] | [013] | [012] | [013] | [025] | [027] | [025] | [013] | [012] | [013] |
| *(a)* | *(c)* | | | *(g)* | | | | | | | *(l)* |

- Lambert then extends the concept of K-class to **K-family**, a more general classification that groups all sets that may be related by either strong or positive isography into the same class. In the case of trichords, this would be all the trichords that share one common interval class. Note that K-classes and K-families are not equivalence classes.

- Philip Stoecker. 2002. "Klumpenhouwer Networks, Trichords, and Axial Isography." *Music Theory Spectrum* 24/2: 231-45.

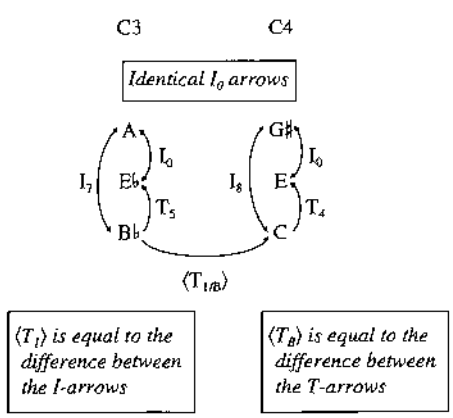
  - This article extends the kinds of isography relevant to K-net analysis. Sometimes, two trichords may not be related by either strong, positive or negative isography using graphs with one $T_n$ arrow and two $I_n$ arrows (the most common graph configuration for modeling trichords). Stoecker notes the trichords that may not be related using the standard kinds of isography below. Note that these are simply the trichords that do not share a single interval class.

Example 2. "X" indicates trichordal set classes that cannot be strongly, positively, or negatively isographic with each other

| 3-1 [012] | 3-2 [013] | 3-3 [014] | 3-4 [015] | 3-5 [016] | 3-6 [024] | 3-7 [025] | 3-8 [026] | 3-9 [027] | 3-10 [036] | 3-11 [037] | 3-12 [048] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | X | X | X | 3-1 [012] |
| | | | | | | | | | | | X | 3-2 [013] |
| | | | | | | | | X | | | | 3-3 [014] |
| | | | | | | | | | X | | | 3-4 [015] |
| | | | | | X | | | | | | X | 3-5 [016] |
| | | | | | | | | | X | | | 3-6 [024] |
| | | | | | | | | | | | X | 3-7 [025] |
| | | | | | | | | | | | | 3-8 [026] |
| | | | | | | | | | X | | X | 3-9 [027] |
| | | | | | | | | | | | X | 3-10 [036] |
| | | | | | | | | | | | | 3-11 [037] |
| | | | | | | | | | | | | 3-12 [048] |

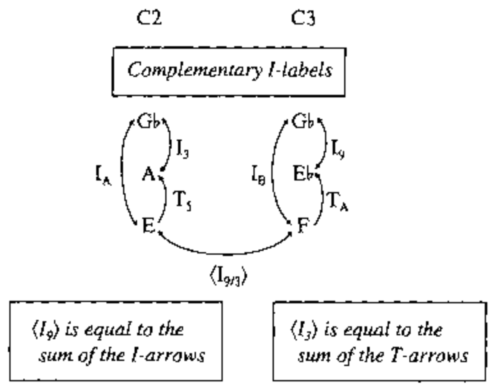
  - **Axial isography**, where two graphs show the same $I_n$ arrow, is one way to relate trichords that are not relatable through standard isographies. An example is given below. Axial isography is expressed in the form $<T_{n/x}>$ where n is the difference between the $I_n$ arrows (other than the ones in common) and x is the difference between the $T_n$ arrows. These numbers will always be complementary.

Example 4. Axial isography of the network interpretations of C3 and C4 in mm. 2–3



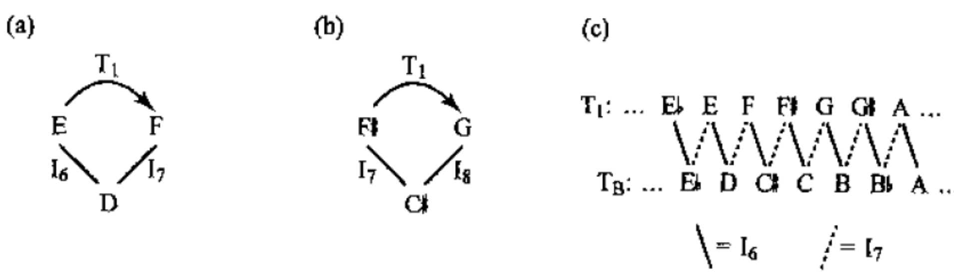
- **Negative axial isography** occurs when $I_n$ arrows are complementary. Negative axial isography is expressed in the form $<I_{n/x}>$ where n is the sum of the $I_n$ arrows (other than the ones that are complementary) and x is the sum between the $T_n$ arrows. As before, these numbers will always be complementary.

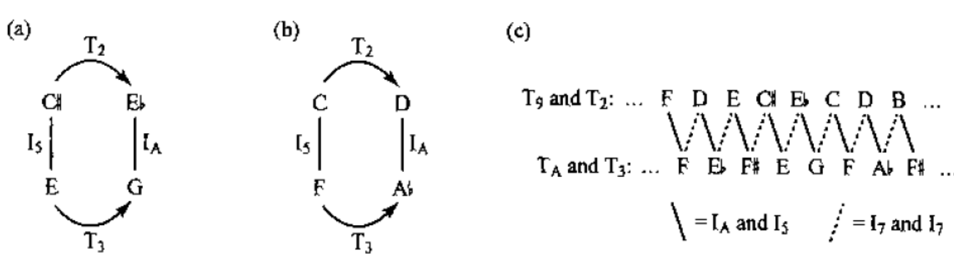
Example 11. Negative axial isography of the network interpretations of C2 and C3 in mm. 8–9




❖ David Lewin. 2002. "Thoughts on Klumpenhouwer Networks and Perle-Lansky Cycles." *Music Theory Spectrum* 24/2: 196-230.

- George Perle (*Music Theory Spectrum* 1993) has noted the relationship between his cycles and K-nets. David Lewin, Philip Lambert and Dave Headlam have all written about this in *Spectrum* 2002, while Gretchen Foley has written about this relationship in *Indiana Theory Review*. In the examples below, (a) and (b) both show K-nets, while (c) shows a Perle cycle.



## § 6.3 CRITIQUE

- Michael Buchler. 2007. "Reconsidering Klumpenhouwer Networks." *Music Theory Online* 13/2.

  - While K-nets have become increasingly popular in analyzing atonal music, very little attention has been paid to evaluating the kinds of statements these analyses are really making and how they relate to phenomenology, recursion, and relational abundance.

  - **Four main criticisms:**

    - K-nets are more succinctly modeled by using O'Donnell's dual transformations. Any strongly or positively isographic K-net using a mixture of $T_n$ and $I_n$ operations are equally well modeled by two T-sets.
    - K-nets are overly promiscuous. Any trichord pair that shares a single interval class may be related by either string or positive isography. Of the 78 trichord pairs that are possible, 65 can form either strong or positive isographic networks. O'Donnell's *double emploi* and Stoecker's axial isography only makes this problem worse.
    - The problem of phenomenology: K-net interpretations often poorly fit the musical surface with respect to aspects such as register and instrumentation. K-net recursion is also often difficult to "hear"—especially dual inversion, or $<I_n>$. [JAH: K-net recursion also often violates the temporal ordering of chords in hyper-graphs.]
    - The problem of recursion: Recursive analysis requires us to locate positive and negative surface-level isographies in the same quantity as shown in any one local K-net. This often entails skewing surface readings into representations that simply provide the right type of graph to fit the situation. How often does one find n-note chords in n-chord progressions?
    - Another problem of recursion: While K-nets involve the transposition and inversion of pitch classes, hyper networks involve the transposition and inversion *of* transpositions and inversions. There is a fundamental difference between relating objects like pcs and relating relationships.

## § 7.0 NEO-RIEMANNIAN THEORY

## § 7.1 BEGINNINGS

- David Lewin. 1987. *Generalized Musical Intervals and Transformations*. New Haven: Yale University Press.

  - Towards the end of *GMIT*, Lewin explores the ways in which *Klangs* (i.e., major and minor triads) may interact in transformational networks. Lewin explicitly mentions the function theories of Hugo Riemann as an antecedent to his own work.

  - For Lewin, every *Klang* may be labeled with the triadic root (NB: Lewin never invokes Riemann's system of dual roots for major and minor triads) and a sign for quality (i.e., + or -; cf. Hook, 2002). For example, (A, +) represents an A-major *Klang*, while (G, -) represents a G-minor *Klang*.

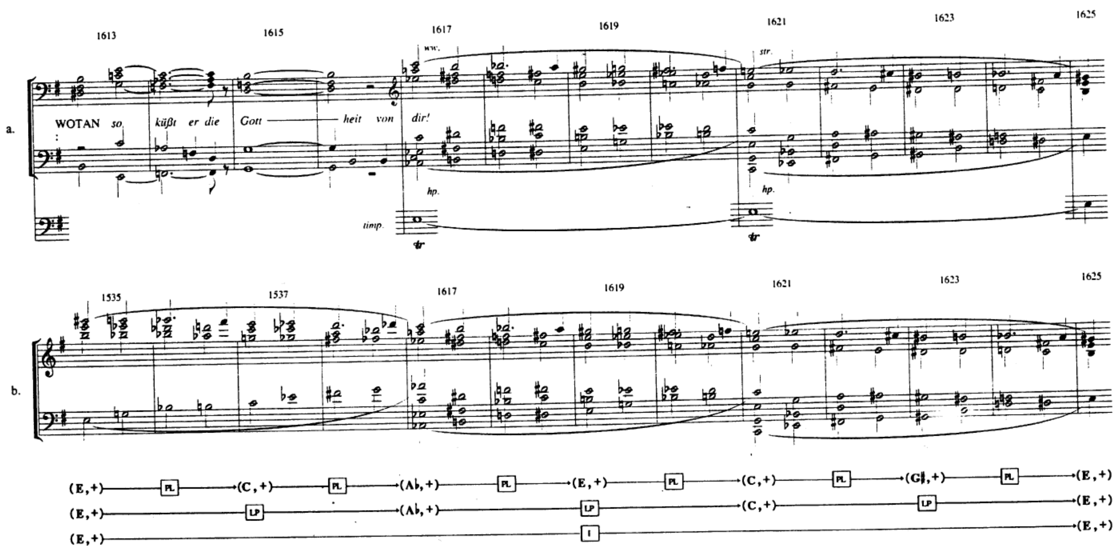
  - Lewin applies a number of transformations to the *Klangs* including:

    - **DOM:** One *Klang* becomes the dominant of the following *Klang*; this transformation is mode preserving. For example: (D,+)DOM=(G,+). (NB: Lewin uses right orthography.) The inverse would be the following: (G,+)$\text{DOM}^{-1}$=(D,+). Note that $\text{DOM}^{-1}$ is the same as the transformation SUBD.
    - **SUBD:** One *Klang* becomes the subdominant of the following *Klang*; this transformation is mode preserving. For example: (E,+)SUBD=(B,+).
    - **MED:** One *Klang* becomes the mediant of the following *Klang*; this transformation is mode reversing. For example: (C, -)MED=(Ab, +).
    - **SUBM:** One *Klang* becomes the submediant of the following *Klang*; this transformation is mode reversing. For example: (C, +)SUBM=(E, -). SUBM is the same as the inverse of MED, or $\text{MED}^{-1}$.
    - **REL:** One *Klang* becomes the relative major/minor of the following *Klang*; this transformation is mode reversing. For example:
(C, +)REL=(A, -).
    - **SLIDE:** Mode reversing operation that maintains an invariant third of each triad. For example (B, +)SLIDE=(C, -).
    - **PAR:** A mode reversing operation where one triad becomes the parallel major/minor triad of the other. For example: (C, -)PAR=(C, +).
    - **LT:** Riemann's mode reversing "leading-tone exchange." For example: (E,)LT=(C, +).

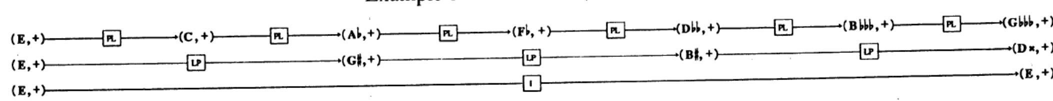
- Brian Hyer. 1995. "Reimag(in)ing Riemann." *Journal of Music Theory* 39: 101-38.

  - Largely influenced by Lewin's study of triadic transformations in *GMIT*, Hyer begins by considering Riemann's own function theories.

  - This article is best known for continuing the analysis of music using operations such as L, P, R, S, and D. [JAH: It is unclear exactly what is "Riemannian" about these operations. For example, in the PLR group, each operation is its own inverse, while this is not true for D and S.] Here is a sample analysis:




Example 5: *Die Walküre,* Act 3, Scene 3




Example 6

- This article is also known for its rather unwieldy multiplication table of the D, P, L and R operations and another table that models the structure of the PLR group.

| | $D^n$ | $D^nLP$ | $D^nPL$ | $D^nL$ | $D^nP$ | $D^nPLP$ | $D^nRL$ | $D^nRP$ | $D^nLR$ | $D^nR$ | $D^nRLP$ | $D^nLRP$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $D^m$ | $D^{m+n}$ | $D^{m+n}LP$ | $D^{m+n}PL$ | $D^{m+n}L$ | $D^{m+n}P$ | $D^{m+n}PLP$ | $D^{m+n}RL$ | $D^{m+n}RP$ | $D^{m+n}LR$ | $D^{m+n}R$ | $D^{m+n}RLP$ | $D^{m+n}LRP$ |
| $D^mPL$ | $D^{m+n}PL$ | $D^{m+n}$ | $D^{m+n}LP$ | $D^{m+n}P$ | $D^{m+n}PLP$ | $D^{m+n}L$ | $D^{m+n+6}LR$ | $D^{m+n}RL$ | $D^{m+n+6}RP$ | $D^{m+n}RLP$ | $D^{m+n+6}LRP$ | $D^{m+n+6}R$ |
| $D^mLP$ | $D^{m+n}LP$ | $D^{m+n}PL$ | $D^{m+n}$ | $D^{m+n}PLP$ | $D^{m+n}L$ | $D^{m+n}P$ | $D^{m+n}RP$ | $D^{m+n+6}LR$ | $D^{m+n+6}RL$ | $D^{m+n+6}LRP$ | $D^{m+n}R$ | $D^{m+n+6}RLP$ |
| $D^mL$ | $D^{m+n}L$ | $D^{m+n}P$ | $D^{m+n}PLP$ | $D^{m+n}$ | $D^{m+n}LP$ | $D^{m+n}PL$ | $D^{m+n+6}RLP$ | $D^{m+n}LRP$ | $D^{m+n}R$ | $D^{m+n}LR$ | $D^{m+n+6}RL$ | $D^{m+n}RP$ |
| $D^mP$ | $D^{m+n}P$ | $D^{m+n}PLP$ | $D^{m+n}L$ | $D^{m+n}PL$ | $D^{m+n}$ | $D^{m+n}LP$ | $D^{m+n}LRP$ | $D^{m+n+6}R$ | $D^{m+n}RLP$ | $D^{m+n+6}RP$ | $D^{m+n}LR$ | $D^{m+n}RL$ |
| $D^mPLP$ | $D^{m+n}PLP$ | $D^{m+n}L$ | $D^{m+n}P$ | $D^{m+n}LP$ | $D^{m+n}PL$ | $D^{m+n}$ | $D^{m+n+6}R$ | $D^{m+n+6}RLP$ | $D^{m+n+6}LRP$ | $D^{m+n+6}RL$ | $D^{m+n+6}RP$ | $D^{m+n+6}LR$ |
| $D^mLR$ | $D^{m+n}LR$ | $D^{m+n+6}RL$ | $D^{m+n+6}RP$ | $D^{m+n+6}RLP$ | $D^{m+n}LRP$ | $D^{m+n+6}R$ | $D^{m+n}$ | $D^{m+n}LP$ | $D^{m+n+6}PL$ | $D^{m+n}L$ | $D^{m+n}P$ | $D^{m+n+6}PLP$ |
| $D^mRP$ | $D^{m+n}RP$ | $D^{m+n+6}LR$ | $D^{m+n}RL$ | $D^{m+n+6}LRP$ | $D^{m+n}R$ | $D^{m+n}RLP$ | $D^{m+n+6}PL$ | $D^{m+n+6}$ | $D^{m+n}LP$ | $D^{m+n+6}P$ | $D^{m+n+6}PLP$ | $D^{m+n}L$ |
| $D^mRL$ | $D^{m+n}RL$ | $D^{m+n}RP$ | $D^{m+n+6}LR$ | $D^{m+n}R$ | $D^{m+n}RLP$ | $D^{m+n+6}LRP$ | $D^{m+n+6}LP$ | $D^{m+n+6}PL$ | $D^{m+n}$ | $D^{m+n+6}PLP$ | $D^{m+n+6}L$ | $D^{m+n}P$ |
| $D^mR$ | $D^{m+n}R$ | $D^{m+n}RLP$ | $D^{m+n+6}LRP$ | $D^{m+n}RL$ | $D^{m+n}RP$ | $D^{m+n+6}LR$ | $D^{m+n}L$ | $D^{m+n}P$ | $D^{m+n+6}PLP$ | $D^{m+n}$ | $D^{m+n}LP$ | $D^{m+n+6}PL$ |
| $D^mRLP$ | $D^{m+n}RLP$ | $D^{m+n+6}LRP$ | $D^{m+n}R$ | $D^{m+n+6}LR$ | $D^{m+n}RL$ | $D^{m+n}RP$ | $D^{m+n}P$ | $D^{m+n}PLP$ | $D^{m+n+6}L$ | $D^{m+n}PL$ | $D^{m+n}$ | $D^{m+n+6}LP$ |
| $D^mLRP$ | $D^{m+n}LRP$ | $D^{m+n+6}R$ | $D^{m+n+6}RLP$ | $D^{m+n+6}RP$ | $D^{m+n}LR$ | $D^{m+n+6}RL$ | $D^{m+n+6}PLP$ | $D^{m+n+6}L$ | $D^{m+n}P$ | $D^{m+n+6}LP$ | $D^{m+n+6}PL$ | $D^{m+n}$ |

Figure 4

| | I | LP | PL | L | P | PLP | RL | RP | LR | R | RLP | LRP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | I | LP | PL | L | P | PLP | RL | RP | LR | R | RLP | LRP |
| PL | PL | I | LP | P | PLP | L | LR | RL | RP | RLP | LRP | R |
| LP | LP | PL | I | PLP | L | P | RP | LR | RL | LRP | R | RLP |
| L | L | P | PLP | I | LP | PL | RLP | LRP | R | LR | RL | RP |
| P | P | PLP | L | PL | I | LP | LRP | R | RLP | RP | LR | RL |
| PLP | PLP | L | P | LP | PL | I | R | RLP | LRP | RL | RP | LR |
| LR | LR | RL | RP | RLP | LRP | R | I | LP | PL | L | P | PLP |
| RP | RP | LR | RL | LRP | R | RLP | PL | I | LP | P | PLP | L |
| RL | RL | RP | LR | R | RLP | LRP | LP | PL | I | PLP | L | P |
| R | R | RLP | LRP | RL | RP | LR | L | P | PLP | I | LP | PL |
| RLP | RLP | LRP | R | LR | RL | RP | P | PLP | L | PL | I | LP |
| LRP | LRP | R | RLP | RP | LR | RL | PLP | L | P | LP | PL | I |

Figure 5

- Finally, this article concludes with another kind of "transformational" analysis by Lorenz.

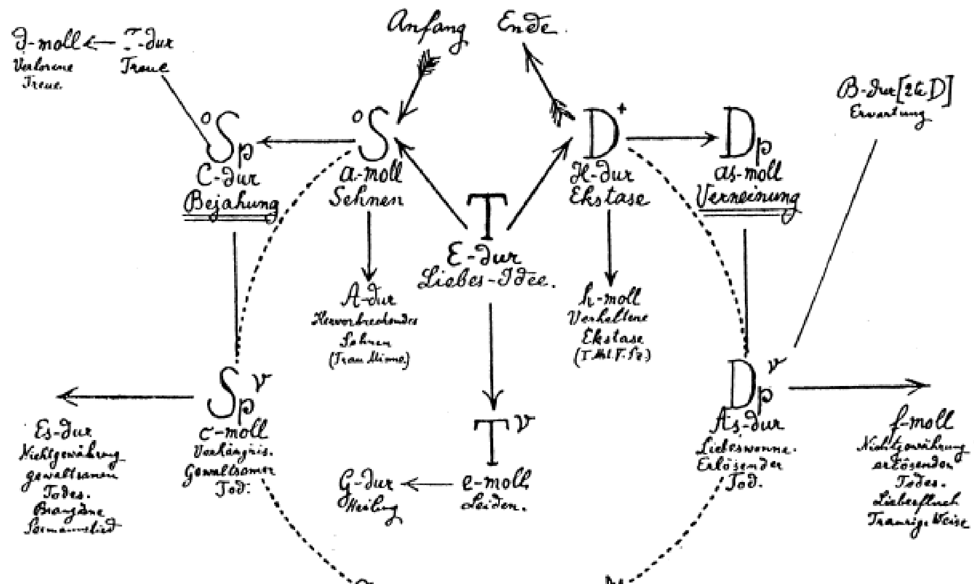



Figure 7: Alfred Lorenz, *Das Geheimnis der Form bei Richard Wagner,* Vol. 2: *Der musikalische Aufbau von Richard Wagners 'Tristan und Isolde'* (Berlin, 1926), 178.

## § 7.2 THE WORK OF RICHARD COHN

- Richard Cohn. 1996. "Maximally Smooth Cycles, Hexatonic Systems, and the Analysis of Late-Romantic Triadic Progressions." *Music Analysis* 15: 9-40.

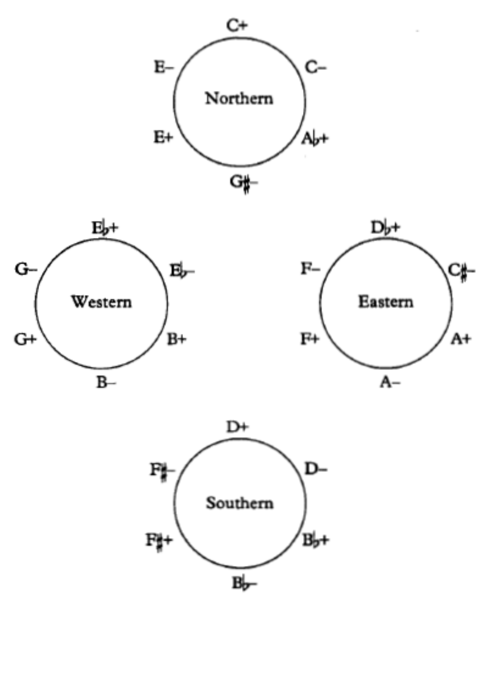
  - This paper argues that in the music of late nineteenth-century composers such as Wagner and Frank, certain harmonic progressions are better understood through parsimonious voice leading, as opposed to root motion. These progressions are classified as "diatonically indeterminate." An example would include major triads based on an equal division of the octave: C+, E+, Ab+, C+.

  - Progressions such as these may be modeled using three "neo-Riemannian" operations Parallel (P), Relative (R) and *Leittonwechsel* (L). Each operation preserves two common tones, is mode reversing, and is its own inverse.

  - The P, L and R operations may be used to generate maximally smooth cycles. A **maximally smooth cycle** is a tonal event with more than three chords of the same set class where the beginning and ending harmonies are the same and the intermittent harmonies are distinct. All progressions between adjacent harmonies may only have one voice that moves by semitone.

  - A **hexatonic system** is one example of a maximally smooth cycle. Hexatonic systems alternate P and L operations until the cycle is closed. Triads separated by (PLP) or (LPL) are known as **hexatonic poles** because they are polar opposites in the cycles of six triads.

**Fig. 1 The four hexatonic systems**



❖ Richard Cohn. 1997. "Neo-Riemannian Operations, Parsimonious Trichords, and Their *Tonnetz* Representations." *Journal of Music Theory* 41: 1-66.

- The triad (i.e., sc 3-11) is **over-determined** because not only is it generated on an acoustical basis—although Cohn doesn't mention the continuing difficulty encountered throughout the history of theory in generating the minor triad—but it participates in a group-theoretic model of parsimonious voice leading.

- Cohn next explores a more generic form of the *Tonnetz* that may be used to model other set classes than sc 3-11. Cohn later expands this generic model to other spaces, including mod 18 and mod 24.

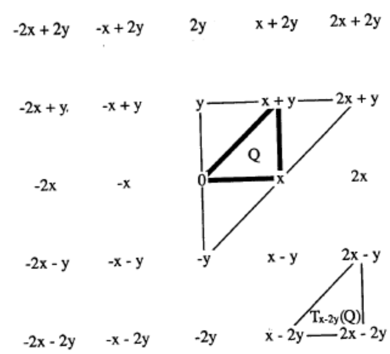



Figure 6: The Abstract *Tonnetz*

- Cohn then explores binary chains of operations on the *Tonnetz* which form closed cycles.

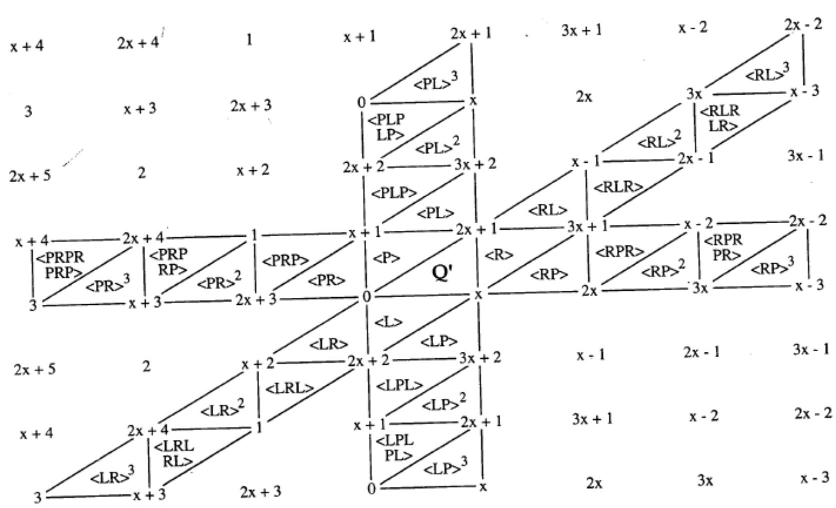



Figure 13: Binary Chains on the Parsimonious *Tonnetz*

- Cohn then explores the possible binary chains mod 12. He then explores the analogue to the hexatonic system in mod 18 space.

| c = 12<br>≡ 3 modulo-9 | (a) operational periodicity | (b) chain-class cardinality | (c) trichordal periodicity | (d) pitch-class cardinality per co-cycle |
|---|---|---|---|---|
| <LP> | 3 | 4 | 6 | 6 |
| <PR> | 4 | 3 | 8 | 8 |
| <LR> | 12 | 1 | 24 | 12 |

Figure 17: Binary-Generated Periodicities and Cardinalities Modulo 12

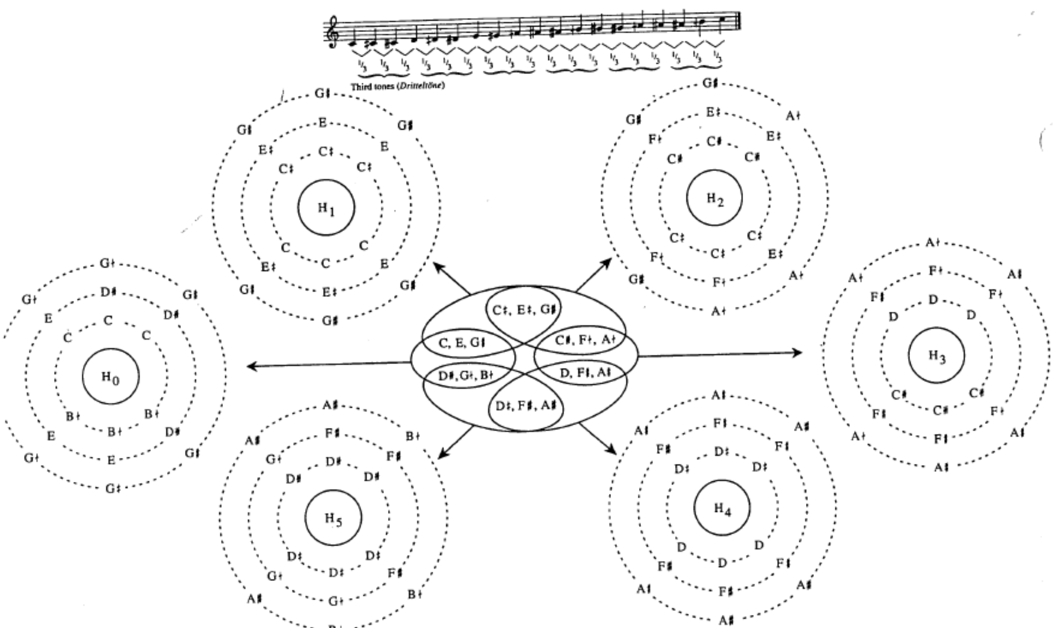


Figure 18: The Hyper-Hexatonic-Analogue System for c = 18

- Cohn finally explores ternary-generated cycles (e.g., PLR loops) and quaternary-generated cycles.

❖ Richard Cohn. 1998. "Introduction to Neo-Riemannian Theory: A Survey and Historical Perspective." *Journal of Music Theory* 42: 167-80.

- As before, Cohn claims that neo-Riemannian theory "arose in response to analytical problems posed by music that is triadic but not altogether tonally unified," p. 167.

- Cohn notes that this music—music by composers such as Wagner and Liszt, but also Mozart and Schubert—has been difficult to categorize. Terms such as "chromatic tonality," "triadic atonality," and "triadic chromaticism" are all somehow unsatisfactory labels. Cohn suggests the term "triadic post-tonality" is the best we've come up with so far.

- Cohn claims that since this music is viewed as disunified, or diatonically indeterminate, it aligns well with recent post-structuralist studies that characterize the New Musicology. However, neo-Riemannian theory is different from post-structuralist theory because it claims that there is an alternative way to organize this music through parsimonious voice leading. Rather than disunity, neo-Riemannian theory recognizes that two bases for harmonic unity (i.e., traditional theories of harmony and voice leading vs. neo-Riemannian theory) may be working in a single piece.

- Cohn recognizes six characteristics of neo-Riemannian theory, which also has its roots in other late nineteenth-century theorists such as Oettingen and Hauptmann.

    - Triadic transformations
    - Common-tone maximization
    - Voice-leading parsimony
    - "Mirror" or "dual" inversion
    - Enharmonic equivalence
    - The "table of tonal relations"

❖ Richard Cohn. 1999. "As Wonderful as Star Clusters: Instruments for Gazing at Tonality in Schubert." *19th-Century Music* 22/3: 213-32.

- This is one of the most analytically oriented articles in the neo-Riemannian literature. Cohn analyzes the first movement of Schubert's late B-flat Major piano sonata through the lens of parsimonious voice leading, as opposed to the traditional "solar" view of tonality with its pull to a central tonic.

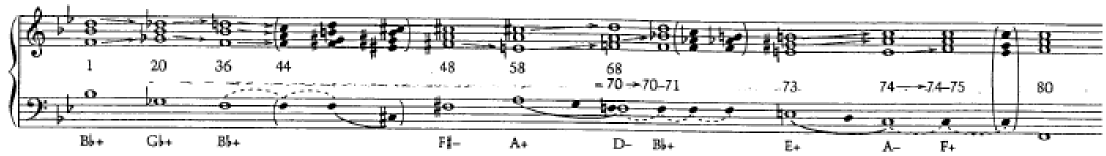
- Cohn cites four aspects of Schubert's harmonic practice that lends well to parsimonious voice leading, as opposed to analysis with reference to a specific diatonic collection:

    - Modal mixture
    - Root relation by third
    - Motion through the enharmonic seam
    - Equal division of the octave

- A typical example of a hexatonic cycle from the music of Schubert:


Example 1: Schubert, Piano Trio, op. 100.

- Cohn’s neo-Riemannian analysis of the exposition of Schubert’s late B-flat Major piano sonata.




Example 2: Schubert, Piano Sonata in B♭ Major, movt. I, mm. 1–80: figural model.

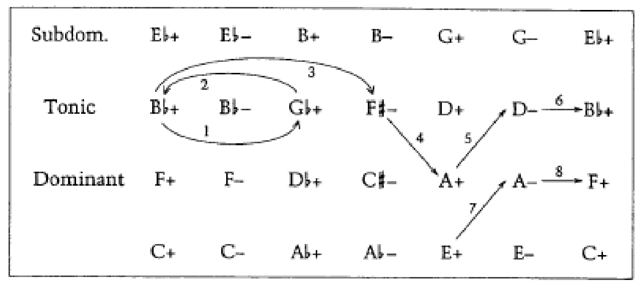



Figure 5: Schubert, Piano Sonata in B♭ Major, movt. I, mm. 1–80: formal model.

- JAH: I find there are a few problems with this analysis. Specifically, Cohn’s approach begins to verge on forcing him to prescriptively pick the triads that fit his transformational graphs regardless of their harmonic context. For instance, the E-major sonority in m. 73 seems more like a passing chord which results from stepwise motion in the bass. In fact, this chord is the result of the prolongation of the previous diminished-seventh chord, which doesn’t resolve until m. 74.

❖ Richard Cohn. 2004. “Uncanny Resemblances: Tonal Signification in the Freudian Age.” *Journal of the American Musicological Society* 57/2: 285-324.

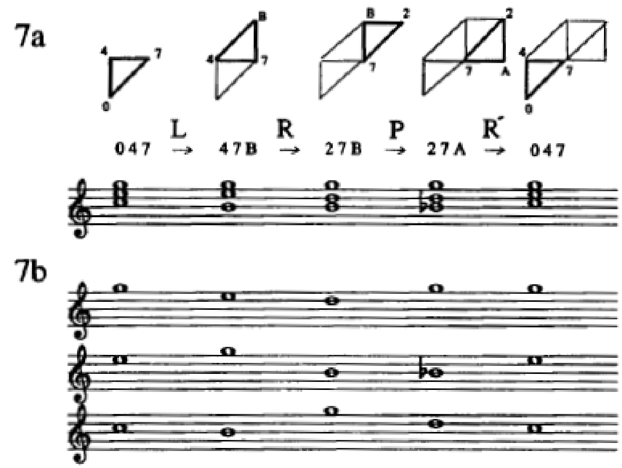
- This article argues that hexatonic poles signify the uncanny. Cohn supports this thesis by analyzing music from Gesualdo and Monteverdi to Wagner and Schoenberg, and bolsters his claim with late nineteenth-century writings on harmony (e.g., Kurth and Lorenz) and psychology (e.g., Freud).

### § 7.3 EXTENSIONS

❖ Robert Morris. 1998. “Voice-Leading Spaces.” *Music Theory Spectrum* 20/2: 175-208.

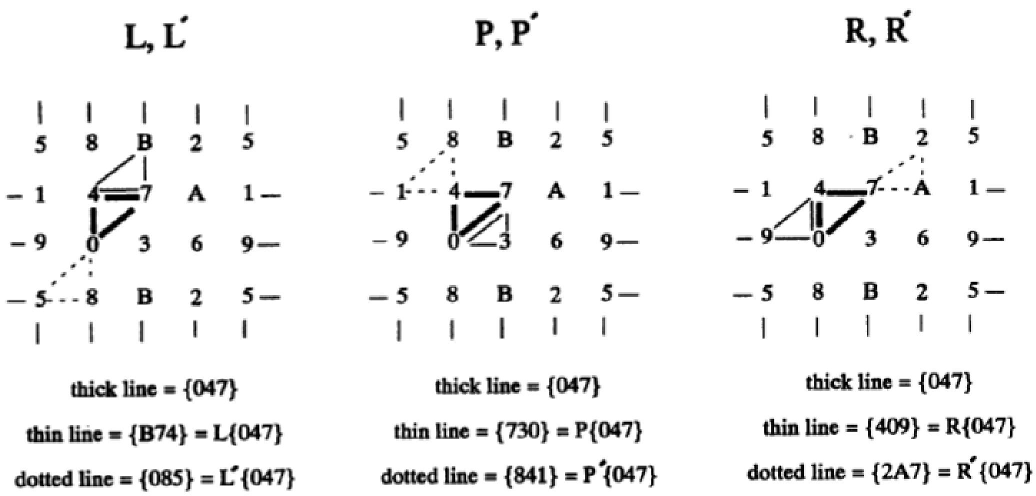
- This article has an important criticism of neo-Riemannian theory. While parsimonious voice leading is often emphasized, many of the operations involved require a lot of motion. Since operations like P, L, and R require inversion, the actual (or transformational) voice leadings implied by these operations include rather large distances.

Example 7. Triad transformation as triangle flips on the tonnetz [4,3,1,7]




- Morris also invents three new neo-Riemannian operations. Where P, L and R keep a single interval invariant and invert a singleton about that interval, Morris's new operations P', L' and R' keep a singleton invariant and invert the dyad about that pc.

Example 6. The tonnetz representation of the LPR transformations




❖ Adrian P. Childs. 1998. "Moving Beyond Neo-Riemannian Triads: Exploring a Transformational Model for Seventh Chords." *Journal of Music Theory* 42: 181-93; Edward Gollin. 1998. "Some Aspects of Three-Dimensional *Tonnetze*." *Journal of Music Theory* 42: 195-206.

- Both of these authors attempt to construct three-dimensional *Tonnetze* to model voice leadings among seventh chords.

▪ From Childs 1998:

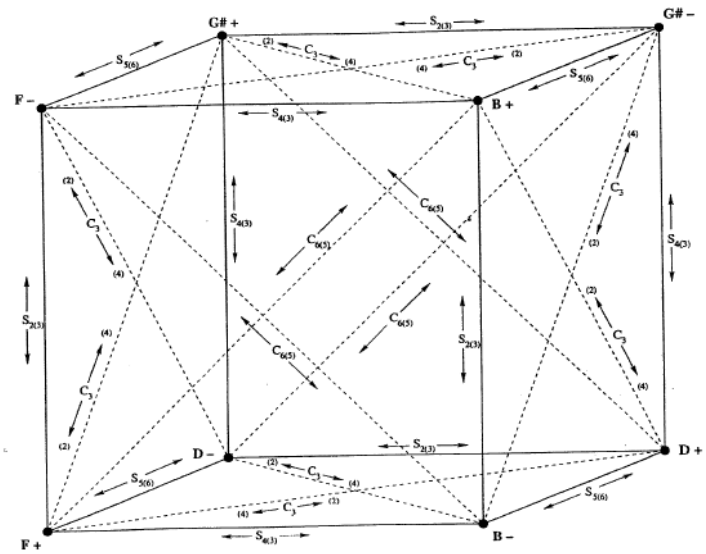



Figure 6. A cubic network which obtains among seventh chords within one octatonic collection

▪ From Gollin 1998:

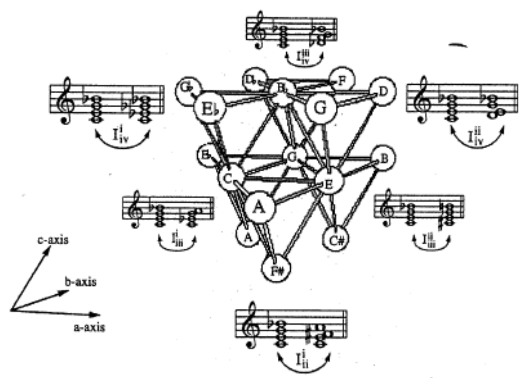



Figure 4a. Six 'edge-flips' about a nexus tetrachord, (C,E,G,B♭), within an [0258] *Tonnetz*

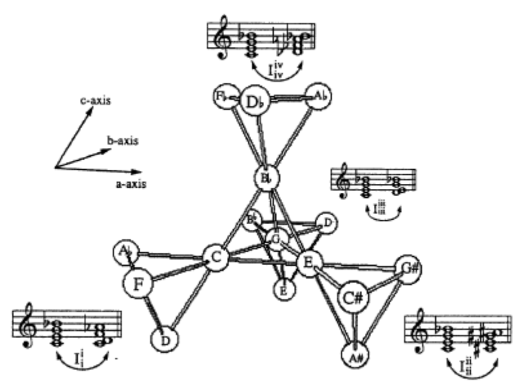
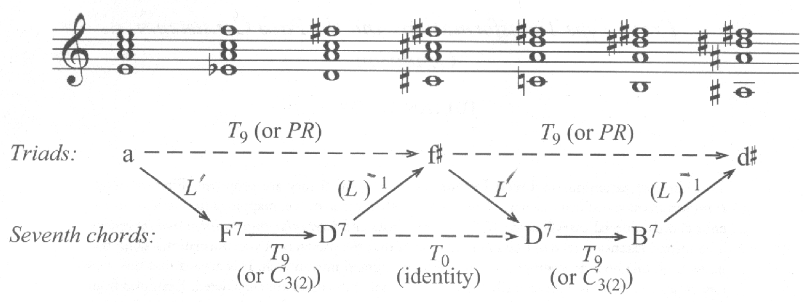



Figure 4b. Four 'vertex-flips' about a nexus tetrachord (C,E,G,B♭), within an [0258] *Tonnetz*

❖ Julian Hook. 2007. "Cross-Type Transformations and the Path Consistency Condition." *Music Theory Spectrum* 29/1: 1-39.

- **Cross-type transformation:** a function that transforms one type of object (e.g., triads) onto another type of object (e.g., seventh chords). For example, Hook's L' (not to be confused with Morris's L') is the transformation that does L to a triad an then embeds it into either a major-minor seventh chord (if the result is major) or a half-diminished seventh chord (if the result is minor). For example:
    - L'(C, +)= C-sharp half-diminished seventh
    - L'(C, -)= A-flat major-minor seventh
    - The same cross-type transformations may be used in the cases of R' and P'




EXAMPLE 1. *Cross-type analysis of an omnibus progression.*

❖ Julian Hook. 2002. "Uniform Triadic Transformations." *Journal of Music Theory* 46: 57-126.

- Hook begins by noting some basic objections to neo-Riemannian theory:
    - There is no standard way to label triadic transformations.
    - Is D a neo-Riemannian transformation or not?
    - Mathematical uncertainty: What exactly is the algebraic structure of various groups and subgroups (cf. Hyer 1995 in this regard).
    - Neo-Riemannian theory is largely restricted to major and minor triads. How do we integrate seventh chords into this model?
    - The application of neo-Riemannian operations to standard harmonic progressions is awkward at best.
    - Most analyses only deal with short, isolated passages.

- **Uniform triadic transformations (UTTs):** UTTs utilize a root-interval approach. "Each UTT consists of a *sign* (+ or -, indicating whether the transformation preserves or reverses mode) and two *transpositional levels* (integers mod 12: one for major triads, the other for minor, indicating the level through which the root of a triad is transposed). For example, the leittonwechsel is represented as L=<-,4,8>, by which we understand that it maps any major triad to a minor triad whose root is four semitones higher (C major to E minor), and maps and minor triad to a major triad whose root is eight semitones higher (C minor to A-flat major)."

- Hook defines the subgroup of **Riemannian operations** as those operations where the transpositional levels are complementary and the function is mode reversing (e.g., L= <-,4,8>). Those operations that are not both mode reversing and complementary with respect to transpositional level are said to not be a Riemannian operation (e.g., D=<+,5,5>). See below for a table of UTTs and other neo-Riemannian transformations.

### Table 1. The 24 Riemannian UTTs

| Group | Action of transformation | UTT | $S_n/W_n$ | $S_n/W_n$ (Gollin) | Riemann/ Klumpenhouwer | $P/Q$ | $L/R$ | $P/L/R$ (shortest) | Hyer | Other names |
|---|---|---|---|---|---|---|---|---|---|---|
| *Schritts* (*elements of* $\mathcal{R}^{+}$) | C → C, c → c | ⟨+, 0, 0⟩ | $S_0$ | $S_0$ | Identity | $(P^0Q^0)$ | $(L^0R^0)$ | $(P^0L^0R^0)$ | $(D^0)$ | $T_0$, $I$, ID, IDENT, $E$ |
| | C → D♭, c → b | ⟨+, 1, 11⟩ | $S_1$ | $S_1$ | *Gegenleittonschritt* | $Q$ | $(RL)^5$ | $LPRP$, $PLRL$, $RLPL$, $RPLP$ | $D^6LR$ | Unit schritt |
| | C → D, c → b♭ | ⟨+, 2, 10⟩ | $S_2$ | $S_2$ | *Ganztonschritt* | $Q^2$ | $(LR)^2$ | $LRLR$, $RLRP$, $RPRL$ | $D^6PL$ | |
| | C → E♭, c → a | ⟨+, 3, 9⟩ | $S_3$ | $S_3$ | *Gegenkleinterzschritt, Gegensextschritt* | $Q^3$ | $(RL)^3$ | $PR$ | $D^6RP$ | |
| | C → E, c → g♯ | ⟨+, 4, 8⟩ | $S_4$ | $S_4$ | *Terzschritt* | $Q^4$ | $(LR)^4$ | $LP$ | $LP$ | |
| | C → F, c → g | ⟨+, 5, 7⟩ | $S_5$ | $S_5$ | *Gegenquintschritt* | $Q^5$ | $RL$ | $RL$ | $RL$ | |
| | C → F♯, c → f♯ | ⟨+, 6, 6⟩ | $S_6$ | $S_6$ | *Tritonusschritt* | $Q^6$ | $(LR)^6$, $(RL)^6$ | $PRPR$, $RPRP$ | $D^6$ | $T_6$, octatonic pole |
| | C → G, c → f | ⟨+, 7, 5⟩ | $S_7$ | $S_7$ | *Quintschritt* | $Q^7$ | $LR$ | $LR$ | $LR$ | |
| | C → A♭, c → e | ⟨+, 8, 4⟩ | $S_8$ | $S_8$ | *Gegenterzschritt* | $Q^8$ | $(RL)^4$ | $PL$ | $PL$ | |
| | C → A, c → d♯ | ⟨+, 9, 3⟩ | $S_9$ | $S_9$ | *Kleinterzschritt, Sextschritt* | $Q^9$ | $(LR)^3$ | $RP$ | $RP$ | |
| | C → B♭, c → d | ⟨+, 10, 2⟩ | $S_{10}$ | $S_{10}$ | *Gegenganztonschritt* | $Q^{10}$ | $(RL)^2$ | $LRPR$, $PRLR$, $RLRL$ | $D^6LP$ | |
| | C → B, c → c♯ | ⟨+, 11, 1⟩ | $S_{11}$ | $S_{11}$ | *Leittonschritt* | $Q^{11}$ | $(LR)^5$ | $LPLR$, $LRLP$, $PLPR$, $PRPL$ | $D^6RL$ | |
| *Wechsels* (*elements of* $\mathcal{R}^{-}$) | C → c, c → C | ⟨–, 0, 0⟩ | $W_0$ | $W_7$ | *Quintwechsel* | $P$ | $(RL)^3R$ | $P$ | $P$ | PAR |
| | C → c♯, c → B | ⟨–, 1, 11⟩ | $W_1$ | $W_8$ | *Gegenterzwechsel* | $QP$, $PQ^{11}$ | $(LR)^3L$ | $LPR$, $RPL$ | $D^6LRP$ | $P'$, SLIDE, $S$ |
| | C → d, c → B♭ | ⟨–, 2, 10⟩ | $W_2$ | $W_9$ | *Kleinterzwechsel, Sextwechsel* | $Q^2P$, $PQ^{10}$ | $RLR$ | $RLR$ | $D^6PLP$ | |
| | C → d♯, c → A | ⟨–, 3, 9⟩ | $W_3$ | $W_{10}$ | *Gegenganztonwechsel* | $Q^3P$, $PQ^9$ | $(LR)^5L$ | $PRP$ | $D^6R$ | |
| | C → e, c → A♭ | ⟨–, 4, 8⟩ | $W_4$ | $W_{11}$ | *Leittonwechsel* | $Q^4P$, $PQ^8$ | $L$ | $L$ | $L$ | LT |
| | C → f, c → G | ⟨–, 5, 7⟩ | $W_5$ | $W_0$ | *Seitenwechsel* | $Q^5P$, $PQ^7$ | $(RL)^4R$ | $PLR$, $RLP$ | $RLP$ | $L'$, $N$ (*nebenverwandt*) stride |
| | C → f♯, c → F♯ | ⟨–, 6, 6⟩ | $W_6$ | $W_1$ | *Gegenleittonwechsel* | $Q^6P$, $PQ^6$ | $(LR)^2L$ | $RPR$ | $D^6P$ | |
| | C → g, c → F | ⟨–, 7, 5⟩ | $W_7$ | $W_2$ | *Ganztonwechsel* | $Q^7P$, $PQ^5$ | $(RL)^2R$ | $LRP$, $PRL$ | $LRP$ | $R'$ |
| | C → g♯, c → E | ⟨–, 8, 4⟩ | $W_8$ | $W_3$ | *Gegenkleinterzwechsel, Gegensextwechsel* | $Q^8P$, $PQ^4$ | $(LR)^4L$ | $LPL$, $PLP$ | $PLP$ | $H$ (hexatonic pole) |
| | C → a, c → E♭ | ⟨–, 9, 3⟩ | $W_9$ | $W_4$ | *Terzwechsel* | $Q^9P$, $PQ^3$ | $R$ | $R$ | $R$ | REL |
| | C → b♭, c → D | ⟨–, 10, 2⟩ | $W_{10}$ | $W_5$ | *Gegenquintwechsel* | $Q^{10}P$, $PQ^2$ | $(RL)^5R$ | $LPRPR$, $LRPRP$, $PLRLR$, $PRLRP$, $PRPRL$, $RLPLR$, $RLRLP$, $RPLPR$, $RPRPL$ | $D^6L$ | *Tonnetz* pole |
| | C → b, c → D♭ | ⟨–, 11, 1⟩ | $W_{11}$ | $W_6$ | *Tritonuswechsel* | $Q^{11}P$, $PQ$ | $LRL$ | $LRL$ | $D^6RLP$ | |

§ 7.4 **VOICE-LEADING PARSIMONY**

- Clifton Callender. 1998. "Voice Leading Parsimony in the Music of Alexander Scriabin." *Journal of Music Theory* 42: 219-33.

    - This article is concerned with ways that many of the prominent pitch collections in the music of Scriabin may be related using split and fuse transformations for collections of unequal cardinalities, or by using semitonal voice leading ($P^1$) in cases of collections with equal cardinalities.

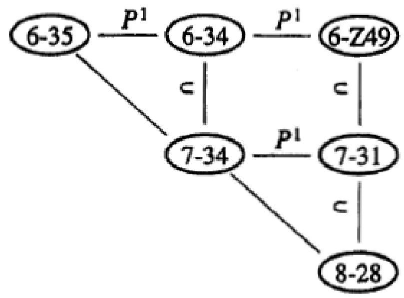



Figure 2. Incomplete relational network of Scriabin's preferred pitch collections


Figure 7. Voice leading between sets resulting from the addition of {8,0,2,6} to the relational network of Figure 6

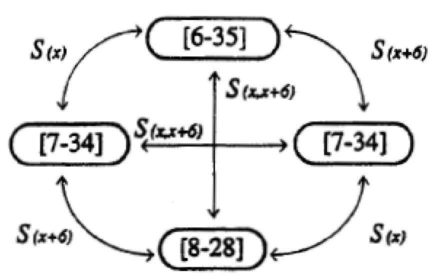



Figure 8. Network of split relations between set classes 6-35, 7-34, and 8-28

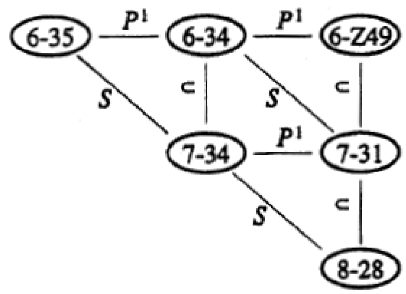



Figure 11. Relational network of Scriabin's preferred pitch collections

❖ Jack Douthett and Peter Steinbach. 1998. "Parsimonious Graphs: A Study in Parsimony, Contextual Transformations, and Modes of Limited Transposition." *Journal of Music Theory* 42: 241-63.

- Much like the work of Callender, Douthett and Steinbach are interested in creating spaces, or cycles, that are generated through minimal voice leading which involve both triads and seventh chords. Here are some examples:

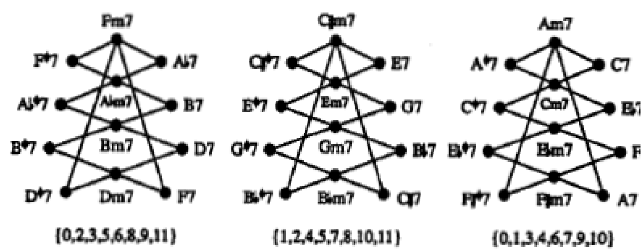



Figure 4. OctaTowers

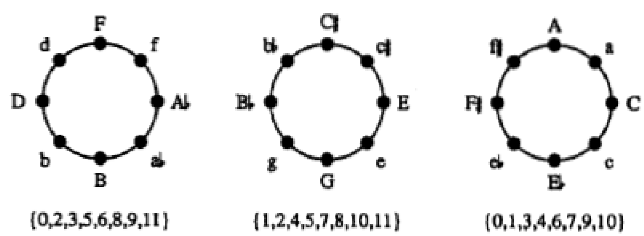



Figure 5. OctaCycles

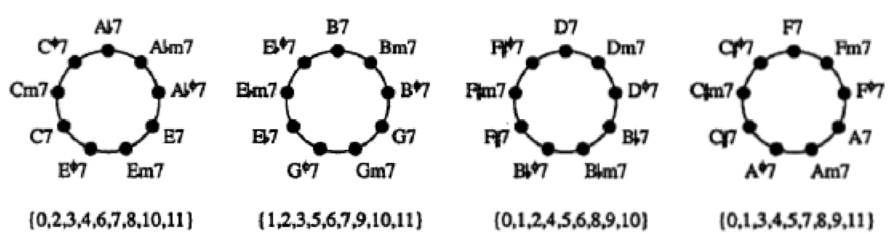



Figure 6. EnneaCycles

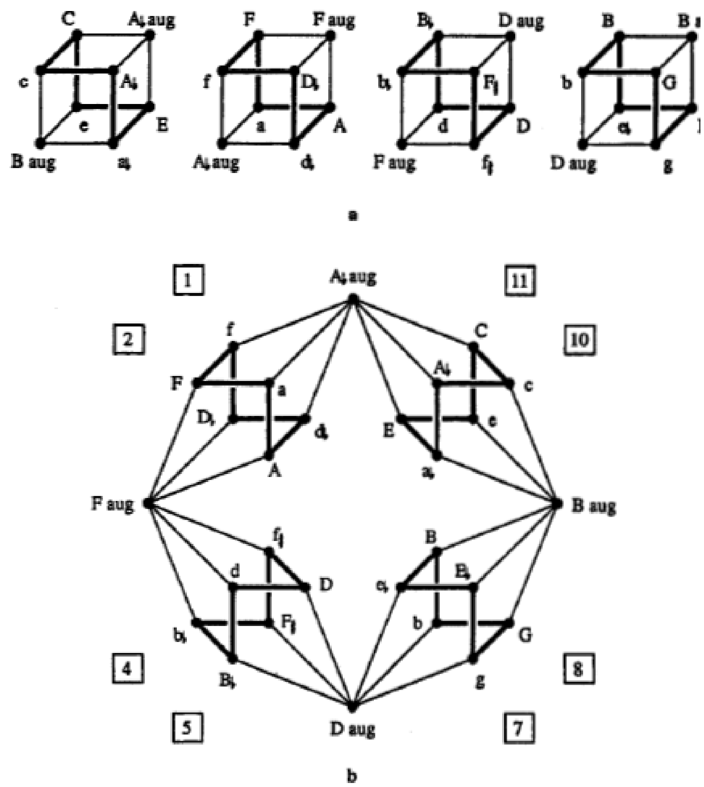



Figure 9. Cube Dance

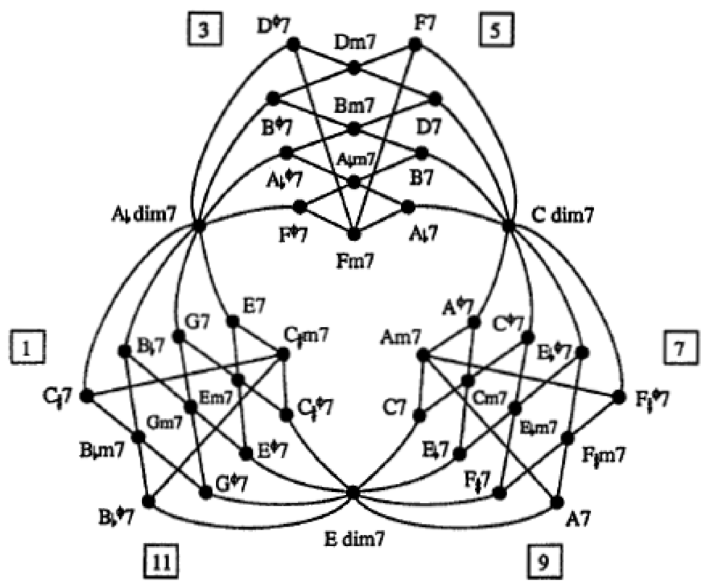



Figure 10. Power Towers

## § 8.0 PERCEPTION AND COGNITION

- These writings take an explicitly listener-oriented approach to music theory. Most posit a competent, universal, idealized listener that supposedly represents how all people listen to music regardless of culture and training. This claim is made because it is assumed that we all basically have the same cognitive structure, more or less anyway. Most of these writings are anti-Schenker, either implicitly, in the case of Gjerdingen, or explicitly, in the cases of Narmour and Lerdahl.

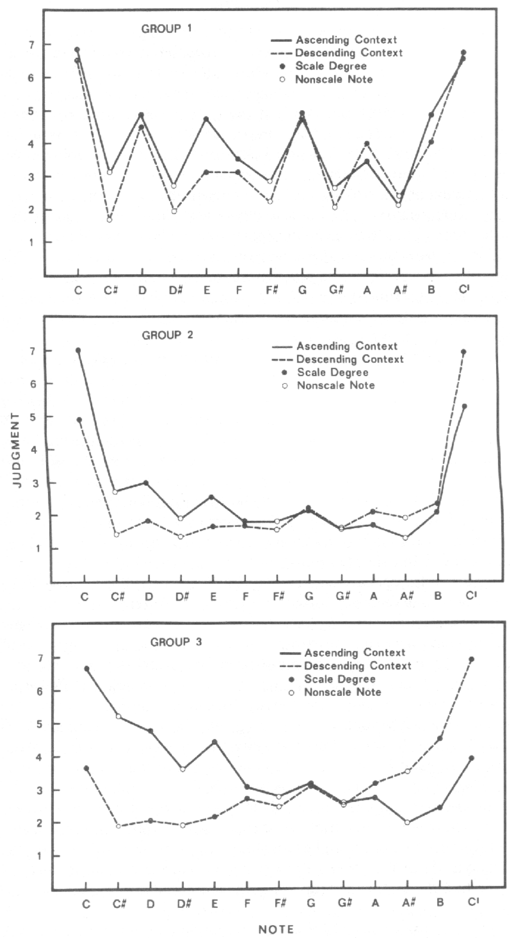
## § 8.1 PERCEPTION: KRUMHANSL AND HURON

- Carol L. Krumhansl. 1990. *Cognitive foundations of Musical Pitch.* Oxford Psychology Series No. 17. Oxford and New York: Oxford University Press.

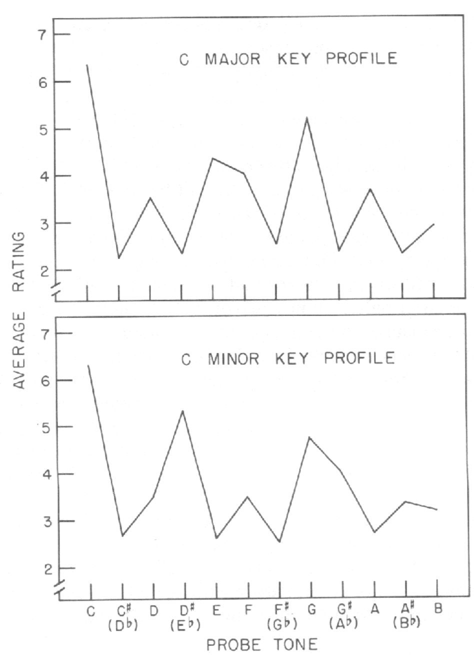
  - This study is largely informed by experimental (cognitive) psychology.

  - **Probe tone experiments:** An "incomplete" diatonic scale is played (e.g., C—B) creating a strong expectation for a tone that follows and completes the scale. Once the incomplete scale is played, any one of twelve notes is played as a "completion" of this diatonic scale, and listeners are asked to rate how well each note provides a sense of completion. The study found three kinds of listener based on musical background (see next page for the graphs):

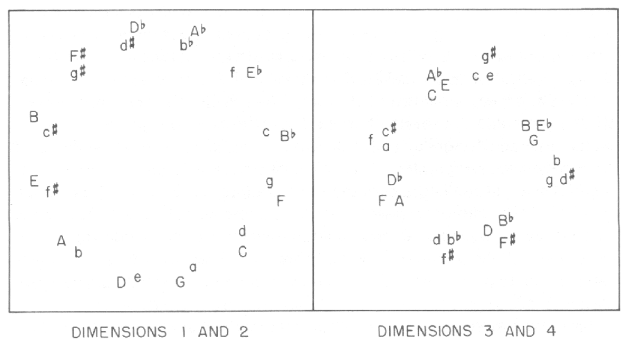
    - **Group 1:** These listeners have the most musical training. These listeners rate tones according to their fit in the diatonic scale. The dominant is rated as the best fit after the tonic. This listening strategy could be generated by a contiguous, diatonic segment along the circle of fifths; it indicates that this group is listening according to some kind of tonal hierarchy.
    - **Group 2:** These listeners had a moderate amount of musical training. While traces of listening to a tonal hierarchy remain, these listeners also seem to be listening according to how close the note of completion is to the tonic in pitch space. This is why E is rated as a better fit than G, because E is "closer" to the tonic in terms of scale steps.
    - **Group 3:** These listeners have very little musical training. They seem to listen according to distance from the tonic in pitch space, with a large spike at the major third (i.e., E).



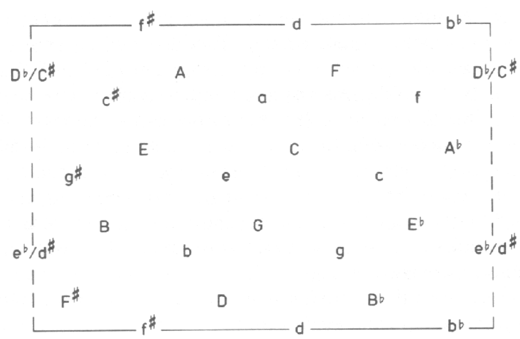

- Extension to minor keys:



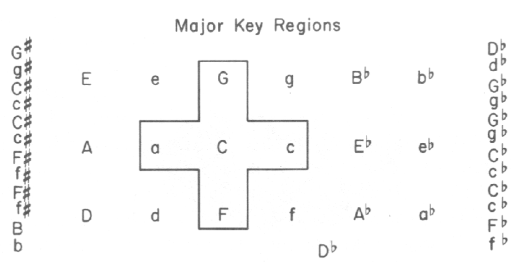
- **Key distances:** Correlations between probe-tone profiles for the twelve major keys and twelve minor keys are calculated as "distances" where a high degree or correlation is interpreted as a relatively short distance and a low degree of correlation is interpreted as a relatively far distance. These distances are then run through multidimensional scaling (MDS). The result is a four-dimensional, toroidal solution. Dimensions 1 and 2 equate to the circle of fifths, while dimensions 3 and 4 equate to the hexatonic system.

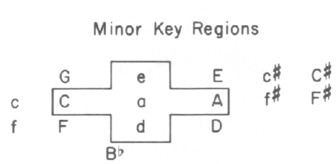



- The four-dimensional solution "flattened out."

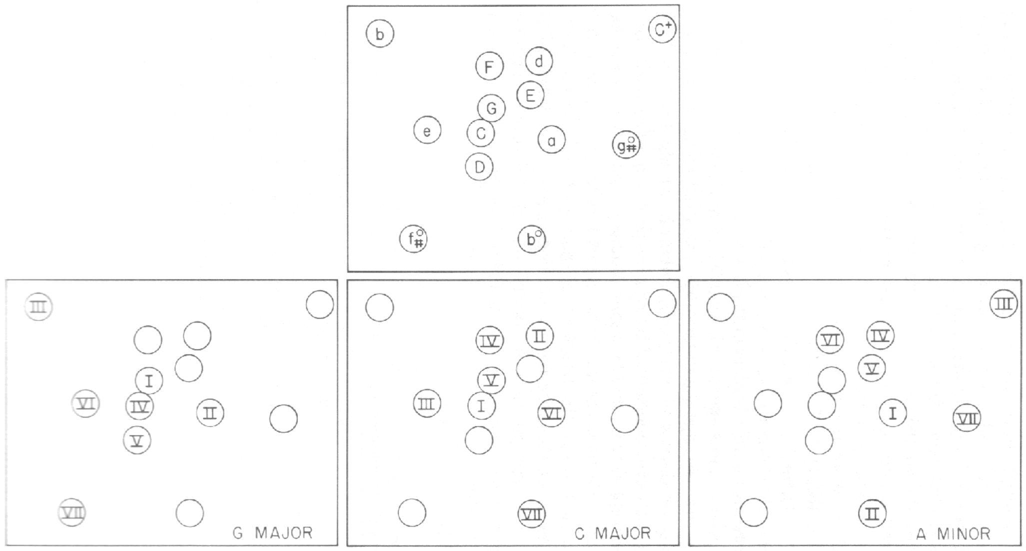



- This result is very similar to Schoenberg's Chart of the Regions.



- A solution for perceived chord distances within the context of a key.




❖ David Huron. 2001. "Tone and Voice: A derivation of the Rules of Voice-Leading from Perceptual Principles." *Music Perception* 19/1: 1-64.

- Six perceptual principles are used to account for the most basic principles of voice leading in Western tonal music. These principles are treated a axioms in a formal system from which voice-leading principles are derived.

    - **Toneness principle:** "Strong auditory images are evoked when tones exhibit a high degree of toneness. A useful measure of toneness is provided by virtual pitch weight. Tones having the highest virtual pitch weight are harmonic complex tones centered in the region between $F^2$ and $G^5$. Tones having inharmonic partials produce competing virtual pitch perceptions, and so evoke more diffuse auditory images," p. 10.
    - **Principle of temporal continuity:** "In order to evoke strong auditory streams, use continuous or recurring rather than brief or intermittent sound sources. Intermittent sounds should be separated by no more than roughly 800 ms of silence in order to ensure the perception of continuity," p. 12.
    - **Minimum masking principle:** "In order to minimize auditory masking within some vertical sonority, approximately equivalent amounts of spectral energy should fall in each critical band. For typical complex harmonic tones, this generally means that simultaneously sounding notes should be more widely spaced as the register descends," p. 18.
    - **Tonal fusion principle:** "The perceptual independence of concurrent tones is weakened when their pitch relations promote tonal fusion. Intervals that promote tonal fusion include (in decreasing order): unisons, octaves, perfect fifths,… Where the goal is the perceptual independence of concurrent sounds, intervals ought to be shunned in direct proportion to the degree to which they promote tonal fusion," p. 19.

- **Pitch proximity principle:** "The coherence of an auditory stream is maintained by close pitch proximity in successive tones within the stream. Pitch-based streaming is assured when pitch movement is within van Noorden's "fission boundary" (normally two semitones or less for tones less than 700 ms in duration). When pitch distances are large, it may be possible to maintain the perception of a single stream by reducing the tempo," p. 24.
- **Pitch co-modulation principle: "**The perceptual union of concurrent tones is encouraged when pitch motions are positively correlated. Perceptual fusion is most enhanced when the correlation is precise with respect to log frequency," p. 31.

- The results of these principles, when applied in Huron's formal system, are independent, step-wise melodic lines operating in relatively narrow and non-overlapping ranges suitable to the human voice. Motion is largely oblique and contrary, rather than parallel and similar. The latter two types of motion cause the voices to seem relatively fused, especially when they move in parallel consonant intervals. This is why, for example, parallel octaves and fifths are prohibited; these rules maintain a sense of perceptual independence among the voices.

### § 8.2 COGNITION: LERDAHL

- Fred Lerdahl and Ray Jackendoff. 1983. *A Generative Theory of Tonal Music.* Cambridge, Mass.: MIT Press.

  - **Music theory as cognition:**

    - "We take the goal of a theory of music to be a *formal description of the musical intuitions of a listener who is experienced in a musical idiom*," p. 1. "The 'experienced listener' is meant as an idealization," p. 3.
    - "The present study will justify the view that a piece of music is a mentally constructed entity," p. 2.
    - The theory of *GTTM* is largely based on the generative-transformational grammar of Chomsky.
    - We hope to "specify a *structural description* for any tonal piece; that is, the structure that the experienced listener infers in the hearing of a piece," p. 6.

  - **Overview of the theory:**

    - **Grouping structure:** The formation of boundaries generated by an experienced listener that are necessarily—but not always, as in the case of phrase overlap—hierarchic. Grouping structure includes motives, themes, phrases, periods, theme-groups, etc.

2.3
a

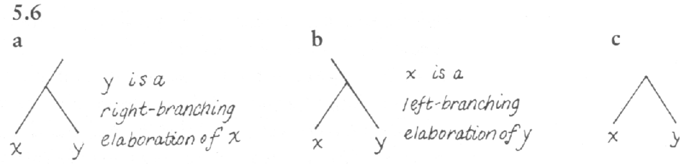
- **Metrical structure:** Beats are conceptualized as geometric points without duration; a time-span is the intervening time between beats; for a metrical hierarchy of strong and weak beats to exist, there must be at least two interactive rhythmic layers; meter is hierarchic by nature; the authors note some problems with large-scale metrical perception.

2.10


- **Reduction hypothesis:** "The listener attempts to organize all the pitch-events of a piece into a single coherent structure, such that they are heard in a hierarchy of relative importance," p. 106.

    - Binary tree diagrams are appropriated from linguistics. Strict binary branching precludes the conception of a passing tone, or any sense of being "in between."

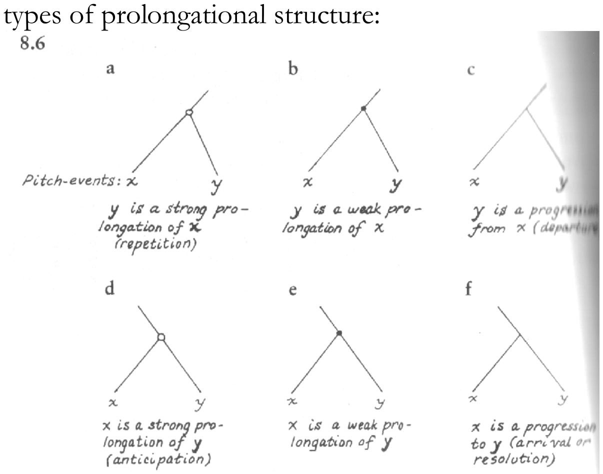
5.6



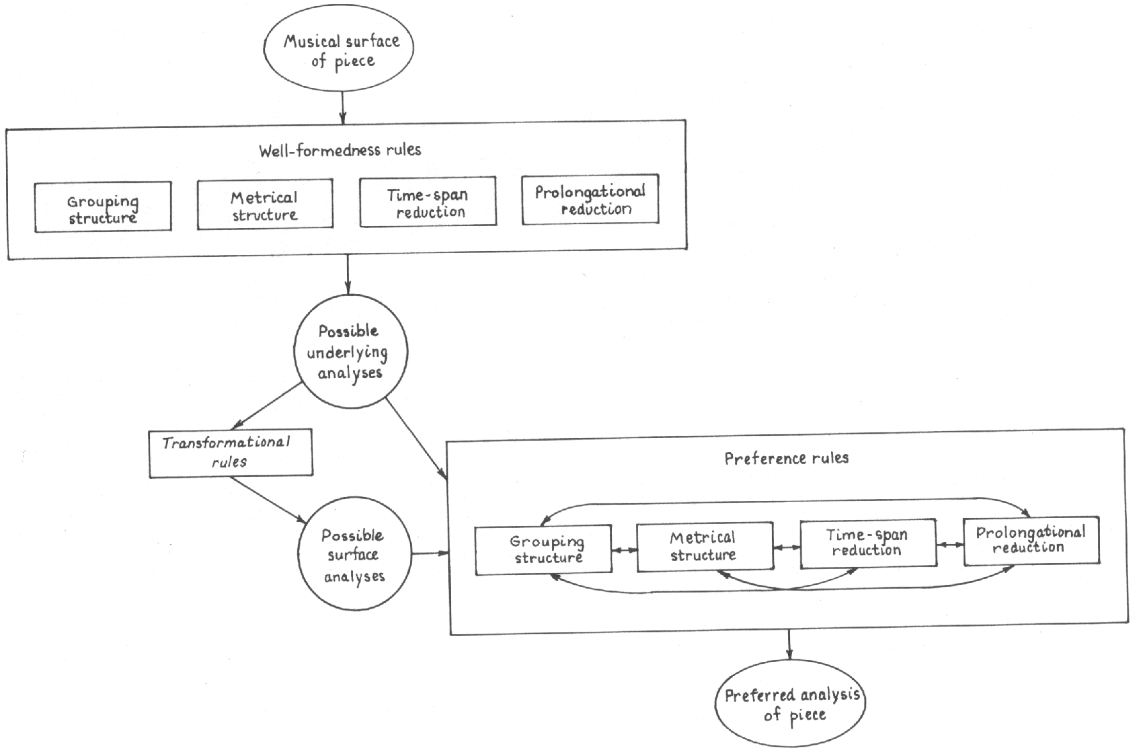

    - Reductions are based on an interaction of metric, grouping and pitch hierarchies. The pitch hierarchy is based on relative consonance/dissonance, or stability/instability.

    - Various types of prolongational structure:

8.6




    - **Rules:** The result of the theory is a rule-based system of well-formedness rules (WFRs) which are "universal" and largely based on *Gestalt* psychology and preference rules, which are like defaults that may be revised by the listener.




❖ Fred Lerdahl. 2001. *Tonal Pitch Space.* Oxford and New York: Oxford University Press.

- The problem with *GTTM* was that pitch criteria used in determining stability for pitch reduction was relatively *ad hoc*; *TPS* is an attempt to remedy this situation and formalize the intuitions concerning pitch implicit in *GTTM.*

- Much of this work is based on the distinction between an event hierarchy and a tonal hierarchy:

    - **Event hierarchy:** "Hierarchical relationships inferred from a sequence of events," p. 41
    - **Tonal hierarchy:** "Hierarchical relations that accrue to an entire tonal system beyond its instantiation in a particular piece. Such a hierarchy is atemporal in that it represents more or less permanent knowledge about the system rather than a response to a specific sequence of events," p. 41.

- Lerdahl's goal is to construct tonal hierarchies in multidimensional spaces and to show how pieces travel through that space.

- There are three spaces at increasingly higher hierarchical levels. These spaces are largely derived from Krumhansl's probe-tone experiments (cf. § 8.1 above).
    - **Basic space:** The hierarchical relationships between the notes in a given collection.

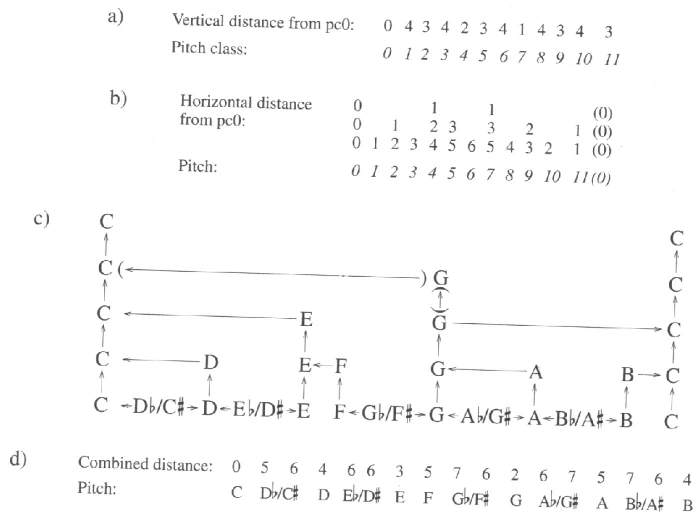



FIGURE 2.5 Pc and pitch proximity in the basic space: (a) vertical depth of pc embedding; (b) number of horizontal steps for each level; (c) stepwise horizontal and vertical pitch paths; (d) number of moves for each pitch in (c).

- **Chordal space:** The hierarchical relationships between chords in a given key.

| | | | | | | |
|---|---|---|---|---|---|---|
| vii° | ii | IV | vi | I | iii | V |
| iii | V | vii° | ii | IV | vi | I |
| vi | I | iii | V | vii° | ii | IV |
| ii | IV | vi | I | iii | V | vii° |
| V | vii° | ii | IV | vi | I | iii |
| I | iii | V | vii° | ii | IV | vi |
| IV | vi | I | iii | V | vii° | ii |

- **Regional space:** The relationship between various keys.

| | | | | | | |
|---|---|---|---|---|---|---|
| ♯ii | ♯IV | ♯iv | VI | vi | I | i |
| ♯vi | VII | vii | II | ii | IV | iv |
| ♯i | III | iii | V | v | ♭VII | ♭vii |
| ♯iv | VI | vi | I | i | ♭III | ♭iii |
| vii | II | ii | IV | iv | ♭VI | ♭vi |
| iii | V | v | ♭VII | ♭vii | ♭II | ♭ii |
| vi | I | i | ♭III | ♭iii | ♭V | ♭v |

- The harmonic trajectory of a given piece may be traced as motions within the spaces.

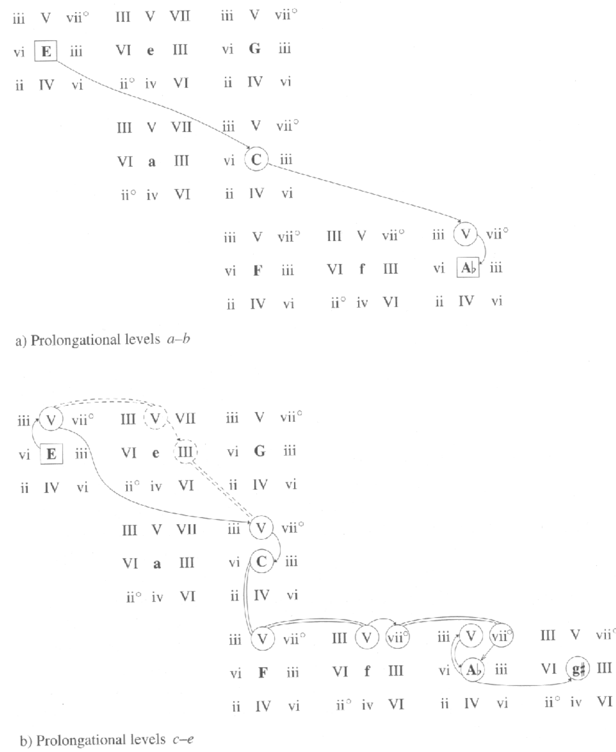



FIGURE 3.7 Chordal/regional representation of paths in the second phrase of the E major Prelude.

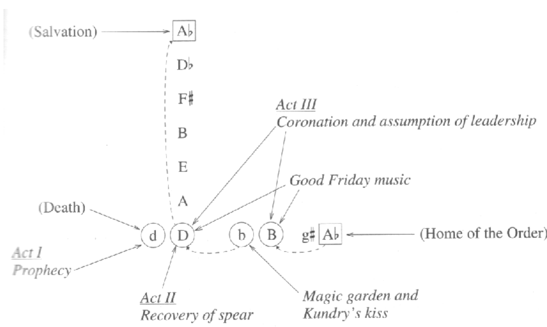



FIGURE 3.47 Stages in Parsifal's journey to redemption.

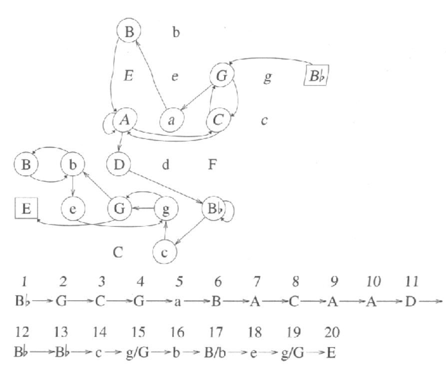



FIGURE 3.57 Regional journey in Schubert's *Die schöne Müllerin*.

- Lerdahl extends his theory to tonal functions. Lerdahl proposes that "tonal function equals prolongational position. In other words, functionality is an epiphenomenon of prolongation structure," p. 215. Here Lerdahl is interested in such things as tonic-finding algorithms which include searching the most stable prolongational configuration as a means determining key.

- Lerdahl further extends hiss theory to post-tonal music. He constructs other plausible spaces such as octatonic, hexatonic, and whole-tone spaces. This shares certain similarities to neo-Riemannian theory. He also tried to formalize a theory of pitch hierarchy for atonal music, but here is working in the realm of pure event hierarchies. In atonal music, there is no recourse to tonal hierarchy.

❖ Richard Cohn. 2007. Review of *Tonal Pitch Space,* by Fred Lerdahl. *Music Theory Spectrum* 29/1: 101-14.

- Some of Cohn's critiques, among many:

    - The *TPS* system requires that we regard smaller contexts before larger ones (i.e., a bottom-up approach), but often, it is sometimes important to consider higher-level structures in a top-down approach that informs lower levels. Where Lerdahl is almost exclusively bottom-up, a more balanced approach would be to incorporate top-down and bottom-up approaches.
    - Prolongational basic form, with its requirements of balance and recursion are sometimes too prescriptive. (Lerdahl argues that the Schenkerian *Ursatz* is too prescriptive.)
    - The symmetry problem: It seems logical that the distance from I→V should be greater than the distance from V→I since departure from stability requires more "work" than a return to stability. This would violate the symmetry constraint of Lerdahl's metric spaces, and as a result, these distances are assumed to be symmetrical. However, the chord-distance rule does indicate asymmetry in the case of $V^7$→I versus I→$V^7$.
    - For all the formalism in Chapter 2, there is entirely too much informal speculation in Lerdahl's analytical chapters. Often, the derivation of prolongational structure is a "given" and we are largely not told how it is precisely derived.
    - Tension curves are particularly problematic over the course of phrases since they are essentially required by prolongational good form.
    - Lerdahl's functional categories are under-theorized. For example, a cadential-$^6_4$ chord satisfies the same definition of subdominant function: a left branch from the dominant. [JAH: The passing function is also problematic, since there is no such thing as a passing tone in Lerdahl's binary tree formalism.]
    - Lerdahl's claim that triadic post-tonality operates under the same basic principles of diatonic tonality is questionable.
    - The cognitive data (cf. Krumhansl 1990) is sometimes at odds with Lerdahl's theory.
    - In general, for a work of such theoretical rigor, Lerdahl can often times be rather *ad hoc* in his prescriptions.

§ 8.3 **GESTALT PSYCHOLOGY: THE MEYER SCHOOL**

- Leonard B. Meyer. 1956. *Emotion and Meaning in Music*. Chicago and London: University of Chicago Press.

  - An important (and early) work that utilizes principles from *Gestalt* psychology in constructing a theory of musical meaning. This is a highly influential work for scholars in cognitive music theory, semiotics and musical meaning. This work also discusses issues that have become of more recent interest including style, gesture, emotion and embodiment.

  - **Thesis:** Emotion is evoked when a tendency to respond is inhibited. (Cf. Narmour 1990 in this regard.)

  - *Gestalt* principles organize our expectations:

    - **Law of good continuation:** A shape or pattern will, other things being equal, tend to be continued in its initial mode of operation, p. 92.
    - **Completion and closure:** We tend to search for complete, whole structures. Often musical logic is based on this principle, including the "gap-fill" contour model and the principle of return (e.g., I→V→I).
    - **Prägnanz:** The fundamental axiom of Gestalt theory which states that psychological organization will always be as "good" as the prevailing conditions allow , p. 86.
    - **Weakening of shape:** Deals with the similarity and dissimilarity of musical shapes, what Meyer calls "conformant relationships." Deviations from perfect shapes often have expressive implication (e.g., developing variation).

- Robert O. Gjerdingen. 1988. *A Classic Turn of Phrase: Music and the Psychology of Convention.* Philadelphia: University of Pennsylvania Press.

  - This work examines the development of the **changing-note schemas** over time. The rise and fall of these schemas is correlated to the rise and fall of the Galant style. These schemas are also subject to variations, similar to the degrees of typicality and atypicality postulated by **prototype theory** developed by psychologists in the 1970s. Here, schemas represent a **network-oriented** way of representing musical information.

  - A changing-note schema and some of its tokens:

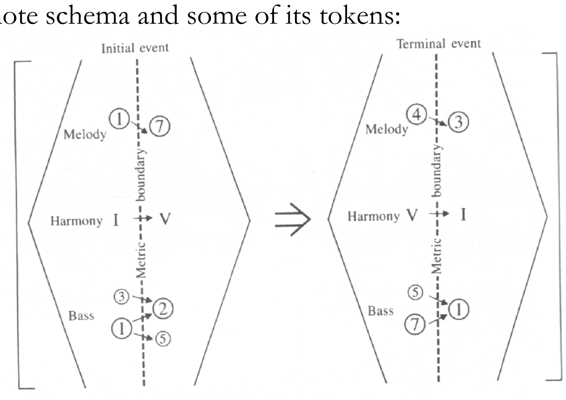
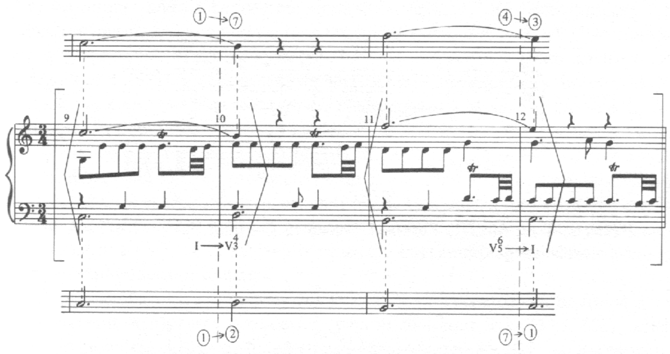
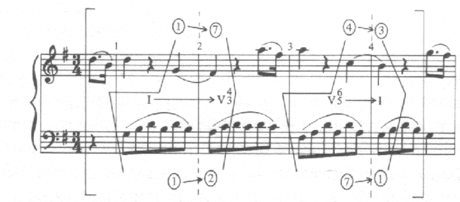



FIGURE 4-4. The 1–7…4–3 schema



EXAMPLE 4-11. Mozart, Symphony in A Major, KV 114 (1771), iii, Trio, meas. 9–12



EXAMPLE 4-12. Mozart, Keyboard Sonata in G Major, KV 283 (189h) (early 1775), i, Allegro, meas. 1–4

- **Empirical musicology:** Like some of the work by David Huron, Gjerdingen studies hundreds of pieces written from 1725-94 and notes the number of occurrences of the 1—7…4—3 changing-note schema. The graph below shows the rise and fall of this schema, which Gjerdingen argues is indicative of the rise and fall of the Galant style.

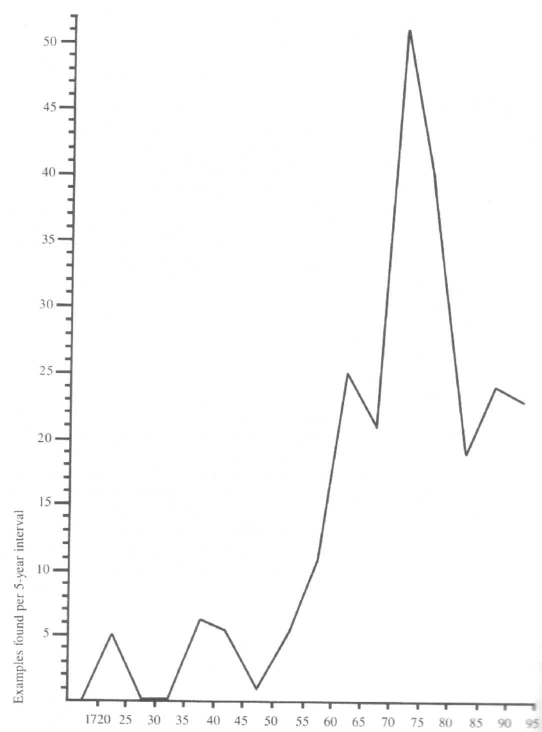
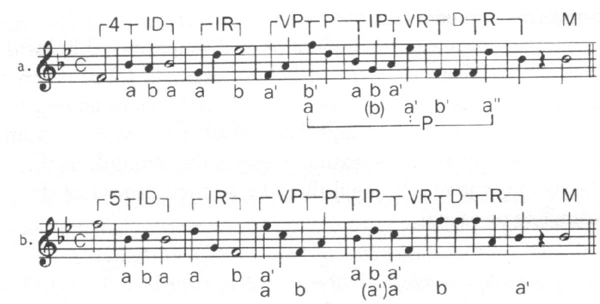



FIGURE 10-1. Population of 1–7…4–3 style structures, 1720–1794

❖ Eugene Narmour. 1990. *The Analysis and Cognition of Basic Melodic Structures: The Implication-Realization Model.* Chicago and London: The University of Chicago Press.

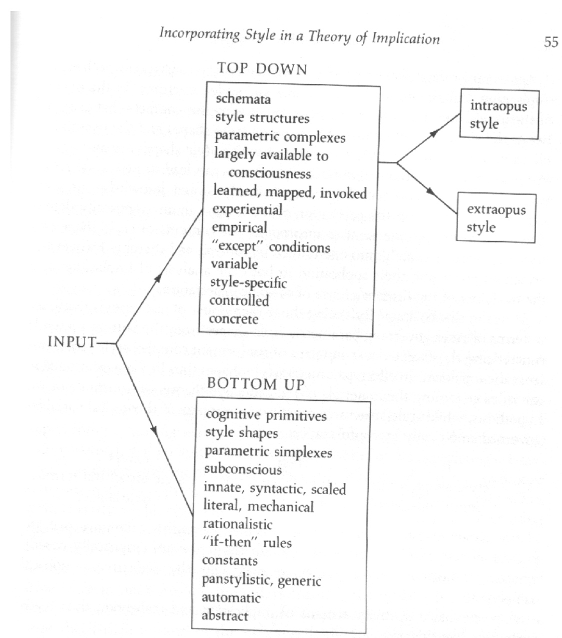
- This work seeks to describe the most basic aspects of melodic cognition. It is largely informed by the principles of *Gestalt* perception and the previous work of Leonard Meyer. It is primarily interested in how an idealized, experienced listener perceives note-to-note melodic processes that are relatively independent of style. The method is mostly descriptive and often invokes various schemas. For example:

    - **IP:** Small interval to similar small interval, different registral directions
    - **P:** Process of continuation
    - **VP:** Small interval to large interval, same registral direction
    - **ID:** Small interval to same small interval, different registral directions
    - **IR:** Large interval to small interval, same registral direction
    - **VR:** Large interval to even larger interval, different registral directions

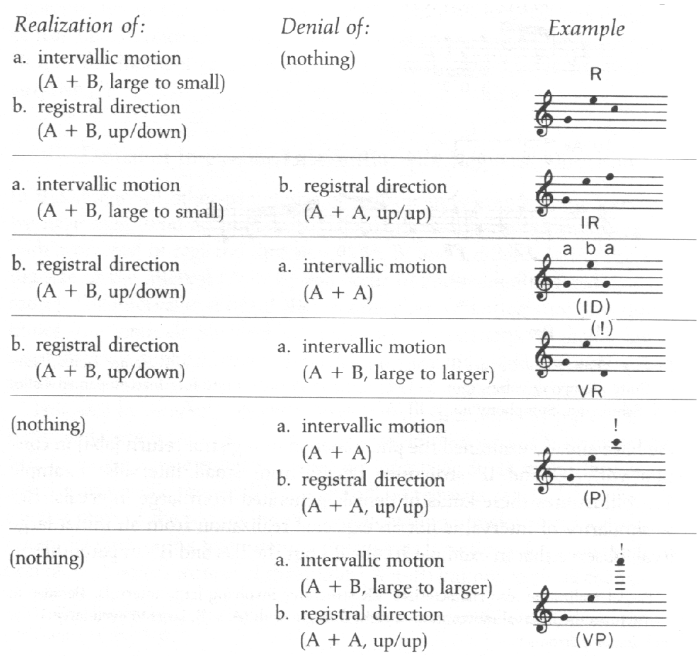


Ex. 1.1. a, Synthetic melody. b, A quasi-inversion of a.

- An integration of top-down and bottom-up approaches to cognition:



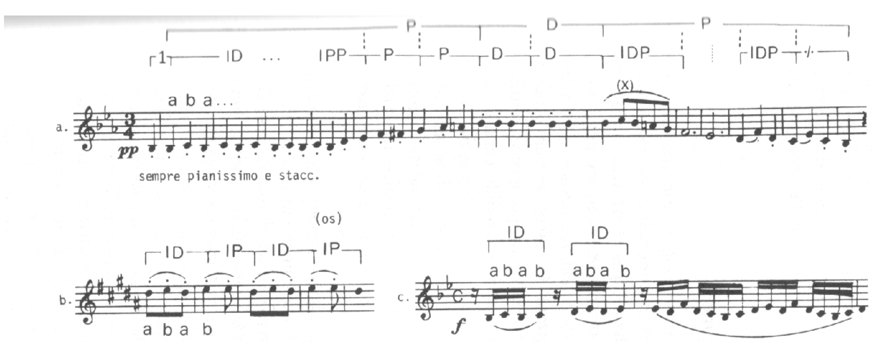
- A summary “of surprise felt on denial of reversal implication,” p. 198.



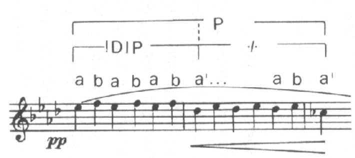
| Realization of: | Denial of: | Example |
|---|---|---|
| a. intervallic motion (A + B, large to small) b. registral direction (A + B, up/down) | (nothing) | R |
| a. intervallic motion (A + B, large to small) | b. registral direction (A + A, up/up) | IR |
| b. registral direction (A + B, up/down) | a. intervallic motion (A + A) | a b a (ID) |
| b. registral direction (A + B, up/down) | a. intervallic motion (A + B, large to larger) | (!) VR |
| (nothing) | a. intervallic motion (A + A) b. registral direction (A + A, up/up) | ! (P) |
| (nothing) | a. intervallic motion (A + B, large to larger) b. registral direction (A + A, up/up) | ! (VP) |

P (process), IP (intervallic process), VP (registral process), D (duplication), ID (intervallic duplication), R (reversal), IR (intervallic reversal), VR (registral reversal)

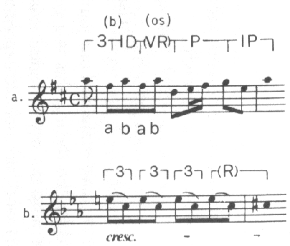
- Other examples:




Ex. 21.16. a, Beethoven, Symphony no. 3, III (Scherzo), mm. 1–13. b, Schubert, Sonata, D. 575, IV (Allegro giusto), mm. 173–76. c, Brahms, Variations on a Theme by Handel, Fugue (Moderato), beginning.




Ex. 21.17. Chopin, Étude, posthumous (Andantino), mm. 58–59.




Ex. 21.18. a, Bach, *Goldberg Variations*, no. 30, m. 9. b, Schubert, Sonata, D. 894, IV (Allegretto), m. 319.

## § 9.0 METAPHOR AND EMBODIMENT

### § 9.1 VIEWS FROM COGNITIVE SCIENCE

- George Lakoff and Mark Johnson. 1980. *Metaphors We Live By*. Chicago and London: University of Chicago Press.

  - This is a highly influential book that argues that metaphor is not just language, but is fundamental to the way we think and use language.

  - For our purposes, music theorists have often made use of **orientational metaphors**, or metaphors that structure abstract concepts in terms of embodied, spatial relationships.

- George Lakoff and Mark Johnson. 1999. *Philosophy in the Flesh: The Embodied Mind and Its Challenge to Western Thought.* New York: Basic Books.

  - This book argues that the fact that we have bodies in physical space greatly affects our capacity to reason. This book also claims the following:

    - Reason is not disembodied.
    - Reason is evolutionary.
    - Reason is not universal.
    - Reason is not completely conscious.
    - Reason is not purely literal.
    - Reason is not dispassionate.
    - There is no Cartesian dualistic person.
    - There is no Kantian radically autonomous person.
    - There is no person of maximum utility.
    - There is no phenomenological person.
    - There is no poststructuralist person.
    - There is no Fregean person as posed by analytic philosophy.
    - There is no computational person proposed by AI.
    - There is no Chomskyan person.

### § 9.2 VIEWS FROM MUSIC THEORY

- Janna Saslaw. 1996. "Forces, Containers, and Paths: The Role of Body-Derived Image Schemas in the Conceptualization of Music." *Journal of Music Theory* 40/2: 217-44.

  - "In this essay, I will outline a method of using theoretical statements to illuminate the cognitive organization underlying the theory. Specifically, I will focus on **image schemas**, which are abstract cognitive structures," p. 217.

  - "Mark Johnson defines an image schema as 'a recurring, dynamic pattern of our perceptual interactions and motor programs that gives coherence and structure to our experience…That is, image schemas are based on direct experience of a kinesthetic nature. They are embodied, particular to and arising from the human body," pp. 217-18.

- Examples of image schemas include:

    - Container
    - Center-periphery
    - Front-back
    - Part-whole
    - Link
    - Force
    - Path
    - Source-path-goal
    - Near-far

- The role of **metaphor:** "The domain in which we form image schemas is one that we experience directly, that is, physically. Lakoff and Johnson propose that, in order to structure domains that are not experienced directly, we map the kinesthetic image schemas just enumerated, along with propositional or ontological structures, onto these more abstract domains. The mappings take the form of metaphors," p. 220.

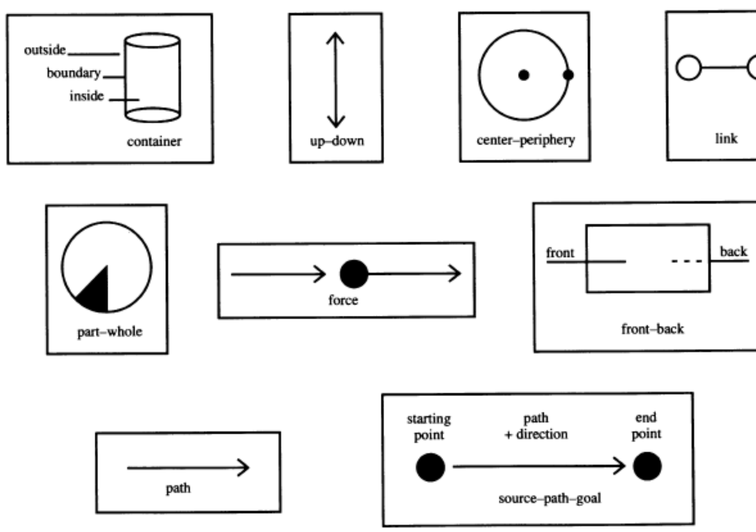



**Figure 1: Diagrams of Image Schemes**

- An example from Riemann:

    - "Riemann views harmonic progression in general as expansions of cadential formations, and he views modulation as a further expansion," p. 222.
    - Balance: "Riemann understood pitch relationships to be inversionally symmetrical," p. 223.
    - Riemann portrays secondary dominants as insertions into the container or the already expanded diatonic cadential progressions," p. 226.
    - "Riemann conceived of all progressions bounded by tonics as containers of different sizes," 227.

- ❖ Candace Brower. 2000. "A Cognitive Theory of Musical Meaning." *Journal of Music Theory* 44/2: 323-80.

    - Introduction: "Thinking consists, at least in part, of matching patterns of thought to patterns of experience…that much of our thinking consists of mapping patterns of bodily experience onto patterns of other domains," p. 323.

    - "According to the present theory, musical meaning arises more specifically through the mapping of heard patterns of a musical work onto three types of stored patterns," p. 324:

        - Intra-opus patterns: Patterns specific to the work itself.
        - Musical schemas: Patterns abstracted from musical convention.
        - Image schemas: Patterns abstracted from bodily experience.

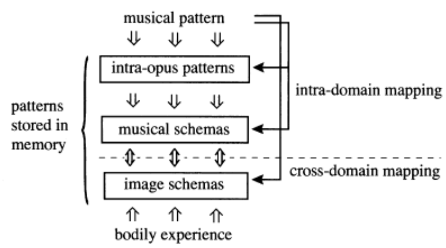


Figure 1. Musical pattern matching

    - "A central premise of the theory is that many tonal conventions are themselves grounded in bodily experience. That is, the image schemas that lend coherence to out bodily experience are metaphorically reflected in conventional patterns of melody, harmony, phrase structure, and form," p. 325.

    - Some examples of image schemas used:

        - Container
        - Center-periphery
        - Cycle
        - Verticality
        - Balance
        - Source-path-goal

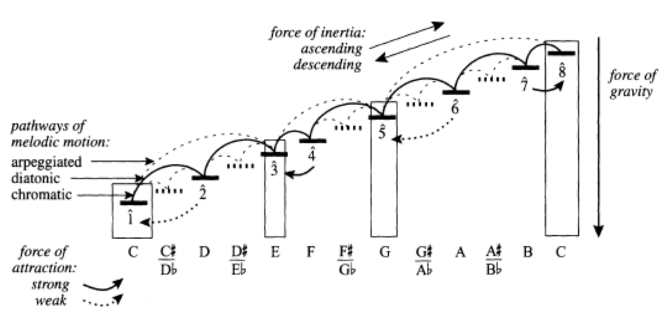


Figure 10. Melodic paths, forces, and stable goals in a major key

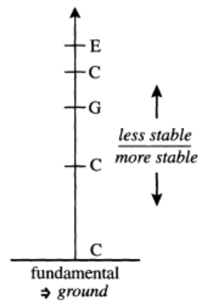



Figure 11. OVERTONE-VERTICALITY schema

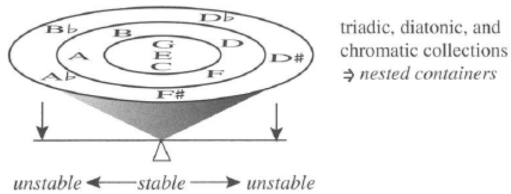



Figure 12. NESTED CONTAINER/CENTER-PERIPHERY schema

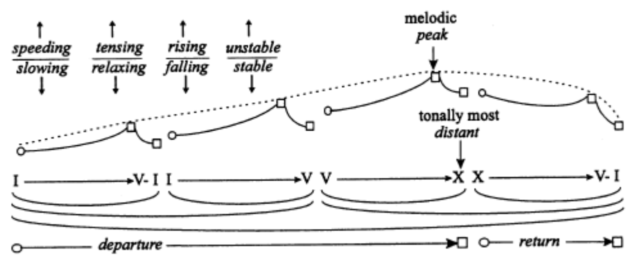



Figure 27. Schema for phrase structure

- Brower then analyzes Schubert's "Du bist die Ruh" based on these principles.

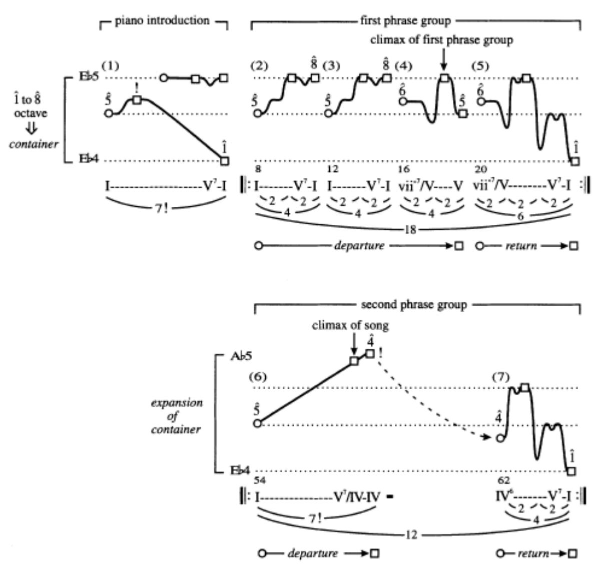



Figure 32. Phrase structure of Schubert's "Du bist die Ruh'"
(piano interludes and postlude omitted)

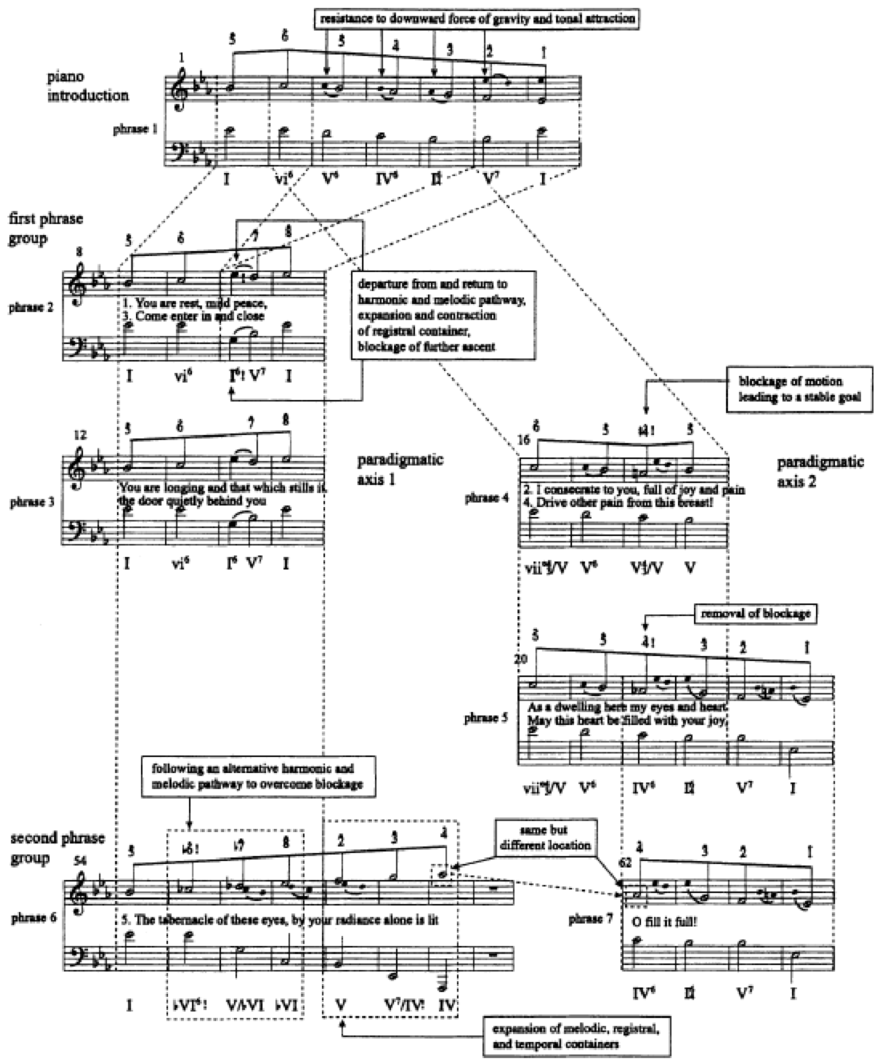



Figure 33. Paradigmatic analysis of "Du bist die Ruh'"

❖ Lawrence Zbikowski. 2002. *Conceptualizing Music: Cognitive Structure, Theory, and Analysis.* Oxford and New York: Oxford University Press.

- "**Cross-domain mapping** plays two important roles in musical understanding: first, it provides a way to connect musical concepts with concepts from other domains, including those associated with language; second, it provides a way to ground our descriptions of elusive musical phenomena in concepts derived from everyday experience," p. 64.

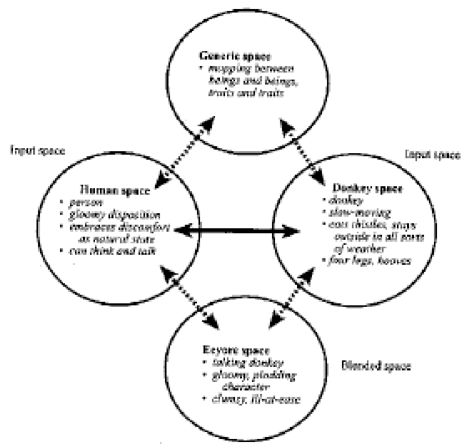



FIGURE 2.2 Conceptual integration network (CIN) for the anthropomorphic blend used for A. A. Milne's Eeyore

- "By definition, **image schemata** are pre-conceptual: they are not concepts, but they provide the fundamental structure upon which concepts are based…The "up" and "down" of musical pitch thus correlate with the spatial "up" and "down"—the vertical orientation—of our bodies," p. 69.

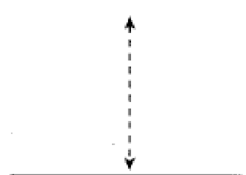


FIGURE 2.1 Diagram of the VERTICALITY schema

- "The cross-domain mappings employed by any theory of music are thus more than simple curiosities—they are actually key to understanding music as a rich cultural product that both constructs and is constructed by cultural experience," p. 72.

- An example of conceptual blending in the case of text setting:

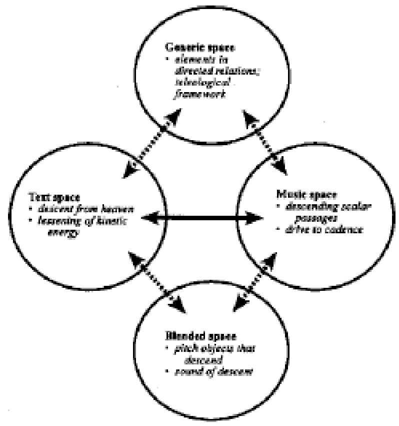



FIGURE 2.4 CIN for Palestrina's text painting

- "It is important to emphasize that not all combinations of text and music will yield rewarding conceptual blends. For a blend to occur, there not only needs to be some correlation between the two domains, but the domains must also have a uniform topography," p. 88.

❖ Joseph Straus. 2006. "Normalizing the Abnormal: Disability in Music and Music Theory." *Journal of the American Musicological Society* 59/1: 113-84.

- "The nature of disability, the kinds of conditions that are considered disabling, and the meanings attached to disability all vary with time and place. To a significant extent, disability is socially and culturally constructed rather than given: it has a history," p. 113.

- "Around the turn of the nineteenth century, disability began to be understood instead as a deviation from a normative standard, neither natural nor permanent, and thus subject to possible remediation. At the same time, Western art music also underwent a significant shift (reflected in the more recent theoretical traditions that have grown up around it), one that involved an increasing interest in rhetorically marked deviations from diatonic and formal normativity, and the possibility of their narrative recuperation," p. 114.

- Critique of embodiment theory: "In all of the experientialist literature, however, including its recent music-theoretical manifestations, there has been the blithe assumption that we all inhabit the same kind of body, a normatively abled body, and thus all experience our bodies in pretty much the same way," p. 123.

- Three case studies:

    - *Formenlehre* tradition: Deviations from formal norms are often viewed as abnormalities or deformations (cf. Caplin or Hepokoski and Darcy).
    - Schoenberg's organicism: The "tonal problem" introduces imbalance into a tonal work which must be corrected; balance must be restored.
    - Beethoven, Symphony No. 3: "*Eroica* reception identifies Beethoven as the hero and his deafness as the obstacle to be overcome," p. 157. (Also note the C#/Db "tonal problem" in the first movement.)

## § 10.0 GENDER AND SEXUALITY

*By Andrew Pau*

- Susan McClary. 1991. *Feminine Endings: Music, Gender, and Sexuality*. Oxford and Minnesota: University of Minnesota Press.

  - A feminist study of five topics:

    - Musical constructions of gender and sexuality (e.g., conventions of "masculinity" and "femininity" in opera).
    - Gendered aspects of traditional music theory (e.g., notion of "masculine" and "feminine" phrase endings).
    - Gender and sexuality in musical narrative (e.g., Marx's description of themes in sonata form).
    - Music as a gendered discourse (e.g., how scholars deal with the fact that musicians and music are gendered "feminine" in Western culture).
    - Discursive strategies of women musicians (e.g., women composers, performers, etc.).

  - Sexual politics in classical music:

    - *Carmen*: Contrast between Carmen and Don José:

      - Carmen's music is marked by strong rhythm (i.e., celebration of the body/eroticism), as well as chromatic excess, marking her as the Other.
      - José's musical discourse is that of a "bourgeois visionary" marked by lofty sentiment and indefinite postponement of gratification. McClary notes the "ejaculatory quality of many so-called transcendental moments."

    - Tchaikovsky's 4th Symphony as the narrative of a homosexual male:

      - Principal theme (which should be masculine) is "appoggiatura-laden, limping, hypersensitive, vulnerable, indecisive."
      - Second theme is "sultry, seductive, slinky."
      - The [closeted] hero has to come to his senses, pulls himself from this drugged state, and emerges with a triumphal theme to finish the exposition.

- Fred Everett Maus. 1993. "Masculine Discourse in Music Theory." *Perspectives of New Music* 31/2: 264-293.

  - **Question:** How might a male writer – specifically, a present-day North American male music theorist – exhibit his gender in writing about music?

    - Positive claims of a theorist might reflect the writer's masculinity, or aspiration to masculinity.
    - More importantly, omissions (things that are not said or not permitted to be said) reflect a desire to avoid discourse that might seem unmanly.

- According to Maus, "the distanced, technical, non-experiential modes" that prevail in theoretical discourse (influenced by Babbitt's logical empiricism) fit comfortably with a "masculine self-image" that male theorists want to project to themselves and their readers.

- Maus acknowledges that his argument depends on certain generalizations and stereotypes; however, his claims do not require that these stereotypes actually be true, only that people behave as if they were.

    - Men: More likely to cultivate and value quantitative, impersonal, rule-bound, competitive thought.
    - Women: More likely to think in qualitative, personal, empathetic, improvisatory, collaborative ways.

- Alternative approaches to music theory—e.g., contextual, phenomenological, literary—have been unfairly marginalized.

- The dualities identified by John Rahn in a 1980 essay on analytical modes can be gendered male or female:

    - Digital [science-based] vs. analog [humanities-based]
    - Out-of-time vs. in-time
    - Concept-driven [top-down] vs. data-driven [bottom-up]
    - Theory-of-piece [impersonal] vs. theory-of-experience [personal]

- Listening is a sensuous and sexualized activity, and male theorists are uncomfortable with the feminine (i.e., passive and receptive) role of listener.

    - "When I listen, it's sort of like the piece is fucking me! Yikes! I'm not going to write about *that*!"

❖ Suzanne Cusick. 1994. "Feminist Theory, Music Theory, and the Mind/Body Problem." *Perspectives of New Music* 32/1: 8-27

- Feminist theory borrowed from literature and art may take us to intellectually interesting, but ultimately unmusical places.

- One way around this problem may be to focus on the relation of gender codes to musical performance.

- Gender results from the repetition of acts (performances) that constitute identities (cf. Judith Butler).

- Cusick argues that composition (as an activity of the mind) is gendered male, while performance (as an activity of the body) is gendered female.

- A feminist music theory must include theorizing about (and analyzing) the practices of bodies (real ones) in addition to the practices of minds, and examine how people deal with the metaphorically feminine act of performance.

- Marion Guck. 1994. "A Woman's (Theoretical) Work." *Perspectives of New Music* 32/1: 28-43

    - Using Rahn's terms (see Maus above), Guck sees her own work as gendered feminine: analog, in-time, data-driven, theory-of-experience. She examines some conflicts that her approach has created in her professional career.

    - "Authorized speech" about music does not endorse recognition of personal musical experience: it is viewed as childish, womanish or naïve. Guck, on the other hand, insists that accounts of musical works should acknowledge the relationship between piece and perceiver: the analyst can only be held personally responsible if his/her location and perspective are made clear.

    - As a professional music theorist, Guck feels an internal conflict between "masculine-gendered intellectual standards and feminine-gendered emotional awareness."

    - Even though it is unusual in music theory to speak about personal experience, a presentation or a paper is inherently personal, however one tries to downplay it.

- Susan McClary. 1994. "Constructions of Subjectivity in Schubert's Music." In *Queering the Pitch: The New Gay and Lesbian Musicology*. Philip Brett, Elizabeth Wood, and Gary C. Thomas, eds., pp. 205-33.

    - Second movement of "Unfinished" Symphony: First theme drifts through various keys, inviting us to "experience – and even *enjoy* – a flexible sense of self."

    - Second theme has stable tonal center: "A kind of prison from which subjectivity cannot escape," until recapitulation is reached.

    - Schubert's disdain of goal-oriented desire *per se* for the sake of pleasure, and an open, flexible sense of self is "alien to the constructions of masculinity."

        - In this, Schubert's movement resembles uncannily some of the narrative structures that gay writers and critics are exploring today.
        - This does not mean Schubert was gay, but it explains why many people think he was or might have been.

- Philip Brett. 1997. "Piano Four-Hands: Schubert and the Performance of Gay Male Desire." *Nineteenth-Century Music* 21/2: 149-176

    - Brett takes issue with scholars who, according to him, exhibit fear/loathing/anxiety about critical engagement with a "homosexual" Schubert (among them, James Webster and Kofi Agawu).

    - The discipline of musicology/music theory is "un-pluralistic" and "monotheistic" and not a happy place for a gay musical scholar.

    - Schubert's piano duets were written for an "essentially domestic" (New Grove) space (i.e., the traditional sphere of the feminine [and by extension the homosexual?]).

- When the players are (gay) male, piano duets become a focus of displaced sexual energy: *primo* and *secondo* = top and bottom.

- Brett describes in great length the emotional experience of playing through the Grand Duo with a (musical) partner: "on supersensitive days, our *pianissimo* rubato here has been *breathtaking*" (italics his).

- To endorse a personal approach to analysis and performance is to "take a stand against the authoritative (and authoritarian)."

❖ Marianne Kielian-Gilbert. 1999. "On Rebecca Clarke's Sonata for Viola and Piano: Feminine Spaces and Metaphors of Reading." In *Audible Traces: Gender, Identity, and Music,* Elaine Barkin and Lydia Hamessley, eds., pp. 71-114.

- An allegorical account of the piece that "explores some of the signifying practices of subjectivity in relation to the contradictions of feminine/female experience and women's lives, acknowledging the dream and passion of alternatives."

- "To theorize musical identity as interactive or conflicting relations of historically situated persons, subject-themes and -producers, and embodied listener(s) is to enable an alternative dynamics of musical relationship from the standpoints of women's lives and the positions of 'other.'"

- K-G's analysis uses metaphorical processes that are connected to musical processes:

    - Theme group 1: Poppies (a reference to Sylvia Plath)
    - Theme group 2: A performer's presence
    - Development and return: A daughter's patchwork

- Multiple meanings come into relationship through a "conversation" of voices: Rebecca Clarke, her contemporaries, feminist writers, K-G's relationship and understanding of the composer as contemporary.

❖ Ellie Hisama. 2001. *Gendering Musical Modernism: The Music of Ruth Crawford, Marion Bauer, and Miriam Gideon.* Cambridge and New York: Cambridge University Press.

- Feminism and formalism are not necessarily irreconcilably opposed.

- Ian Bent's foreword: Hisama's book offers a critique of the place of women in musical modernism (e.g., the male-dominated world of Schoenberg, Stravinsky, Webern, Bartók).

- Hisama uses methods of analysis designed specially for the music concerned: When such a "close reading" recognizes and takes into account the impact of the composer's gender and political views, it can offer us valuable ways to hear and apprehend that work.

- "The Politics of Contour in Crawford's 'Chinaman, Laundryman'"

  - "Chinaman, Laundryman" (1932) is a song that "grapples with the capitalist exploitation of an immigrant Chinese laundry worker."
  - The structure of the composition comments on ways the laundry worker's race and gender shape his existence.
  - Through her use of musical register, Crawford depicts a transformation in the relationship between the two figures in the poem, one in which the launderer emerges from being dominated by the boss to becoming independent and self-affirming.
  - Hisama analyzes the contour profile of the piano's figuration in each measure. Pitches are generated by strict rotation of a nine-note pattern, so compositional choices mainly involve register.
  - Greatest deviations from the prototype of the opening section correspond to sections in the text where the laundryman increasingly stands up to, and resists, the boss.
  - Piano has a dual function: represents the labor system being splintered; also prompts the launderer to take a more active role in changing his situation; once this is achieved, piano reverts to original contour in the final section.
  - The vocal line is always beneath or between the staves of the piano part; launderer's inability to improve his working conditions is symbolized by his lack of pitch mobility.
  - Connection to gender: Low and high registers traditionally signify male and female identities (David Lewin).
  - Use of mezzo-soprano voice in the song signifies (i) laundry as women's work, (ii) Asian men as more stereotypically feminine than white men.

- "Gender, Sexuality, and Performance in Marion Bauer's Toccata"

  - Was Bauer a lesbian? A former colleague states that "Marion Bauer . . . did not have any romantic relationships with men, and moreover [the colleague believes that] she was not interested in them."
  - Hisama's analysis explores the relationships between music and gender that exist within the dimension of performance.
  - In the Toccata, because of the position of the hands, the question of "who's on top" motivates the entire composition [cf. Maus; Suzanne Cusick's "On a Lesbian Relation with Music"].
  - Hands pursue each other. Power is not wielded by one party as a means to control the other party; rather, the playful "continuous circulation of power" may be heard as expressive of a relationship between women.
  - To illustrate her thesis, Hisama uses an analytical method based on contour segments: contour positions are assigned to fingers that play various notes in dyads/triads.

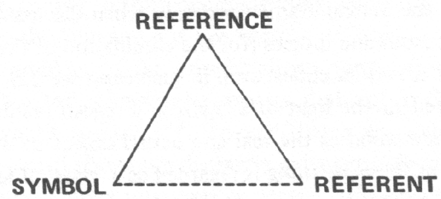
## § 11.0 SEMIOTICS

### § 11.1 PRELIMINARIES

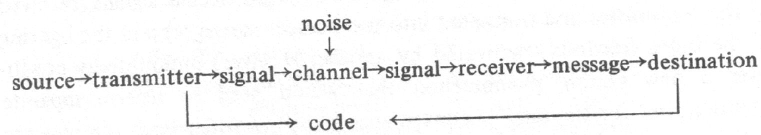
- Umberto Eco. 1979. *A Theory of Semiotics*. Bloomington: Indiana University Press.

  - "A design for a general semiotics should consider: (a) a *theory of codes* and (b) a *theory of sign production*…This discussion will allow me to posit a distinction between 'signification' and 'communication': in principle, a semiotics of signification entails a theory of codes, while a semiotics of communication entails a theory of sign production," pp. 3-4.

  - The tripartite form of semiosis:




  - The communication model:




### § 11.2 LINGUISTICS

- Raymond Monelle. 1992. *Linguistics and Semiotics in Music*. Chur, Switzerland and Philadelphia: Harwood Academic Publishers.

  - "The present book is intended…to introduce the educated musician to the whole field of semiotics," p. xiii.

  - "Semiotics is the theory of signs," p. 1.

  - "Much of the writing on musical signification is vitiated by a naïve view of meaning, the *referential* or *denotative*," p. 13.

  - Saussure:

    - Diachronic vs. synchronic views of language
    - Syntagmatic (e.g., a word's meaning in relation to, or in context of, other words) vs. paradigmatic (a word's denotative meaning) view of structure.

  - Music at the neutral or **immanent level** (after Nattiez): Something akin to the purely structural or formal attributes of structure (e.g., Nattiez's motivic analysis of Varèse's *Density 21.5*) vs. music at the **poietic level** (after Gilson) where music is viewed as a cultural artifact that was the result of human production.

- C.S. Peirce's trichotomies:

    - **Firstness:** "The area of pure possibility. Before we can perceive a man, it is necessary that such things as men may exist, and that is possible to perceive them," p. 194.
    - **Secondness:** "The most obviously 'real' plane, is the area of 'happening-to-be;' not only is it possible that a man may exist, but there happens to be a man before me now and I perceive him. 'The real is that which insists upon forcing its way to recognition as something other than the mind's creation.' This is the level of 'experience'," p. 194
    - **Thirdness:** The area of purpose, intention, relation, will, understanding, cognition. When I see that the man is a porter, that he intends to give me a message, that his arrival may interrupt my work or raise my spirits, I enter the domain of Thirdness," p. 194.

❖ Robert S. Hatten. 1994. *Musical Meaning in Beethoven: Markedness, Correlation, and Interpretation.* Bloomington: Indiana University Press.

- **Question:** "How does one draw upon that stylistic competency to reconstruct historically appropriate interpretations," p. 1?

- This study is largely concept-driven:

    - **Abnegation:** Willed resignation as spiritual acceptance of a (tragic) situation that leads to a positive inner state, implying transcendence.
    - **Association:** Any motivated relationship. Correlations and interpretations are particular kinds of association.
    - **Change:** For music, the consequence of extensive growth (regardless of its motivation or source) that can no longer be accommodated by the hierarchy of principles or constraints of a style, often (in Western style theory) resulting in a reformulation of the hierarchy through change in one or more of its guiding principles.
    - **Competency:** In terms of music, the internalized (possibly tacit) cognitive ability of a listener to understand and apply stylistic principles, constraints, types, correlations, and strategies of interpretation to the understanding of musical works in that style. More than a lexicon of types or a set of rules.
    - **Constraint:** A limit on the possibilities of sound and meaning in music, either psychological (affordant), stylistic (emergent), or historical (resulting from a particular historical time, its technology, aesthetics, ideologies, etc.).
    - **Correlation:** Stylistic association between sound and meaning in music; structured (kept coherent) by oppositions, and mediated by markedness.
    - **Decoding:** Identification or recognition of correlations whose understanding is so habitual as to appear automatic or transparent.
    - **Diagrammatic:** Peirce's term for isomorphism of structure, involving a mapping of corresponding parts regardless of different shapes, forms, domains, etc.
    - **Emergent:** Cognitive (learned) competencies (stylistic and strategic) that go beyond the predictions or expectancies of psychological affordances. In music, a cadence that is not given strong textural articulation may not create segmentation for a listener relying solely on *Gestalt* cues.
    - **Encoding:** Term for the process by which a musical entity, its markedness, and its correlation become a systemic part of the style, creating a stylistic type.

- **Expressive genre:** Category of musical works based on their implementation of a change-of-state schema (tragic-to-triumphant, tragic-to-transcendent) or their organization of expressive states in terms of an overarching topical field (pastoral, tragic).
- **Hermeneutic:** Originating with methods interpreting the Bible, and long a part of literary criticism; appropriated in this century by Kretschmar (1902) for musical expressive meaning. Here, the term refers to an interpretive approach to any meaning that goes beyond the purely structural or "syntactic" (implicational, functional), drawing on evidence from any relevant source to (abductively) reconstruct (stylistically guided) strategic interpretations.
- **Iconic:** Motivation for association based on similarity, whether of properties or of structure. The latter, structural variety may also be termed isomorphic or diagrammatic.
- **Indexical:** Motivation or association based on a dynamic relationship between two entities, whether by contiguity, synecdoche, cause-and-effect, stimulus-reaction, deixis (pointing), or ostension ("showing" of a token to convey its type).
- **Intertextuality:** As defined for music (Hatten, 1985) the use of (parts of) earlier styles (pastiche or parody) or identifiable (allusions to) works from the home style or earlier styles to enhance the discourse of a musical work.
- **Irony:** For music, the bracketing, reversal, or negation of some portion of a musical discourse, so as to undercut its sincerity, and suggest its intentional extravagance.
- **Markedness:** The asymmetrical valuation of opposition (in musical structure, language, culture). For musical meaning, markedness of structural oppositions correlates with markedness of (expressive or other) oppositions among cultural units. Marked entities have a greater (relative) specificity of meaning than do unmarked entities. Marked entities also have a narrower distribution, which means they tend to occur in fewer contexts, and thus (usually) less often than their unmarked opposites. Stylistic meaning in music is systematically secured by correlations of oppositions between musical structures and cultural units, as mediated by markedness values.
- **Romantic irony:** Reflexivity of discourse, especially implying an author (persona) projecting above the discourse in order to comment critically upon it. Often cued by drastic shifts (especially of style or topic, and especially late in a work where there is less chance of thematic working out or rationalization) or by the recitative topic.
- **Signifier/signified** [Saussure: *signifiant/signifié*]: Components of the sign, akin to vehicle/content. For Saussure, the relationship between signifier and signified in language is arbitrary, and signifiers articulate a differential or oppositional field of meaning ("meaning is difference"). The dyadic model of signification lacks the crucial *interpretant*, or interpretive mediation between (in music) sound and meaning, as in Peirce's triadic model.
- **Style:** For music, that competency in semiosis presupposed by a work, and necessary for its understanding as a work of music. Competency in interpretation implies an understanding of correlations, and is guided by a hierarchy of principles (ensuring flexibility) and constraints (ensuring coherence).
- **Token:** A physical manifestation (either in sound or notation) of a stylistic type.

- o **Topic:** A complex musical correlation originating in a kind of music (fanfare, march, various dances, learned style, etc.; Ratner, 1980), used as a part of a larger work. Topics may acquire expressive correlations in Classical style, and they may be further interpreted expressively.
- o **Topical field:** Larger areas such as the tragic, the pastoral, the heroic, and the *buffa* that are supported by topical oppositions.
- o **Trope:** Figurative meaning in music. Troping involves a species of creative growth that goes beyond the typical articulation of established types and their implied hierarchy. Troping akin to metaphor occurs when two different, formally unrelated types are brought together in the same functional location so as to spark an interpretation based on their interaction.
- o **Type:** A generalized category or concept. Types can tolerate a range of variation in their manifestation (as tokens) without losing their identity.

▪ **Theory**

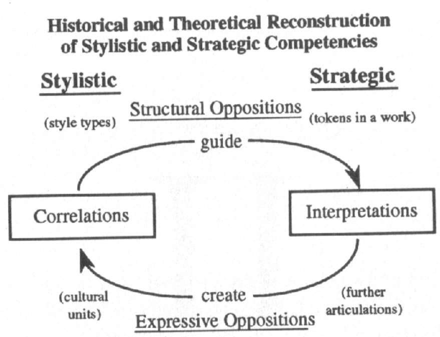



Figure 2.1. Basic model of the interaction between stylistic correlations and strategic interpretations, with respect to expressive meaning in music.

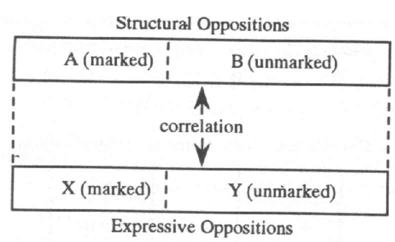



Figure 2.2. Markedness as the asymmetrical organizational structure underlying correlations between structural and expressive oppositions.

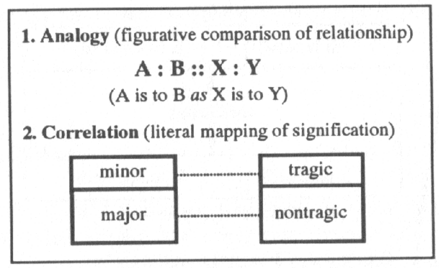



Figure 2.3. How correlation differs from analogy.

| Spirit \ Form | Lyric | Narrative | Drama |
|---|---|---|---|
| **Lyrical** | Lyrical lyric: Goethe's "Wanderer's Nachtlied" | Lyrical narrative: Byron's "Don Juan" | Lyrical drama: Shakespeare's "The Tempest" |
| **Epic** | Epic (narrative) lyric: "Ballad of Sir Patrick Spence" | Epic narrative: "Iliad" | Epic drama: Shelley's "Prometheus Unbound" |
| **Dramatic** | Dramatic lyric: R. Browning's dramatic monologues | Dramatic epic: Dickens' A Tale of Two Cities | Dramatic drama: Molière's plays, many of Shakespeare's plays |

Figure 3.1. Matrix of literary character and class (adapted from Guérard [1940: 197ff.] and Hernadi [1972: 58]).

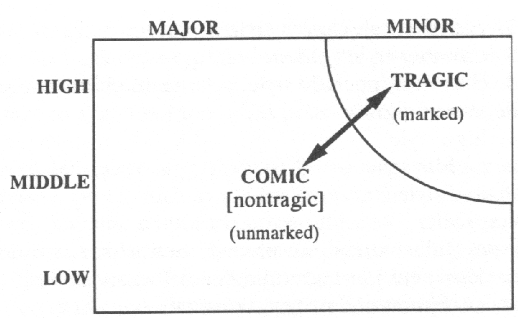



Figure 3.2. Expressive oppositional field as defined by a matrix of structural oppositions for the classical style.

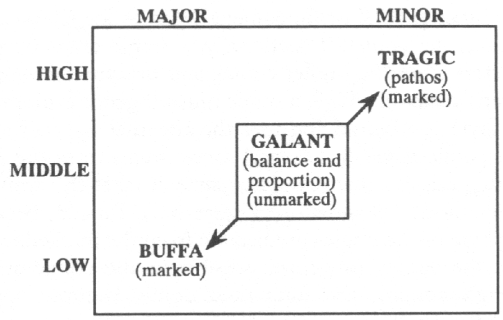



Figure 3.3. Galant as the unmarked mean between expressive extremes.

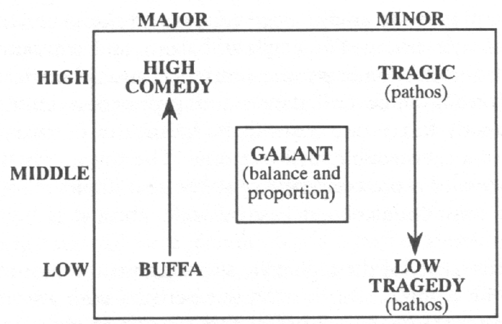



Figure 3.4. Effect of contextual revaluation (shift in "stylistic register").

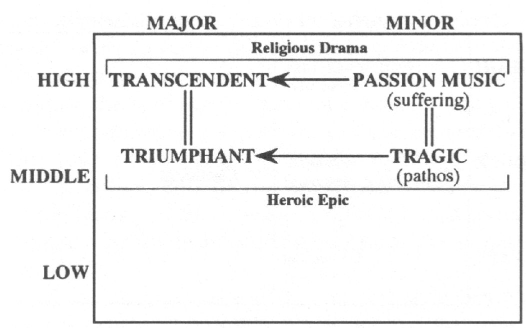



Figure 3.5. Archetypal expressive genres and their relative stylistic registers.

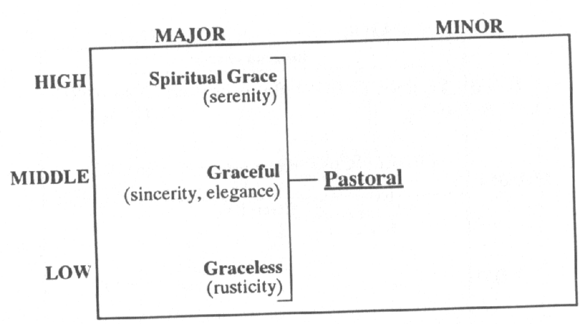



Figure 3.6. The pastoral as interpreted in high, middle, and low styles.

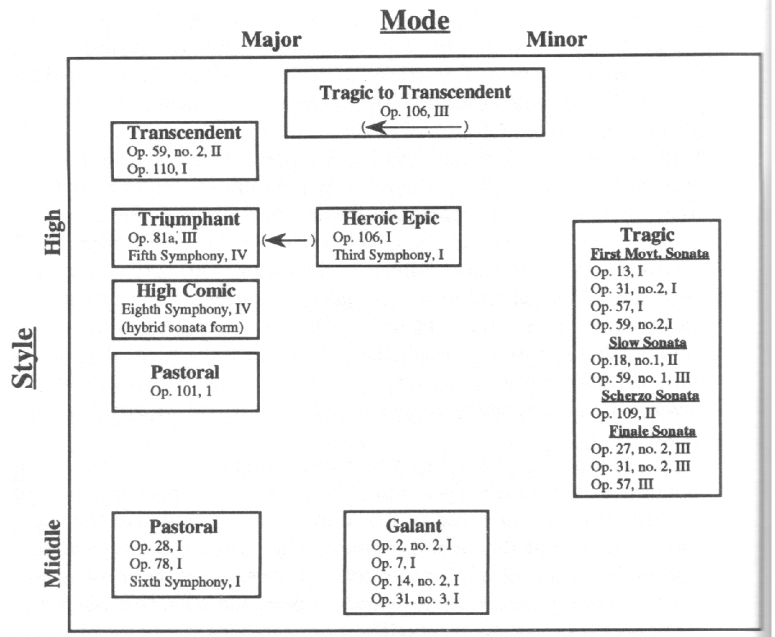



Figure 3.7. Placement of Beethoven sonata-form movements according to expressive genres and styles.

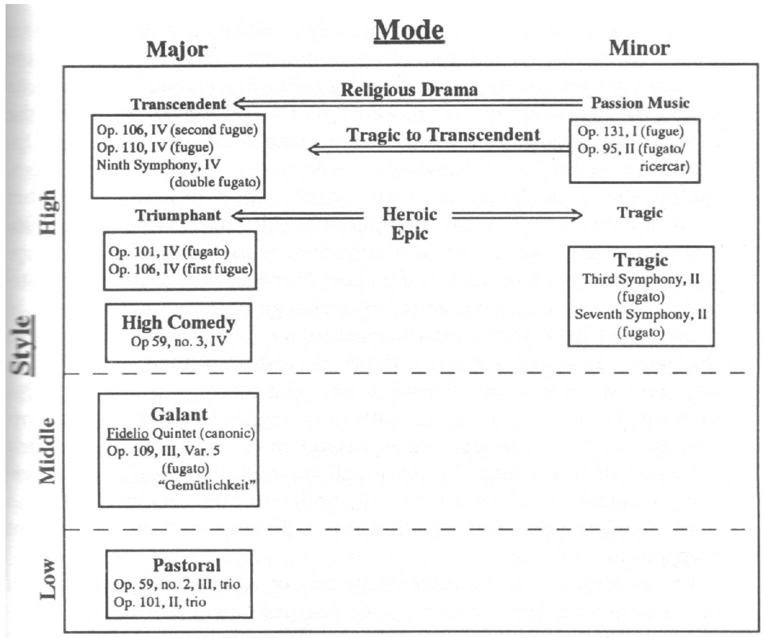
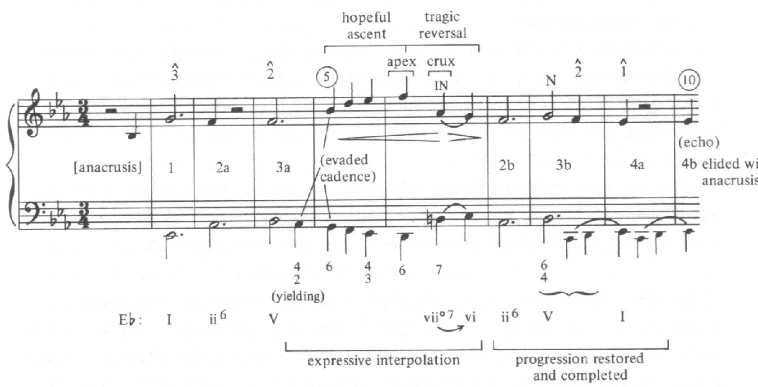


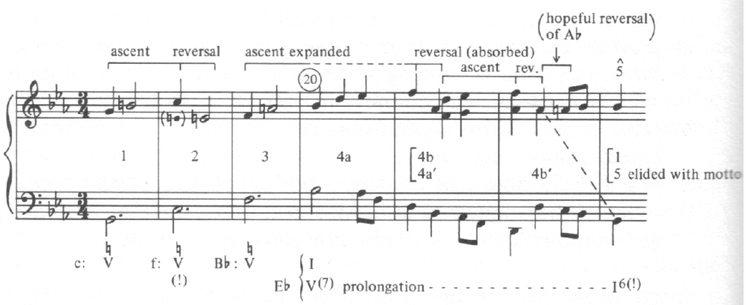

Figure 3.8. Placement of Beethoven fugal or contrapuntal movements or sections according to expressive genres.

- **Analysis**

Example 8.3. Anaylsis of the *Cavatina* opening theme, mm. 1–10, showing expressive focal points in the context of phrase-structural analysis and quasi-Schenkerian outer-voice reduction.




Example 8.4. Reductive analysis of the *Cavatina* transition, mm. 17–22, showing development of the crucial ascent-reversal idea from mm. 5–6.




- **Semiotics: C.S. Peirce**

| Saussure (dyadic) | Peirce (triadic) | Applied to Music |
|---|---|---|
| 1. signifier ⟶ | 1. sign vehicle | = musical entity |
| 2. signified ⟶ | 2. designatum | = correlation (cultural unit) |
| | 3. interpretant | = interpretation |
| | ground | = interpretive competencies of both <u>style</u> and <u>strategy</u> |

Figure 9.1. Categories of semiosis.

| Saussure | Peirce | Applied to Music various <u>motivations</u> from such relations as: |
|---|---|---|
| | iconic ⟶ | similarity/analogy (icon) |
| | indexical ⟶ | contiguity/part-to-whole (index) |
| arbitrary ⟶ | symbolic ⟶ | conventional (symbol) |

Figure 9.2. Potential relations motivating semiosis.

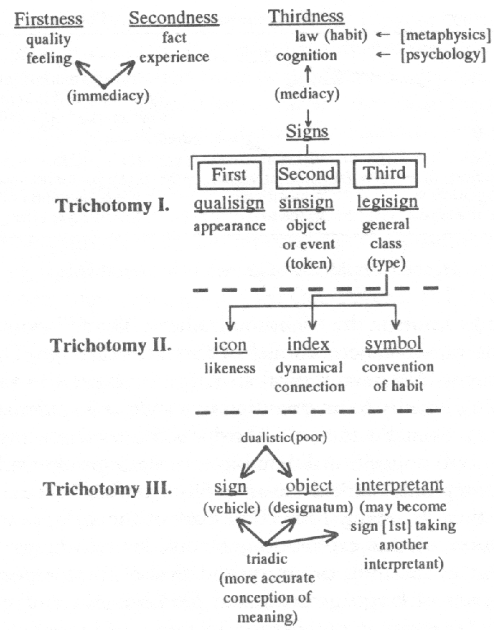



Figure 10.2. C. S. Peirce's categories and some trichotomies.

❖ Eero Tarasti. 1994. *A Theory of Musical Semiotics*. Bloomington: Indiana University Press.

- It is terribly difficult to make sense of this work, much less summarize it. A better title might have been *In Search of A Theory of Semiotics*. It is mainly important to know the concerns of Tarasti:

    - The problem of narrative in music
    - Conceptions of musical space
    - Conceptions of musical time
    - Agency, performance and gesture

❖ Michael Klein. 2004. "Chopin's Fourth Ballade as Musical Narrative." *Music Theory Spectrum* 26/1: 23-55.

- **Abstract:** This article argues a perspective of musical narrative as an emplotment of expressive states rather than a sequence of actors and their actions, and offers a narrative analysis of Chopin's Fourth Ballade. The analysis braces both hermeneutic and semiotic concerns by examining what this music means and how it signifies that meaning, and proposes a reading of the Fourth Ballade that situates it intertextually.

    I begin with a discussion of mimetic and diegetic properties of music and consider ways in which Chopin's ballades signify time, particularly the past tense often deemed crucial to narrative forms. I then expand Edward T. Cone's notion of apotheosis, showing how Chopin's larger works depend upon an emotionally transformed recapitulation of an anterior theme that often represents a desired emotional state. After applying these theories of apotheosis and temporality to the Fourth Ballade, I conclude with a discussion of pastoral literary narratives and the ways they elucidate the expressive logic of this work.

## § 11.3 TOPICS

- ❖ V. Kofi Agawu. 1990. *Playing with Signs: A Semiotic Interpretation of Classical Music.* Princeton: Princeton University Press.

    - Agawu's theory is limited to Western classical music from 1770-1830; the usual suspects are present: Haydn, Mozart and Beethoven. Agawu further limits himself to instrumental music.

    - Agawu's goal is not to learn what music means, but *how* it accrues that meaning in the first place.

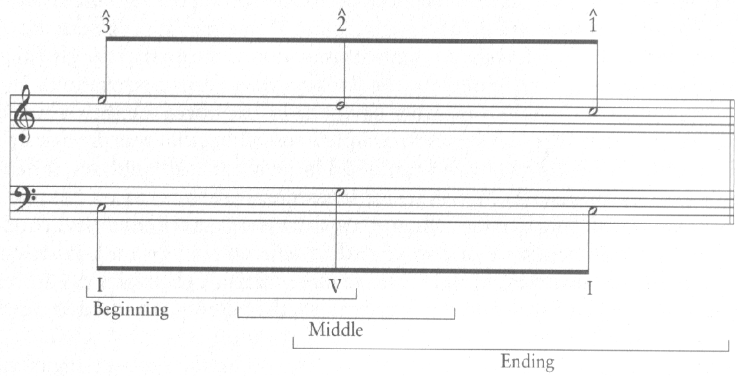
    - **Topics** (cf. Ratner, *Classic Music*, 1980): "The expressive aspects of any piece of Classic music, M, may be described with respect to a set of topics, T, which are subjects of musical discourse…A topic, T, may be defined as a musical sign. Each T embodies the union of signifier and a verbally mediated signified. Signifiers are purely musical dimensions such as texture, timbre, rhythm, melody, and harmony *in a particular disposition*; the latter caveat means that references to "static" Ts (Such as *Sturm und Drang*) or to "dynamic" procedures (such as imitation) are admitted without discrimination into the domain of signifiers…it is proposed that, within the domain of expression, signifiers [i.e., topics] be regarded as the most meaningful small-scale elements that define a particular relationship," pp. 128-29.

1. alla breve
2. alla zoppa
3. amoroso
4. aria
5. bourrée
6. brilliant style
7. cadenza
8. sensibility (Empfindsamkeit)
9. fanfare
10. fantasy
11. French overture
12. gavotte
13. hunt style
14. learned style
15. Mannheim rocket
16. march
17. minuet
18. musette
19. ombra
20. opera buffa
21. pastoral
22. recitative
23. sarabande
24. sigh motif (Seufzer)
25. singing style
26. Sturm und Drang
27. Turkish music

Figure 2. The Universe of Topic

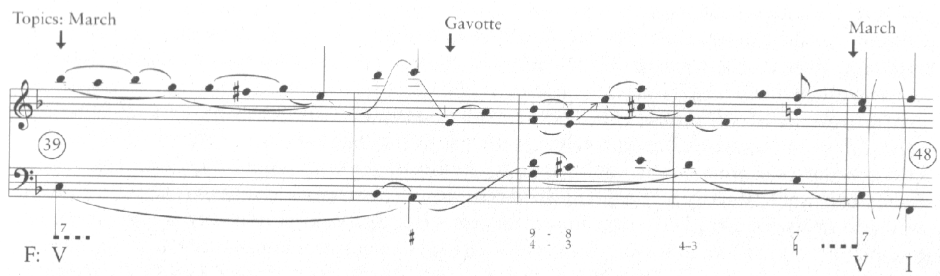
- **Interpretation**

    - **Plot:** "Plot denotes something like a secret agenda, a coherent verbal narrative that is stimulated by both types of T and the nature of their disposition in M. A confrontation between high and low styles, an episode from a *commedia dell'arte*, a critique of an Enlightenment world view: these are sample plots developed for various Classic pieces," p. 130.
    - **Structural rhythm:** "The SR for any M is a fluidly conceived, intramusical process that represents the end result of stripping Ts of referentiality and pursuing their purely musical attributes or essences," p. 130.
    - Interpretation relies on knowledge of **convention** for specific forms, genres, etc.
    - Structure is interpreted using a **beginning—middle—end paradigm** based on a hierarchic view of musical structure (i.e., Schenker), especially harmony.




- **Interaction**

  - **Introversive semiosis:** "Internal, intramusical reference, both backward and forward, retrospective and prospective," p. 132.
  - **Extroversive semiosis:** "Denotes external, extramusical, referential connections," p. 132.
  - **Play:** "The notion of play describes not the broad and inevitable interaction between topic and harmony but, more specifically, the activity at the moment of break or rupture in each mode's process of self definition," pp. 133-34.




Example 6.2c. Interaction between topic and harmony in Beethoven's String Quartet in A Minor, Op. 132—First Movement, measures 39–48

❖ Raymond Monelle. 2000. *The Sense of Music: Semiotic Essays*. Princeton: Princeton University Press.

- This book is comprised of various vignettes and is often difficult to summarize. What follows are partial summaries of my two favorite parts.

- Chapter 2, "Search for Topics"

  - Part of this chapter is a critique of Ratner's theory of topics. Monelle argues that while Ratner thinks his topics are historically grounded, they are in fact not historically grounded, but are essentially a presentist construction. Monelle argues that many of the passages that Ratner cites from eighteenth-century sources are mistranslated, misquoted, or poorly interpreted. In fact, topics were not a major concern of eighteenth-century theorists.
  - Monelle writes that the "different 'styles'—strict and free, church, chamber, and theatrical—were fully acknowledged by contemporaries, but they refer usually to social purpose rather than signification," p. 29.

- Chapters 4 & 5, Temporality
    - In these chapters, Monelle is largely concerned with how music can signify different tenses, especially the past tense. Here he is after a kind of poetics of musical temporality via signification.
    - "There is a temporality of the signified, as well as a temporality of the signifier," p. 83.
    - **Novelness:** "A world in which the moments of present time are transposed into the past of the future; in which all love and romance seemed beyond the subject's grasp, lost in the personal or historical past, where passages of terrible sweetness are always touched with nostalgia and regret—this was the temporal dynamic of the nineteenth century, and it was reflected in music. A temporal dialectic now joins hands with a dialectic that is ontological and sentimental. Time-in-a-moment and progressive time respectively evoke lostness and struggle; the extended present of lyric time becomes a space where the remembered and imagined past is reflected, while the mobility of progressive time is a forum for individual choice and action that is ultimately doomed," p. 115.

## § 12.0 TONAL FORM

### § 12.1 ROSEN

*By Andrew Pau*

- Charles Rosen. 1980. *Sonata Forms.* New York: Norton.

  - Examines sonata form as a product of its original cultural and intellectual *milieu*, rather than taking a theoretical and ahistorical approach. Historical style and convention are emphasized more than abstract concepts (i.e., influenced by Tovey and Ratner).

  - Ternary and binary forms:

    - **Ternary:** *da capo* aria; minuet and trio
    - **Binary:** "three-phrase" (i.e., rounded binary) and "two-phrase" (i.e., simple binary)

  - Distinction between sonata forms and Baroque forms (e.g., *allemande*): The idea of *dissonance*, embodied by the contrasting key area, is raised from the level of the interval or phrase to that of the whole structure; it becomes the generating force for the whole movement.

  - **Aria form** for outer sections of a *da capo* aria:

| | | | | |
|---|---|---|---|---|
| Ritornello | Solo ($A^1$) | Ritornello | Solo ($A^2$) | Ritornello |
| I | I→V | V | I→I | I |

    - "Disregarding the ritornelli" (!), this is slow-movement sonata form (i.e., sonata without development).

  - **Concerto form:** Closely related to aria in its alternation of ritornellos and solos:

    - In both the concerto and the aria (unlike in the quartet, symphony, or sonata), the end of the (solo) exposition runs directly and continuously into a new texture, the opening of the second ritornello.

    - Second solo section has developmental features (e.g., "Fuor del mar" from *Idomeneo*).

    - "Reciprocal" relation of concerto to sonata: "Sonata is less a form than a way of conceiving and dramatizing the articulation of forms: concerto is a special kind of articulation. For some of the techniques of articulation, sonata style is directly indebted to the concerto. In turn, the articulations of concerto form are transformed by sonata style, ordered, balanced, and given new power," p. 95.

- **Sonata forms** (note plural). First-movement sonata form has two parts:

  - **First part** with three "events": (i) movement away from tonic; (ii) establishment of dominant; (iii) full cadence on V (cf. Hep./D.'s MC and EEC); discussion of "three-key expositions" (cf. Schenker): the apparent "second key" is just "a stop on the road to V."
  - **Second part** with at least two events: (i) return to tonic and to some part of exposition in its original form; (ii) final cadence on tonic (cf. ESC)

    - Development is marked by techniques of thematic transformation: (i) fragmentation, (ii) deformation, (iii) imitative counterpoint, (iv) sequence.
    - Flat (subdominant) side is often visited in the recapitulation (e.g., "Waldstein" first movement).
    - There may be a "secondary development" section.
    - Coda: reaffirmation of the tonic.

- **Slow-movement form** (i.e., Marx's sonatina form, or sonata without development).

- **Minuet sonata form:** In two parts, but with three large phrases or periods. (Refers to the form of the minuet or trio by itself, not the larger ABA.) Due to brevity, the functions of second theme and development are combined in the second phrase (after the first double bar).

- **Finale sonata form:** more loosely organized (e.g., sonata rondo).

- **Historical evolution of sonata forms:** 18th-century Italian composers like Sammartini, Domenico Scarlatti; German composers like C.P.E. Bach and Haydn.

  - Sonata form unified a set of scattered procedures (i.e., "mid-century stereotypes") through a new insistence on the "large-scale balance of proportions and the awareness of the specific function of long sections and their relation to the movement away from tonic stability and back towards the resolution of dissonance."

  - "By the early 1780s, we may speak of the triumph of sonata style or of Viennese Classicism: all earlier forms, rondo, concerto, fugue, da capo aria, ternary form, have now been turned into sonata forms," p. 155. Typically, Rosen then gives the *Kyrie* from Haydn's "Creation" Mass as an example of "sonata form with central trio."

- **Motive and function:** Examines motivic transformation and development, e.g., "Lebewohl" motive in Beethoven's "Les Adieux" Sonata; short-short-short-long motives in 5th Symphony and "Appassionata" Sonata.

- Sonata form after Beethoven: Schubert, Brahms, Schumann, Chopin.

- **"Atonal sonata form:"** Berg, Piece for Orchestra, op. 6, no. 3; *Lulu,* Act I; Bartók; Boulez.

## § 12.2 CAPLIN

*By Jason Hooper and Andrew Pau*

- William E. Caplin. 1998. *Classical Form: A Theory of Formal Functions for the Instrumental Music of Haydn, Mozart, and Beethoven.* Oxford and New York: Oxford University Press.

  - Based on a revival of taxonomic *Formenlehre* building on the functional approach of Schoenberg and Ratz.

    - Goal: to formulate coherent principles and propose clear terminology to serve as theoretical tools for analyzing form at all hierarchical levels in a single movement
    - Emphasizes the role of local harmonic progression as a determinant of form
    - Distinguishes formal function from grouping structure
    - Minimizes motivic content as a criterion of formal function (Caplin explicitly distances himself from Schoenberg's preoccupation with *Grundgestalt* and developing variation)
    - Caplin says his theory is "empirical and descriptive, not deductive and prescriptive;" he "establishes strict formal categories but applies them flexibly in analysis."

  - **Tight-knit themes:**

    - **Sentence** [8 bars]: presentation [4] + continuation [4]

      - **Presentation:** Basic idea [2] + repetition of basic idea [2]; the repetition of a basic idea can be (i) exact, (ii) statement-response (i.e. tonic-dominant), or (iii) sequential (anything other than tonic or dominant).
      - **Continuation:** Fragments [2] + cadence [2].
      - **Fragmentation:** Marked by acceleration of harmonic rhythm, increase in surface rhythmic activity, harmonic sequence.
      - **Cadence:** Requires a cadential progression, as well as a context of closure.

    - **Period** [8]: Antecedent [4] + consequent [4]

      - Antecedent: Basic idea [2] + contrasting idea [2] + weak cadence.
      - Consequent: Repeat of antecedent with strong cadence (usually a PAC).

    - **Hybrid themes** [8]: Mix and match

      - Antecedent + continuation
      - Antecedent + cadential
      - Compound basic idea [CBI: antecedent with no cadence] + continuation, etc., etc.

- **Compound themes** [16]
  - 16-measure period: 8-measure antecedent + 8-measure consequent; antecedent = presentation + continuation; CBI + continuation; antecedent + continuation, etc., etc.
  - 16-measure sentence: 8-measure presentation + 8-measure continuation.
- **Small ternary:** A B A' (exposition-contrasting middle-recapitulation); at theme level, not at movement level.
- **Small binary:** Not rounded binary.

▪ **Looser Formal Regions**

- **Subordinate theme:** marked by looser sentential and cadential functions (cadential extensions, expansions, evasions, etc.).
  - Exposition of a movement usually contains a *group* of subordinate themes, each ending with a PAC in the subordinate key.
  - "Closing theme" is either a true subordinate theme (last of the group), or just a collection of codettas; Caplin uses "closing section" to refer to codettas.
- **Transition:** modulating and non-modulating; ending a transition; two-part transition.
- **Development:** Pre-core/core technique
  - **Pre-core:** More relaxed, somewhat hesitant and anticipatory
  - **Core:** Emotional quality of instability, restlessness, dramatic conflict, *Sturm und Drang*, fragmentation, sequence; ends with standing on dominant.
- **Recapitulation**
- **Coda**

▪ **Full-movement forms**

- **Sonata form:** Main theme tends be tight-knit, subordinate themes tend to be looser-knit.
- **Slow-movement forms:** Include large ternary; sonata without development; theme and variations.
- **Minuet/trio form:** Exposition (A) – contrasting middle (B) – recapitulation (A') – (Coda).
- **Rondo forms:** Refrain and couplets (often in new keys, parallel *maggiore*/*minore* or IV/VI).
  - Five-part rondo (ABACA)
  - Seven-part rondo (ABACADA)
  - Sonata rondo (ABACAB'A) [B returns in tonic second time]
  - Nine-part sonata rondo (you figure it out)

- **Concerto form:**

  - Opening ritornello
  - Solo exposition (main theme-transition-subordinate theme group)
  - Subordinate-key ritornello
  - Solo development
  - Solo recapitulation (main theme-transition-subordinate theme group)
  - [Cadenza]
  - Closing ritornello

❖ Warren Darcy. 2000. Review of *Classical Form*, by William E. Caplin. *Music Theory Spectrum* 22: 122-25.

- Caplin's taxonomic thoroughness is "dizzying" to a fault: norms have plenty of possible deviations, each of which is explored with "relentless thoroughness."

- Caplin's "neutral attitude" towards compositional choice is problematic: although Caplin excels at explaining *what* a composer does, he rarely asks *why*; he does not discuss the expressive point of compositional choices.

- Some of the formal categories are too rigid and/or too flexible:

  - Caplin is fixated on "quadratic syntax": basic idea = 2 measures; phrase = 4 measures; period/sentence = 8 measures, etc.
  - At the same time, any 4-measure idea can be a "phrase;" Caplin doesn't recognize that a "sentence" is one way of constructing a "phrase," i.e. they can be the same thing.

❖ William E. Caplin. 2004. "The Classical Cadence: Conceptions and Misconceptions." *Journal of the American Musicological Society* 57/1: 51-117.

- A reassessment of the classical cadence: "Cadence is an enormously complex concept, one that often conveys distinctly different connotations and embraces a multitude of musical phenomena," p. 51. Caplin's approach is "to focus on a relatively narrow, stylistically unified repertory, one in which most historians recognize cadence as a central feature," p. 51. The music under examination is that by Haydn, Mozart and Beethoven. While Caplin's approach is stylistically constrained, his approach is decidedly presentist.

- A cadence should be understood as syntactical, rather than rhetorical, p. 52.

- History of Theory

  - **Mattheson, Kirnberger and Koch:** "The idea of cadence as closing gesture was strongly associated with grammatical punctuation of language," p. 54."Cadential classifications became based primarily on harmony rather than on melodic or contrapuntal intervals," p. 54.
  - **Rameau:** With the *cadence parfait*, "the concept of cadence was thus no longer confined to musical situations involving gestures of ending," p. 54.
  - **Riemann:** "Expanded the [cadential] progression to embrace the complete functional sequence, tonic-subdominant-dominant-tonic, and he deemed such a

cadence the fundamental model of *tonality*, a broader conception of tonal relations than harmony alone," p. 54.

- Caplin's Fundamental Concepts, p. 56.

    - Cadence effects formal closure at a limited number of levels of musical structure. A cadence must end something.
    - The harmonic content of a cadence—the *cadential progression*—is highly constrained.
    - *Cadential function* embraces the time-span from the beginning of the cadential progression to its end—the *cadential arrival*.
    - Passages of *cadential content* do not always function as syntactical cadences.
    - Cadential function must be distinguished from postcadential function, which embraces the music that follows the cadential arrival (and appears prior to a new beginning).
    - Cadential arrival represents a formal *end*, not a rhythmic *stop*.
    - The appropriate linguistic analogy for cadence is *syntactical closure*, not the external, written signs of *punctuation*.
    - *Cadential strength* can be distinguished as syntactical or rhetorical, the former being the one aspect of essential for form-functional expression.

- Caplin distinguishes between the concepts of cadence and phrase. For example, a 4-measure presentation phrase never ends with a cadence, p. 59.

- Problem of cadential hierarchy: "To say, however, that a given cadence appearing late (or even at the end) in a work represents cadential closure for the work as a whole is somewhat more viable, but still problematical. Take the case of a movement in sonata form, where a decisive cadence ends the second-theme group in the recapitulation. What exactly would it mean to say that this cadence, per se, is responsible for creating closure for the entire movement, the sense, say, of Darcy and Hepokoski's essential sonata closure," p. 61?

- Plagal (non)cadence: "If the plagal progression does not fulfill the requirements of a true cadential progression, then the formal construct of "plagal cadence," described in virtually every music theory textbook on rudiments and harmony, must be seen as a fiction, at least for the classical repertory," p. 71.

- "Cadential function is not sufficiently distinguished from post-cadential function," p. 92.

**§ 12.3 SONATA THEORY: HEPOKOSKI AND DARCY**

*By Charity Lofthouse*

- Sonata theory is chiefly concerned with the conceptualization of sonata form—usually focused in the decades around 1800—and on the music of the Austro-Germanic tradition, including Haydn, Mozart, and Beethoven. Issues include historical conceptualization, analytical constructs, and hermeneutic explanation for formal and tonal events.

❖ Warren Darcy and James Hepokoski. 2006. *Elements of Sonata Theory.* Oxford and New York: Oxford University Press.

- **Themes:** Superscript integers placed after these indicators are used to divide the theme areas into smaller themes and units for ease of reference and analysis. The integers are increased according to the principle of PAC cadential division: $P^2$ indicates that the theme or module is in the P-zone, after the PAC that ended $P^1$, and is different than what came before it, not just a slight variation or repetition of $P^1$. A second number, after a decimal, can delineate modules within a PAC span: $P^{1.2}$ would follow $P^{1.1}$, perhaps as the presentation and continuation of a sentential structure in a P-theme. There is some flexibility here in terms of good musical reasons to add integers after the decimal. Exceptions to the principles listed above are the special numberings used in a Tri-Modular Block (TM1, TM2, TM3), and the use of 0 to indicate introductory material within a section ($P^0$, $S^0$, $P^{1.0}$, etc.).

    - **P** (Primary Theme Area): The idea that begins the sonata process and that establishes rhetorical function as the initiator of rotations. The structure of P can contain one theme or multiple modules (they use most of Caplin's terminology in describing the various structures used in the various areas: sentence, period, hybrid, etc.). P can be made up of larger structures as well, including rounded binary and grand antecedent (Mozart, Symphony No. 40). P can end expectedly and tonally closed, or dissolve mid-phrase into TR material. The proportions used in constructing the P area often have implications regarding the size/scope of other areas; also, the relative tonal under- or over-determination of P can have implications later as well.

    - **TR** (Transitional Theme Area): Brings the initial idea, P, to the moment of re-launch, S. In a two-part exposition, TR will end with a Medial Caesura (MC). Modulation is not necessary; it is the rhetorical drive and energy gain that characterizes TR passages. Common types of TR include independent (separately thematized) and developmental (working out of some idea from P): it is not always easy to tell if something is independent or working out a kernel of an idea from P. There are also the dissolving restatement (starts like P but turns into TR) and dissolving consequent (P closes in the manner of an antecedent, and the expected consequent becomes TR). Related to these is the sentence with dissolving continuation, period with dissolving consequent restatement and sentence with dissolving continuation restatement. Depending on the structure of P, it is also possible to have a dissolving P-codetta, dissolving hybrid, or larger rounded structure (ABA', aa'ba") with dissolving reprise. Problematic exceptions are treated in the book, like lack of energy gain, multiple PACs in TR, etc.

- **MC** (indicated by a **‘**; Medial Caesura): The brief, rhetorically reinforced break or gap which divides the exposition into two parts, ending the first part and opening up S-space. It is usually built around a strong half-cadence in the new key (first-level default) which is rhythmically, harmonically, or texturally reinforced. Other possibilities for the cadence include I:HC (second-level default) or, less commonly, a PAC in the new key (third-level default).

- **S** (Secondary Theme Zone): The structure of S can, like P, include many smaller forms, from periods and sentences to small binary structures. Though the cantabile S is most familiar, there are also many options for the character of S, from boisterous to P-based to learned style. For the Tri-Modular S, see below. The EEC is accomplished in the S zone, and is usually proportional in terms of the relationship between S and C (e.g., if S is long and has many phrases, the EEC appears later and the Closing zone will usually balance this out by being relatively brief).

- **C** (Closing Zone): Optional material appearing after the EEC. It is differentiated from S by its identity as post-cadential, and by the norms usually employed in its thematic construction. Like P and S, C can contain more than one phrase, which would be numbered C1, C2, etc. in accordance with the principles outlined above. The most common thematic structures for C are: codetta modules; P-based C; TR-based C; and New Theme as C. A C zone can also be replaced by a re-transition (RT), depending on the piece.

- **TM**: Themes functioning as part of the Tri-Modular Block, followed by integers to distinguish the three themes. Numbered TM1, TM2, TM3.

- **GP**: Grand Pause; MC followed by a rest, as opposed to caesura fill (CF), in which the rest is occupied by linking material.

- **TMB**: The Mid-Expositional Tri-Modular Block; associated with the effect of "apparent double medial caesuras" each followed by an S-like theme, giving the impression of double S-themes.

- **PMC** (Post-medial Caesura; also indicated by a **‘** ): The second caesura in a TMB – complications with the two themes in the S-space in a TMB will dictate which caesura launches the 'true' S-theme.

- **EEC** (Essential Expositional Closure): The first PAC in the new key area followed by new material, it signals the end of the S-space and the progression to C (or DE in a type 5) space.

- **ESC** (Essential Structural Closure): Analogous to the EEC, but located in the S-theme area of the Recapitulation; this PAC, by taking place in the tonic, brings tonal resolution to the sonata.

- **Continuous Exposition:** Instead of a MC followed by an S zone, TR will dissolve, at a point of conversion, into *fortspinnung*-like material (FS), which drives to the EEC. This is usually followed by a Closing Zone.

- **Development:** Typically, Development space moves through several key areas before reactivating the dominant in preparation for the recap. The rhetorical and thematic layout of developmental rotations is more difficult to generalize, but some basic trends can be seen. The onset of the development usually employs P material, which may be treated to falling fifths movement. An episodic opening that "writes over" or substitutes for P in the rotational layout is also common. On occasion, the development may begin with C-based material; an indication that C is a strong idea that still has more to do, taking the place where P usually appears. S-based beginnings are somewhat rare. Rotation types include half rotations (P-TR or S-C), double rotations (each treating material from the exposition's parts 1 and 2 in order, though usually differently in some way.) Double or Triple Half Rotations (P-TR, P-TR, etc.) Typical pathways for developmental space include the possibility of four normative zones: an optional link from the preceding C or RT, which seems like it takes place before the beginning of the development proper; the entry zone, which is an anticipatory, often piano, section, usually utilizing P-based material; the Central Action Zone, which may be quite long, and unfold in various subsections, as well as commonly using one or more sequence blocks; and the Exit or Re-transition Zone, which usually involves a structural dominant-lock, and possible foreshadowing of the return of P at the recap.

- **Recapitulation:** Various interesting alterations are possible here in terms of variation from the exposition. It is common for the composer to alter P and TR, as TR would usually need to be altered to bring about S in the tonic key. Correspondence measures between the exposition and recapitulation are usually easily determined, as the material tracks closely to the first appearance. After several measures of correspondence, the composer will often slip off track, often to make the tonal adjustments noted above, before getting back on track. This moment of rejoining is referred to as the crux; at this point, the tonal trajectory is prepared, and the rest of the movement could be accomplished by and large by transposition if the composer so desired. Alterations made before the crux are referred to as pre-crux; those after the crux as post-crux. Sometimes there is more than one slip off, so another crux is accomplished further into the recap. Usually, post-crux alterations, not being necessary tonally, are deliberate complications to the recap, and may have rhetorical significance. The ESC is achieved in the S zone of the recap, tonally closing the sonata.

- **Coda:** Outside of sonata space proper, codas often have rhetorical significance in terms of choices made in the sonata movement. It is so common to begin a coda with P material that the appearance of P-based music is often the indicator that the coda has started (there are, of course, exceptions.) When a coda is lengthy, it is referred to as discursive, usually a multi-section discourse outside of sonata space. Sometimes a rotation is suggested by the presence of P, TR, S, and C material in order, a device sometimes seen in Beethoven. Beethoven also likes to use development-like discourse in his codas. Discursive codas can have the impression of working out difficulties or obstacles present in the sonata itself.

- **Coda-Rhetoric Interpolation (CRI):** Usually the coda takes place after the C zone, but composers sometimes interpolate coda-rhetoric material before all of the final C modules have sounded. There is a large variety of possibilities for this treatment, but a classic example can be seen in Mozart's Symphony No. 39/I.

- **Types of sonata form:**

    - **Type 1:** Sonata without development. The second rotation, following a non-repeated exposition, begins with an intact P sounded in the tonic.
    - **Type 2:** Sometimes thought of as a binary variant of type 3. The exposition may or may not be repeated; the second rotation begins as developmental space, and only in its second half, usually by use of S material onward, does a recapitulatory effect take place. P usually appears in the development in a non-tonic key; this is often followed by material based on P or TR that drives toward a crux point, where tracking with correspondence measures from S or shortly before S material in the exposition becomes possible. From this point, S and C material will be presented/resolved in the tonic, offering a *tonal resolution* (S+C block in tonic).
    - **Type 3:** Sonata-allegro. This occupies most of the book, as the most common type. The basic concepts of exposition, development, and recapitulation explained above have this model as a basic default.
    - **Type 4:** Sonata-Rondo. The standard Type 4 is a Type 3 sonata/rondo mixture. Variants include the Type 1/Rondo mixture and the expanded Type 1/Rondo mixture. Type 1/Rondo mixture, or Type 41, features both rotations from a type 1 ending with a RT, with the recap RT followed by third presentation of the P material (with or without coda) representing at least a partial third rotation. The expanded variant features a pronounced internal expansion in the recap rotation.
    - **Type 5:** Concerto-sonata form. Combination of ritornello formats and concerto and aria traditions with sonata form. As with the other types, the labeling system for themes in a type-5 sonata form labels a theme by its first appearance; this aids in representing theme relationships in later appearances. In addition to terms used for all sonata types, the terms unique to type 5, or used most often with type 5, are:

        - **R** (Ritornello): R1, R2, etc, - indicates Ritornello 1, Ritornello 2, etc.
        - **S** (Solo Exposition): S1 = Solo Exposition; S2 = Solo Development; S3 = Solo Recapitulation
        - **DE** (Display Episode): Closing material consisting mostly of virtuosic passages, and absent of significant melodic material.
        - $\mathbf{P^{pref}}$**:** A new theme found at the beginning of the Solo Exposition which appears before the orchestra's Primary theme.
        - The labeling system is structured similarly to that used to store computer files: R1:\P would refer to the theme first heard as the Primary theme in Ritornello 1.

## § 13.0 ANALYSIS AND PERFORMANCE

### § 13.1 BIBLIOGRAPHY

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## § 14.0 ROCK-POP MUSIC

### § 14.1 METHODS

- Walter Everett. 2000. "Confessions from Blueberry Hell, or, Pitch Can Be A Sticky Substance." In *Expressions in Pop-Rock Music,* ed. Walter Everett, pp. 269-345. New York: Garland Publishing.

  - Everett discusses what motivates his work. This is largely a rebuttal to those who criticize Everett's work for too much emphasis on formalism (i.e., Schenker) and theory. Everett writes that "pop/rock-scholar peers have condemned me further for betraying the heretic spirit of rock and roll by approaching it with ears trained by the academy," p. 269.

  - Everett argues that the "technical ways tones relate to each other" is as important as the sociological approaches taken to this repertoire, p. 269.

  - Everett argues that "the entire pitch and rhythm worlds of 'anarchic' tonal rock music are based upon, or relate to, principles that underlie the 'legitimate' classics," p. 270.

  - Everett considers a number of musical parameters in isolation:

    - **Form and design:** Everett discusses the normative verse-chorus-bridge formal paradigm in pop-rock songs, and then mentions a few tracks that deviate from this design. He does not discuss more expansive forms, such as the "rock opera."

    - **Timbre:** Everett discusses vocal quality and instrumental timbre. This passage contains my favorite statement in the entire music-theory literature: "the *Sprechstimme* rap technique…has a redneck heritage," p. 279.

    - **Temporality:** Everett discusses displaced accents, metric ambiguity, and asymmetrical phrase rhythms. This is in contrast to rock-pop music's stereotypical metric and hypermetric regularity.

    - **Tonal systems:** Everett argues that Schenkerian analysis is appropriate in the analysis of rock-pop music. Everett believe that the progression I—bVII—I represents neighbor motion, rather than viewing bVII as a "rock dominant."

    - Everett argues for a approach that considers both harmony and counterpoint, where before, most approaches simply focused on harmony.

    - Everett argues that in the case of the double-plagal cadence bVII—IV—I "relies on contrapuntal neighbors, not its roots, for identity," p. 325. Everett also argues (somewhere else) that in a blues progression V—IV—I, the V chord is the primary harmony which moves to I. IV is read as an incomplete lower neighbor to I.

- Allan F. Moore. 2001. "Elements of an Analytic Musicology of Rock." In *Rock, the Primary Text: Developing a Musicology of Rock*, 2nd ed., pp. 33-63. Aldershot, England: Ashgate.

  - Rock tracks are stratified into four layers:

    - A rhythmic layer (e.g., drum kit and cowbell)
    - Bass (e.g., bass guitar)
    - Melody (e.g., guitar and vocals)
    - Harmonic filler (e.g., rhythm guitar and keyboards)

  - The importance of melody: "It is always the tune which seems to be the prime carrier of the song's identity," p. 34.

  - The primary text in the analysis of rock is the audio track, rather than any kind of score or notation.

  - A song's structure can sometimes indicate whether it was composed on the guitar or at the keyboard, so that instrumentation in not only a matter of timbre, but a matter of harmonic structure as well.

  - Common-time meter, four-measure groups, and the sixteen-measure verse/chorus structure are considered rhythmic norms.

  - There is often a (rhythmic) tension between a songs "persona" (i.e., the melody or the singer) and the accompanimental background of a track (i.e., the kit and bass).

  - There are four components to analyzing rock voice types:

    - Register and range
    - Resonance
    - Attitude toward pitch
    - Attitude toward rhythm

  - Moore analyzes melody according to contour and focal pitches. Moore is not willing to elevate the status of harmony above other musical parameters.

  - Rock's formal sections:

    - Verse (different lyrics)
    - Refrain (same lyrics; repeated at the end of each verse)
    - Chorus (same lyrics each time)
    - Introduction
    - Playout
    - Solo break
    - Bridge (contrasting material)

  - Rock music is often based on a modal system (e.g., I→bVII→I).

- Albin J. Zak. 2001. "Sound as Form." In *The Poetics of Rock: Cutting Tracks, Making Records*, pp. 48-96. Berkley: University of California Press.

  - Zak is mostly interested in the studio production that goes into making a track. He divides production into five sound categories:

    - **Musical performance:** "The expressive nuances of particular performances have been considered matters of performance practice, not composition…Recording, on the other hand, transforms the particularities of performance from ephemera to fixed concrete elements," p. 50. Tracks may also be **overdubbed** or cobbled together from different takes, and are therefore "composed."

    - **Timbre:** Signals genre and affect.

      - The Beatles' influence "assured the string quartet [and other orchestral instruments, including woodwinds and brass] became an accepted element in the rock palatte at large," p. 63.
      - Electric guitar distortion (e.g., Dylan plugs in)
      - Spectrographic translations
      - Contrast of familiar and highly processed, distorted sounds

    - **Echo** and **slapback.**

    - **Ambience** (reverb): "Multiple echoes produced by sound reflecting randomly off of surfaces in an enclosed space accumulate to form an aural image known as ambience, or reverb," p. 76. Phil Spector is especially known for using reverb.

    - **Texture:** "For as a determinate of a record's character, texture is as fundamental as song. It is the way that everything, including song, fits together—the way that the record presents itself," p. 86. "In the early 1990s, juxtaposition of radically different textures between verse and chorus became a stylistic hallmark of so-called alternative rock," p. 93.

### § 14.2 HARMONY

- Ken Stephenson. 2002. "Chapters 4 and 5." In *What to Listen for in Rock: A Stylistic Analysis*, pp. 73-120. New Haven: Yale University Press.

  - **Harmonic palette:** The range of harmonic choices afforded by a scale system.

    - Natural-minor system
    - Chromatic-minor system: Contains chords like the Neapolitan
    - Major system
    - Mixed systems: Different formal sections of a track are governed by different harmonic palettes

  - Stephenson claims that "the interaction of melody and harmony in rock is best understood in relation to melody and harmony in Western music over the ages," p. 74.

- **Aspects of harmony:**

    - Pedal points are important
    - Chordal inversion is relatively infrequent
    - Use of split-third chords
    - Use of primary triads with added sevenths (major and minor)
    - Added-sixth chords
    - Further extended chords (e.g., ninths and elevenths)
    - Power chords and distortion often add harmonic interest through overtones
    - Traditional harmonic functions do not apply

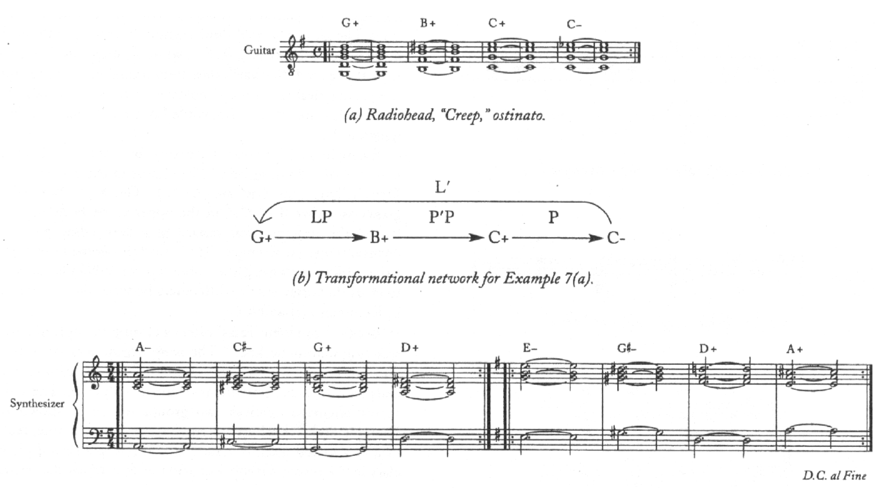
- The blues is indicative that rock harmony has a new sense of harmonic progression (e.g., V→IV). However, it is useful to compare rock progressions to the traditional harmonic norms from which Stephenson claims they derive.
- For harmonic analysis, Stephenson uses Roman numerals, including secondary dominants. His harmonic outlook is relatively traditional and doesn't recognize features of modal harmony that this repertoire seems to require. For example, bVII isn't recognized as the "rock dominant."

❖ Guy Capuzzo. 2004. "Neo-Riemannian Theory and the Analysis of Pop-Rock Music." *Music Theory Spectrum* 26: 177-99.

- Capuzzo analyzes rock harmony according to neo-Riemannian theory. He claims this repertoire is suited to this kind of analysis because of the frequent modal mixture, root movement by third, and the lack of leading tones and dominant harmonies. However, complete cycles and the equal division of the octave are rare in pop-rock music.

- Open chords on the guitar—C, D, E, G and A major—create many interesting chromatic progressions that occur frequently in pop-rock music and are particularly well suited for analysis using neo-Riemannian operations.

- Capuzzo later extends his model to include some seventh chords (cf. Hook 2007).




*(a) Radiohead, "Creep," ostinato.*

*(b) Transformational network for Example 7(a).*

*(c) Radiohead, "Morning Bell."*

EXAMPLE 7

- Walter Everett. 2004. "Making Sense of Rock's Tonal Systems." *Music Theory Online* 10.4.

  - This article provides a classification for rock's tonal systems. Everett writes that "it is my contention that the tonal norms basic to the pop music from which rock emerged are the same norms common to the system of common-practice tonality," § 3. Everett then states that "while the underlying principles of tonality are unchanging, rock has evolved several different ways of relating to that tonal background," § 5. (NB: Schenkerian theory defines tonal norms for Everett.)

  - Classification of rock's tonal systems:

    - **1a:** Major-mode systems with common-practice harmonic and voice-leading behaviors. May be inflected by minor-mode or chromatic mixture.
    - **1b:** Major-mode systems with common-practice harmonic and voice-leading behaviors. May be inflected by minor-mode or chromatic mixture.
    - **2:** Diatonic modal systems with common-practice voice-leading but sometimes not with common-practice harmonic behaviors.
    - **3a:** Major-mode systems, or modal systems, with mixture from modal scale degrees. Common-practice harmonic and voice-leading behaviors would be common but not necessary.
    - **3b:** Major-mode systems with progressive structures. Common-practice harmonic and voice-leading behaviors would be typical at lower, but not higher, levels.
    - **4:** Blues-based rock: minor-pentatonic-inflected major-mode systems. Common-practice harmonic and voice-leading behaviors not always emphasized at the surface, but may be articulated at deeper levels and/or in accompaniment.
    - **5:** Triad-doubled or power-chord minor-pentatonic systems unique to rock styles: I - bIII - IV - V - bVII. Common-practice harmonic and even voice-leading behaviors often irrelevant on the surface.
    - **6a:** Chromatically inflected triad-doubled or power-chord doubled pentatonic systems of early metal. Common-practice harmonic and voice-leading behaviors often irrelevant on the surface.
    - **6b:** Chromatically related scale degrees with little dependence upon pentatonic basis. Common-practice harmonic and voice-leading behaviors often irrelevant at deeper levels as well as surface.

- Allan F. Moore. 1995. "The So-Called 'Flattened Seventh' in Rock." *Popular Music* 14: 185-201.

  - Problem: "There is as yet very little concern for theorizing analytic method in rock music," p. 185.

  - Argues that rock is mainly a modal system that often lacks a proper dominant or a leading tone.

  - Conclusion: Schenkerian method cannot be adequately applied to most rock music and its application is largely under-theorized (cf. the work of Everett). The problem stems from the frequent use of the bVII chord, or the rock dominant. This chord should be given a more functional status. The use of Schenkerian theory to analyze rock music mistakenly assumes that rock music operates under the norms of classical tonality. However, Moore has no objection to linear analysis *per se*.

## § 14.3 FORM

❖ John Covach. 2005. "Form in Rock Music: A Primer." In *Engaging Music: Essays in Music Analysis*, ed. Deborah Stein, pp. 65-76. Oxford and New York: Oxford University Press.

- "Generally speaking, harmonic structure tends to be a primary factor in determining formal units at all levels of structure…In considering form in rock (as in many other types of song), it is also helpful to separate out harmonic concerns from those regarding the lyrics, at least provisionally," p. 66.

- **Twelve-bar blues:**

    - "The third phrase [of the blues] moves from dominant harmony through a passing subdominant harmony to tonic," p. 67.
    - "The twelve-bar pattern can itself be modified, leading to eight-bar and sixteen-bar schemes," p. 68.

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| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Measures (beats) | 1 1234 | 2 1234 | 3 1234 | 4 1234 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Chords | I | (IV) | I | I | IV | IV | I | I | V | IV | I | V |
| Phrases | Question ------------------\| | | | | Question again ------------\| | | | | Answer ------------------\| | | | |

**Example 6.1.** The twelve-bar blues (Muddy Waters, "Train Fare Blues" [1948])

- **AABA form:**

    - "Rock musicians have been influenced most by the use of the thirty-two-bar AABA scheme in American popular song," p. 69.
    - The A sections are often sixteen bars; the B section (bridge) is often eight measures.

- **Verse-Chorus Form:**

    - The verse serves as a way to get back to the chorus, the primary focus of the track.
    - When there is no harmonic contrast between the verse and chorus, this is known as **simple verse-chorus form**.

- **Compound forms:** Boston, "More Than a Feeling:" "After a six-measure introduction, a verse-chorus pair appears once and is repeated. After the second chorus, a bridge sections occurs that functions much like a bridge in an AABA form: it prepares the return of the third verse-chorus pair, which follows immediately. Thus, the features of a contrasting verse-chorus form are combined with those of an AABA to form a compound AABA form," p. 74.

- Mark S. Spicer. 2004 "(Ac)cumulative Form in Pop-Rock Music." *Twentieth-Century Music* 1: 29-64.

  - **Cumulative form** (after Burkholder's work on Ives): "Thematic fragments are gradually introduced and developed, only to crystallize into a full-fledged presentation of the main theme in a climatic pay-off at the end of the piece," p. 29. This is music like a reverse form of liquidation.

  - Cumulative form is part of the recording process itself: "Various interlocking riffs—such as drum rhythm, bass line, and guitar vamp—are introduced one by one until the groove is complete, a technique more often employed at the beginnings of songs. This technique of building up a groove gradually from its constituent parts is often the defining feature of smaller formal units within large compositions, and so it seems to merit a descriptor of all its own which I will henceforth refer to as **accumulative** rather than cumulative, reserving the latter adjective for describing the strategy of complete tracks," pp. 32-33.

  - Often, accumulative form involves metric ambiguity which is then clarified with the addition of other musical layers.

  - As "a gradual process of textural growth…a climatic final section, one in which two or more distinctive melodies that had previously been heard separately are made to sound in counterpoint against one another," p. 58.

### §14.4 SCHENKER

- Matthew Brown. 1997. "'Little Wing:' A Study in Musical Cognition." In *Understanding Rock: Essays in Musical Analysis*, ed. John Covach and Graeme M. Boone, pp. 155-96. Oxford and New York: Oxford University Press.

  - Brown states that "composition might be understood as a form of knowledge-based problem solving…a tonal piece of music might be regarded as a successful solution to a musical problem," p. 156.

  - According to Brown, the six characteristics of common practice music include:

    - Tonal harmonies are fundamentally triadic
    - Harmonies are hierarchic
    - Harmony is essentially diatonic
    - Tonal melodies tend to descend and reach closure at ^1
    - Tonal dissonance arises from motion between consonances
    - Parallel fifths and octaves are banned

  - Brown write that "at some level Hendrix had to find a way of extending some kernel of thematic material so as to create a larger tonally satisfying whole," p. 160. Note Brown's explicit organicist ideology when it comes to analyzing this Hendrix track.

  - Brown goes on to sketch the track "Little Wing." Note in the graph how deeper levels promote V over bVII (cf. Moore 1995). Measures 5-8 are seen as a prolongation of V, but V might also be read as an upper-neighbor to IV so that the progression IV→bVII emerges. Schenkerian tonal norms—to my mind—require a hearing that is not commensurate with the blues-based harmonic style of this track.

Figure 6.2.

- Allan F. Moore 1997. "Commentary." In *The Beatles:* Sgt. Pepper's Lonely Hearts Club Band, pp. 26-57. Cambridge: Cambridge University of Press.

  - This chapter provides an analysis of the Beatles' concept album *Sgt. Pepper's Lonely Hearts Club Band.* Moore borrows symbols from Schenkerian analysis (sort of), but the graphs are basically nonsense.

  - In the graph below, Moore claims the opening of the album is in "G mixolydian." (Compare the linear motion in the outer voice (i.e., F-sharp.)

❖ Lori Burns. 2000. "Analytic Methodologies for Rock Music: Harmonic and Voice-Leading Strategies in Tori Amos's 'Crucify'." In *Expressions in Pop-Rock Music*, ed. Walter Everett, pp. 213-46. New York: Garland Publishing.

- This is one of the most thoughtful articles on how to reconcile Schenkerian theory with the analysis of pop-rock music.

- **Problem:** "I am simply identifying the need for greater precision in and sensitivity to our theoretical/analytical methodologies," p. 216.

- **Question:** "How ought we interpret a song whose harmony is at times modal, at times tonal, and at times a conflation of the two," p. 216? (Cf. Stephenson's mixed systems.)

- Burns arrives at a method which is a revision of Schenker. She elevates modal features to being more normative (e.g., bVII is treated as a "true" harmony). However, Burns avoids reducing a song to the level of the *Ursatz*. She also rejects organicism and analyzes a song section by section.

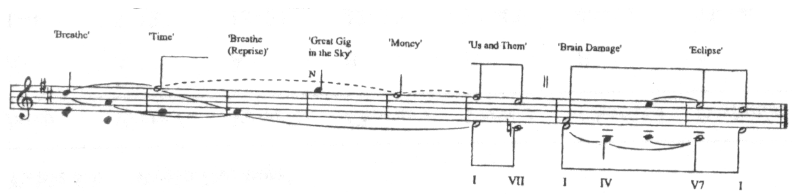
- Three different graphs used:

  - Normative progression: The governing harmonic progression of a formal section.
  - Voice-leading graph: The contrapuntal frame between the melody and bass with a distinction between embellishing and structural tones.
  - Reduction: A reduction of the voice-leading graph to find a more basic prolongational structure.


**Example 8.3.** "Crucify" (Tori Amos), Chorus.

- ❖ Shaugn O’Donnell. 2006. “On the Path: Tracing Tonal Coherence in *Dark Side of the Moon*.” In “*Speak to Me:*” *The Legacy of Pink Floyd’s* The Dark Side of the Moon, ed. Russell Reising, pp. 87-103. Aldershot, England: Ashgate Publishing.

    - ▪ O’Donnell analyzes an entire concept album, *Dark Side of the Moon*, according to Schenkerian principles. The result for the entire album:




**Example 6.10 Background structure of *The Dark Side of the Moon***

## § 15.0 ANALYZING NON-WESTERN MUSIC

*By Noriko Manabe*

### § 15.1 PRELIMINARIES

- Most musics are oral traditions, so transcriptions need to be made. Many of the same issues as analyzing popular music.

- Many key aspects of the music cannot be notated by Western notation (e.g., microtonal inflections and timbre).

- Different concepts of rhythm; many free-rhythmic genres; time signatures imply strong beats/weak beats which may not exist; which may prejudice the reader as well as the transcriber (e.g., Spanish music, ternary but strong beats in different places).

- Different concepts of pitch/scale (i.e., Javanese scales are not tempered in the same way, no concept of absolute tuning; Balinese tune differently from town to town; many transcribers resort to numbers).

- Music may be largely improvised or change, in which case, is what has been recorded or transcribed the norm?

- Prejudicial/political implications of tools chosen (e.g., German musicologists compared Japanese music to ancient Greek music).

- Mentality of "us vs. them;" exoticization of the Other (see Agawu 2003 below; Scherzinger for an extensive discussion).

- Musicology/music theory tends to ignore non-Western music, leaving it to ethnomusicologists, which is rooted in anthropology, not the study of music per se.

- Western ethnomusicologists tend to search for difference and ignore the similarities.

- Scholars in the non-Western culture often have fewer resources (e.g., more African archives available outside Africa than in Africa; less access to Western publications; less access to resources for publishing; English publications hegemonic over those in other languages; etc.).

- "Native" input to discourse discouraged.

- Appropriation of work already done by native scholars unpublished in the West.

- Prejudice against analysis in favor of ethnography; privileging short-term field work sanctioned/funded by a few institutions rather than actual experience/analysis.

- Lack of acknowledgment of music for music's sake/contemplative music in favor of search for social function (e.g., dance, ritual).

- Lack of a canon that most music readers will know; hence, much explaining necessary.

## § 15.2 AFRICAN MUSIC

- Kofi Agawu. 2003. *Representing African Music: Postcolonial Notes, Queries, Positions*. New York: Routledge.

  - The bulk of this book is essentially a critique of ethnomusicologists operating in Africa. While I am sympathetic to many of Agawu's comments, they leave less space for actual analysis. The third chapter is available as the article "The Invention of 'African Rhythm'" in *JAMS* 48/3: 380-395; there are rebuttals and reviews by Veit Erlmann in *Music Theory Spectrum*, among many others. Similar debate followed Agawu's earlier book on Ewe music (see Stephen Blum's review in *Spectrum*).

  - Disadvantages of African scholars:

    - The spirit of African music is not always manifest in scholarship. The community of scholars is decentralized; the number of African scholars is small, while foreigners dominate the field; much of the scholarship is directed outward toward overseas markets. Agawu aims to stimulate debate on modes of knowledge production—who writes about the music? What prejudices influence the presentation of data? To what authorities are these scholars appealing?
    - Ekwueme (Yale-trained) used intervallic analysis/Schenker to analyze Igbo songs in mid-1970s; African scholars accused him of "thinking white."
    - A majority of African ethnographic recordings are outside Africa; African scholars can't afford to visit them; they don't have widely-read English-language journals.

  - Inadequacy of Western (ethnomusicological) approaches to Africa:

    - Ethnomusicology has been formulated as a study of difference, with the knowledge being produced by Euro-American scholars about Others (Africans, Asians, Latins, etc.) based on brief periods of fieldwork. They exert power over those studied—they lay down the terms for subsequent discourse. These Others don't have the same access to the West. Asymmetrical relationship is the basis of production of ethnomusicological knowledge. Asks if the difference is real.
    - On the other hand, music theory tends to produce sameness, concentrates on European repertory, uses systematic methods, doesn't consider context, and encourages hegemony (p. 174). Some rapprochement between ethnomusicologists and theorists would be fruitful.
    - Knowledge of African language crucial to understanding music (e.g., translate song texts, interpret drum language, conceptualization of performance, etc.). Many Western scholars don't have this background.
    - This short-term fieldwork sponsored by Western institutions is considered more prestigious/valuable while knowledge acquired informally over long periods of time is not valued. This disqualifies Africans from fieldwork-enabled scholars and reduces them to informants.
    - Many Western ethnographers engage in autobiography, which can deteriorate into narcissism over one person's isolated experience. African scholars Nzewi, Nketia, Euba, Mensah tend to take a more distanced stance.
    - Amusing (alarming) account of Agawu's analytical article for *Ethnomusicology*, which suffered multiple rejections for analyzing music "recorded by others" rather than by oneself in the field, in a "Western" fashion.

- Analytical issues:

    - Issues with transcription: sub-traditions of similar music might be transcribed as 2/4 or 6/8. Africans have accepted the limitations of staff notation, but work with it for pragmatic reasons; it is the Westerns who insist on other solutions.
    - Examples of hierarchic melodic/tonal organization in African music found by Hornbostel, Blacking. However, some argue that a Schenkerian approach to African melody is inappropriate as it represents "intellectual imperialism." Cites Jonathan Stock as recognizing the problems and possibilities of a reductive analysis.

- Myths about African music:

    - The marking of African music as "rhythmic" is a Western construct; problems with invented notational forms by Pantaleoni and Koetting; the importance of indicated timbre or neutralizing downbeat emphasis is not unique to African music. Koetting's creation of TUBS notation to avoid time signatures and bar lines is questionable because meter also exists in African music (as evidenced by dancing); Koetting simplifies and creates another set of problems. It makes more sense to use commonly accepted notation. Other transcribes (Jones) can't tell the difference between metrical and word accent.
    - Agawu discusses a topoi of rhythmic patterns in terms of foreground vs. background: alignment/nonalignment between metrical structure and grouping structure (citing Temperley). Discusses problematic writing about polymeter (often confused with polyrhythm) and additive rhythm (depending on how one notates it, a clave can be divisive or additive), attributing it to "(Western) power-based constructions of knowledge motivated by a search for self through imagined differences," p. 95.
    - African music is described as functional, needing a social context, vs. (Western) art music without such functions. He analyzes some songs as being purely "contemplative" musics, looking at the interaction of language and music. He argues that this "functionality" of African music is a Western idea constructed out of the need for difference. Also points out the problems of referring to "call-and-response," which in performance practice could be "cutting," "catching," "throwing," etc. He argues that ethnomusicologists with fieldwork "experience" should not have a monopoly on the interpretation of African music, given its diversity and richness.

- Discusses the undervaluation of African popular music by both African and Western scholars. Western scholars value "traditional" music over "Westernized" forms; Africans value Western art music over indigenous music. Analyzes several highlife (West African popular music) examples, looking at (multiple) language choices, rhythms, form, chord schemes and modality, melodic shape, etc. Mentions that highlife listeners and players have internalized functional harmonies so that they are part of their first-order musical language (i.e., African practice); points out the need to beware of histories that value origins or postmodern critiques in paradox, intertextuality, etc. that try to characterize the present as more complicated.

- "We must reject ethnomusicological cautions about analysis because their aim is not to empower African scholars or musicians but to reinforce certain metropolitan [hegemonic] privileges. Analysis matters because, through it, we observe at close range the workings of African musical minds. Given the relative paucity of analyses, erecting barriers against one or another approach seems premature," p. 196.

❖ Martin Scherzinger. 2001. "Negotiating the Music-Theory/African-Music Nexus: A Political Critique of Ethnomusicological Anti-Formalism and A Strategic Analysis of the Shona Mbira Song Nyamaropa." *Perspectives of New Music* 39/1: 5-117.

- A very long article covering much of the same ground as Agawu. Points out mistakes made by Paul Berliner in analyzing mbira music (in identifying the lowest pitch on the instrument as tonal center; referring to a "clash of rhythms"). Explains differences in tunings, the problems of transcribing something that is improvised. Comes up with a graphical mapping to explain recurring patterns. Constructs dyad cycles. No conclusions.

❖ Willie Anku. 2000. "Circles and Time: A Theory of Structural Organization of Rhythm in African Music." *Music Theory Online* 6/1.

- Taking the rhythmic cycle/timeline of African music, Anku describes rhythms in a set-theory-like way (i.e., [22211], where each number denotes duration of a strike) to identify similar, but rotated, forms across three African cultures. Clear and easy to read. Lauded by Agawu.

### § 15.3 INDIAN MUSIC

❖ Lewis Rowell. 2000. "Scale and Mode in the Music of the Early Tamils of South India." *Music Theory Spectrum* 22/2: 135-56.

- A highly problematic article where the author attempts to reconstruct ancient Tamil scales, for which there are no transcriptions, pictures, diagrams or other documents explaining the musical system other than verbal, narrative description. Somehow, he concludes that "Tamil scales were diatonic, with none of the chromatic tunings of the Persian scales" and "no hint of the equidistant scales and more restrictive sets of modal rotations" of Southeast Asia. He draws this conclusion out of assumptions for maximally even sets made in an earlier article in *Spectrum* by Clough, Douthett, Ramanathan, and Rowell in 1993. He goes on to conclude that "the most appropriate comparisons are to the modes of the medieval Roman Catholic Church and the scales of ancient Greece and India." (How can this be inferred?) He then describes the rotations of these modes as related to the zodiac; diatonic rotations; pentatonic rotations. He then claims that the Tamil system shows us that diatonic and pentatonic systems are not separate orders; that there is a numeric pathway through the nested pitch collections from 22 to 12 to 7 to 5; that scale degrees can fall within a band of tolerance within which there can be considerable variation; rotation as a universal tactic of modality (I'm not sure that's true – e.g. Bali); that the mixolydian and dorian are proto-diatonic constructions; that the modes have spatial and temporal connotations; and that humans arrange music in relative step sizes and that perfect intervals are the building blocks of melody (not so in Java). He then mentions Indonesia and its "spectacular ability to resist the charms of diatonicism" (but Java has two sets of scales, pelog and slendro, and tunings differ widely throughout Indonesia). He also makes some statements that can easily be regarded as colonialist ("scale-building—like evolution—seems to operate by natural selection"… "No doubt we hear many fossils in some world musics today").

- ❖ Robert Morris. 2001. "Variation and Process in South Indian Music: Some Kritis and Their 'Sangatis.'" *Music Theory Spectrum* 23/1: 74-89.

    - A detailed analysis of a short part of a kriti. Morris first points out the difficulties in analysis: Indian notation needs intimate knowledge of performing practices to understand; much melodic ornamentation; rhythms based on additive rhythmic cycles called talas; the profusion of ragas which have different numbers of pitches and different ascents/descents; different characteristic motives, stressed pitches, with many affect/time of day/seasonal associations. He then explains the form of the kriti, puts Carnatic notation into Western notation, and breaks down the first part of the kriti (pallavi), describing the process of variation through motives. Discrepancies between notation and performance are noted. The article is essentially descriptive and draws on other work done by Indian scholars.

- ❖ Morris, Robert and Chitravina N. Ravikiran. 2006. "Ravikiran's Concept of Melharmony: An Inquiry into Harmony in South Indian Ragas." *Music Theory Spectrum* 28/2 (Oct): 255-276.

    - As with above, the analysis is adequate in and of itself, but I doubt its value. The authors take the 72 scales of the melakarta, assign set-class names, divide them into species, and postulate how two melodic patterns of the same scale/species may fit together and form chords. This is all very well and logical, but it doesn't relate to existing music or practice (Indian music is heterophonic, typically one soloist plus drones). The authors try to justify the value of the article by referring to "world-beat" or "fusion," but I highly doubt musicians of such improvised genres will think this way or use this as a template.

    - Morris also has an article in Tenzer's *Analytical Studies of World Music* (see below), where he uses contour theory to analyze kritis. I find this problematic, as a number of different ragas can have characteristic phrases with the same contour, but different pitches, and will be heard and recognized as being aesthetically different. (Ragas are distinguished by pitches used going up and coming down, which often differ and can double back in the descent; characteristic phrases; relatively important notes; etc. These features have accorded ragas different aesthetic meanings: light vs. serious, morning vs. night, season, affect, etc.).

### § 15.4 ADDITIONAL READING

Nazir Jairazbhoy. 1971. *The Ragas of North Indian Music: Their Structure and Evolution.* Middletown: Wesleyan University Press. Monograph explaining North Indian ragas in terms of circles of fifths instigated by the need to resolve tritones.

Peter Manuel. 2002. "From Scarlatti to 'Guantanamera': Dual tonicity in Spanish and Latin American Musics." *Journal of the American Musicological Society* 55/2: 313-38. Observes that many Hispanic musics end on V and postulates (I think problematically) that these musics think of V as I, as in the Phrygian scale.

Peter Manuel. 1998. "Improvisation in Latin Dance Music: History and Style." In *In the Course of Performance: Studies in the World of Music Improvisation*, ed. Bruno Nettl. Chicago: University of Chicago Press. Transcription of Latin jazz/salsa piano solo by Larry Harlow.

Peter Manuel. 1988. *Popular Musics of the Non-Western World: An Introductory Survey.* New York: Oxford University Press. This book contains explanations of many non-Western popular music genres, along with transcriptions.

Peter Manuel. 1985. “The Anticipated Bass in Cuban Popular Music.” *Latin American Music Review* 6/2: 249-61.

Helen Myers, ed. *Ethnomusicology: An Introduction*. New York: W. W. Norton & Co., 1992. Chapter by Ter Ellington on transcription outlines the issues and the solutions; Stephen Blum’s chapter on analysis of style is a literature review of different approaches taken.

Michael Tenzer 2006. *Analytical Studies in World Music*. New York: Oxford University Press. Each chapter analyzes a different music: Persian song by Stephen Blum; flamenco by Peter Manuel; Afrocuban drumming by Robin Moore; Balinese gamelan by Tenzer; Shanghainese opera by Jonathan Stock; and a controversial analysis of South India kriti using contour theory by Robert Morris.

Michael Tenzer. 2000. *Gamelan Gong Kebyar: The Art of Twentieth-Century Balinese Music*. Chicago: University of Chicago Press. About half ethnographic and half analytical, the book includes an excellent analysis of the form of Balinese gamelan gong kebyar and a detailed categorization of kotekan (Balinese part-writing) patterns. Probably the best analytical monograph I know on a non-Western genre. Author is a member of both SMT and SEM.

Bell Yung. 1989. *Cantonese Opera: Performance as Creative Process*. New York: Cambridge University Press. Cantonese opera and the relation of speech tones to melody (which is improvised); also wrote monograph on the work of Charles Seeger. The dissertation version has more transcriptions.