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What is Tonality?

Zusammenfassung: Was ist Tonalität? *Der Aufsatz arbeitet ein Bild des Wesens der Tonalität heraus, das nach Ansicht des Verfassers in George Perle's Werk über die nach-diatonische Musik impliziert ist. Es ist eine Grundprämisse dieses Werkes, daß die weit verbreitete Annahme, Tonalität sei eine Frage der Bezogenheit auf einen Zentralton oder eine solche der Dreiklangsharmonik, verfehlt ist. Perle hat jedoch nirgends eine alternative Kennzeichnung angeboten. Nach Ansicht des Verfassers ist es Perles implizierte Meinung, Musik sei tonal, wenn ihre vordergründigen Ereignisse und ihre Erfindung erschöpfend auf einen einheitlichen, präkompositionellen Hintergrund beziehbar sind.*

1. Introduction.

It is, I should think, well known that George Perle holds the following negative views on the nature of tonality: it is not, as is usually supposed, a matter of "tone-centeredness," whether based on a "natural" hierarchy of pitches derived from the overtone series or an "artificial" precompositional ordering of the pitch material;[1] nor is it essentially connected to the kinds of pitch structures one finds in traditional diatonic music (viz., major and minor scales and triads). That the diatonic system, with its tone-centered keys and modes, is not the only precompositional ordering of the pitch material capable of serving as the basis for the composition of tonal music is a point Perle has argued for

1 According to Dalhaus (1980) (pp. 51-52), for example, "In common usage the term ['tonality'] denotes ... a system of relationships between pitches having a 'tonic' or central pitch as its most important element." Cf. Lerdahl and Jackendoff (1983) (p. 294):

> A preliminary examination suggests three elements that enter into the definition of a tonal system: a pitch collection, or scale, a member of the pitch collection designated as tonic, and a measure of relative stability among members of the pitch collection, particularly with respect to the tonic.

and Holland (1994):

> The arguments for atonality's inevitable self-defeat are familiar. One is the 20th-century listener's learned and possibly innate impulse to hear fundamental attractions of one tone to another, which is the basis of tonal language.

many years. It is a foundational premise in his work as a composer and a theorist.

Given this premise, it is natural to ask: what, then, is meant by "tonal"? If tonality is not a matter of tone-centeredness or triadic harmony, what *is* it a matter of? On what conception of tonality could non-diatonic, non-tone-centered music be *tonal*?

Perle has nowhere given explicit, systematic answers to these questions. I believe, however, that he does have a positive view as to the nature of tonality and the possibility of non-diatonic tonal music. Though aspects of this view will be familiar from Perle's theoretical writings, the full account remains largely implicit. It is my purpose in this paper to give an explicit formulation of what I take Perle's conception of tonality to be.

I take this conception, briefly stated, to be the following:

What it is for music to be tonal is for it to be in *a* tonal system.

Given this definition, it follows that if the traditional diatonic system is not the only possible tonal system that music can be "in," diatonic music is not the only possible tonal music. The complete statement of the view will thus involve specifying what a tonal system is, and what it is for music to be "in" one, such that non-diatonic music can be tonal. The bulk of this paper will be devoted to discussion of these issues. In the last section, I will return to our main question and formulate an answer in more detail.

2. Tonal systems.

A tonal system is a precompositional ordering of a given harmonic vocabulary. However, it is Perle's view that not every precompositional ordering of any harmonic vocabulary is a tonal system. In this section we will see what more is required – i.e., under what conditions, according to Perle, a precompositional system is a tonal system.

Let us say that the *foundation* of a tonal system consists of a *basic scale-type* and a *constructive principle* for deriving chord-types from the basic scale. Thus, for example, in the diatonic system, the basic scale-type is the *diatonic scale*, and the principle for constructing chords is what we may call the *triadic principle* (triads are derived by filling in the fifths of the scale with the intervening scale degree a third above their roots).

Now, I believe it is Perle's view that a precompositional system is *tonal* if its constructive principle is itself derived from the basic scale *and* determines the overall systematic organization of the harmonic vocabulary it generates from that scale. Let us say that a precompositional system constructed in this way is *unified*. Thus:

A precompositional system is tonal if and only if it is unified.

In the diatonic system, the *fifth* plays the role of pervasive constructive principle. The diatonic scales themselves are reorderings of seven-note segments of the cycle of fifths,[2] and the triads are derived by filling in those fifths with intervening scale tones. Moreover, the tonalities (C major, G major, etc.) are defined by functional relations among their constituent triads (tonic, dominant, etc.) which are based on fifth-relationships, and fall into large-scale structural configurations by fifth.[3] The tonality of the diatonic system depends upon the unity of materials and relationships that results from the employment of a single generative principle. Thus, Perle:

> In the traditional tonal system every simultaneity and every progression is referable to a single type of chord structure, the triad, and to the complex of functional relations postulated in the concept of a "key center." (Perle (1977), p. 162);

and:

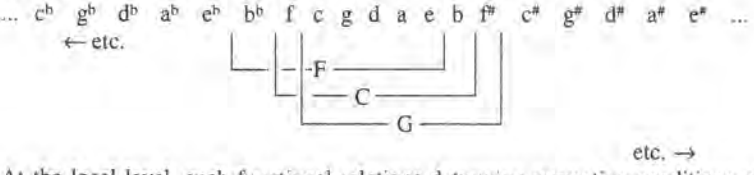
> The structural function of transpositions at the fifth in diatonic music does not depend upon the "natural" character of this interval but upon the fact that in the diatonic system a hierarchy of relationships is generated by such transpositions (Perle (1981), pp. 116-117).

In the case of Perle's twelve-tone tonal system, the basic scale is the semitonal (chromatic) scale, and the pervasive structural principle is *symmetry*:

> Symmetry is as central to what I call twelve-tone tonality as the triad and key center are to the major/minor system, and the meaning I impute to the term "tonality" in "twelve-tone tonality" derives only from the presence of an analogously central and all-pervasive principle and not from any other shared properties of the two systems, though there certainly are such shared properties (Perle (1990), p. 190).

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2 That is:



3 At the local level, such functional relations determine normative conditions on *progression*; at larger-scale levels, the same relationships determine normative conditions on *modulation*.

The principle of symmetry is naturally implied by the semitonal scale, which is symmetrical in two respects: it divides the octave by equal intervals and it is self-invertible.[4]

The symmetry inherent in the semitonal scale implies a new kind of musical equivalence. Whereas in the diatonic context there is only *intervallic* equivalence, in the twelve-tone context there is also *inversional* equivalence. Any two pairs of notes the same distance apart are recognized as falling into an equivalence class with respect to their interval. The complete collection of all transpositions of all intervals (i.e., the twelve interval equivalence classes) can be derived from parallel alignments of semitonal scales. Thus, for example, the following alignment produces all possible unisons (or octaves):

c c# d d# e f f# g g# a a# b c c# d d# (etc.
c c# d d# e f f# g g# a a# b c c# d d# (etc.

Example 1

Successive realignment of these scales, effected, for example, by moving the upper scale one place to the left, yields the twelve intervallic equivalence classes. Each such alignment of paired parallel semitonal scales is called a *difference scale*. Example 1 is difference scale 0; a shift of the upper scale one place to the left converts Example 1 to difference scale 1 (see below).

If semitonal scales of *opposite* aspect are aligned, a set of twelve *inversionally* related dyads is produced. Whereas intervallically equivalent dyads will have the same *difference*, where difference is determined by subtracting pitch-class numbers (e.g: 3(e♭) - 0(c) = 3; 4(e) - 1(c#) = 3; etc.), inversionally related dyads will have the same *sum*, where sum is determined by *adding* pitch-class numbers. Thus, the following alignment produces all dyads of sum 0 (0(c) + 0(c) = 0; 1(c#) + 11(b) = 0 (=12); etc.):

4 It is also divisible into uni-intervallic self-invertible *subscales*, or "interval cycles," in five different ways, viz.:

The 12 pitch classes (interval-0 cycle)	(12 partitions)
The whole-tone scale (interval-2 cycle)	(2 partitions)
The "diminished seventh chord" (interval-3 cycle)	(3 partitions)
The "augmented triad" (interval-4 cycle)	(4 partitions)
The tritone (interval-6 cycle)	(6 partitions)

Cycles other than the interval-1 (semitonal) and interval-7 (perfect-fifth) cycles require "partitions" (non-equivalent transpositions) to exhaustively subdivide the semitonal scale. The interval cycles figure prominently in the derivation of chords from the basic scale in twelve-tone tonality (see the text below for discussion).

c c# d d# e f f# g g#a a# b c c# d d# (etc.
c b b♭ a a♭ g g f e e♭ d d♭ c b b♭ a (etc.

Example 2

Successive realignment of *these* scales yields the twelve inversional equivalence classes. The points where the aligned cycles cross are the *axis of symmetry* of the dyads in the equivalence class. Each alignment of paired semitonal scales of opposite aspect is called a *sum scale*. Example 2 is sum scale 0; a shift of the upper scale one place to the left converts Example 2 to sum scale 1.

This new kind of equivalence is the basis for the harmonic organization characteristic of twelve-tone tonality.[5] The principle of symmetry operates as the constructive principle at all levels of the system, from the derivation of the basic chord-type to the determination of the broadest structural features.

In diatonic tonality, all simultaneities are derived from the diatonic scale, according to the triadic principle. In twelve-tone tonality, all simultaneities are derived from symmetrical alignments of the semitonal scale, via pairings of a special kind of twelve-tone set called a *cyclic set*.

A cyclic set is an ordered collection of the twelve pitch-classes whose alternate elements are members of inversionally complementary cycles of a given interval. For example, the following set consists of two interlocking inversionally complementary cycles of interval 7 (ascending cycles are boldface):

c c **g** f **d** b♭ **a** e♭ **e** a♭ **b** d♭ **f#** g♭

Example 3

This set is also derivable from the symmetrical alignment of semitonal scales presented in Example 2 by reading successive columns a perfect fifth apart consistently from top to bottom (the inversionally related "cognate set" results from reading the same dyads bottom to top). Each of the 78 distinct possible cyclic sets is derivable in a similar way from one of the twelve symmetrical alignments of semitonal scales. Such sets are identified by the repeating pair of sums (in Example 3, 0 and 7) generated by the pairing of interval cycles.

Any two cyclic sets may be paired to form what Perle calls an *array*. An array consists of all of the alignments of the sets, each of which generates a collection of 12 symmetrically related chords. For example, consider the pairing

5 The musical significance of sum-equivalence (symmetry) was also appreciated by Bartók and Berg, among others. (See, e.g., Perle (1955) and (1989) for discussion.)

of the set in Example 3 with the following set, also based on the interval-7 cycle:

d **d** g **a** c **e** f **b** b♭ **f#** e♭ **c#** a♭ **g#**

Example 4

in the following alignments:

f g **c** c **g** f **d** b♭ **a** e♭ **e** a♭ **b** d♭
d **d** g **a** c **e** f **b** b♭ **f#** e♭ **c#** a♭ **g#**

Example 5

g **c** c **g** f **d** b♭ **a** e♭ **e** a♭ **b** d♭ **f#**
d **d** g **a** c **e** f **b** b♭ **f#** e♭ **c#** a♭ **g#**

Example 6

All alignments which pair cycles of *opposite* aspect, as in Example 5, are called *sum alignments*. All alignments which pair cycles of identical aspect, as in Example 6, are called *difference alignments*.

Any vertically aligned dyad of an alignment may be paired with its two neighboring dyads to form a six-note *axis-dyad chord*, the basic chord-type of twelve-tone tonality. Any two of the 144 axis dyad chords of an array (the sum alignments and difference alignments generate the same set of axis-dyad chords, in different orderings) will be symmetrically related, and each such chord will represent the array from which it is derived. For example, in the chords in Example 7, taken from the alignment in Example 5:

f g **c** **a** e♭ **e**
d **d** g b♭ **f#** e♭

Example 7

the central dyads (viz., g/d and e♭/f#) are sum 9, and the neighboring dyads (viz., f/d, c/g, a/b♭ and e/e♭) are sum 7. Thus, these chords are "symmetrical transpositions" of each other.[6]

6 It is very important to recognize that the principle of symmetry operates to generate symmetrically *related* – not symmetrically *structured* – chords. Thus, though symmetrical chords are available in twelve-tone tonality (chords of *any* structure are

The arrays themselves fall into symmetrically structured families[7] *em* though the systematic significance of such families (and the families *they* fall into) is at present not completely clear. What *is* clear, however, is that the source of all of the structural features specifically characteristic of twelve-tone tonality must be the symmetrical relations exhaustively expressed in the alignments of semitonal scales represented by Example 2. Twelve-tone tonality is a tonal system because it is *unified*, by the principle of symmetry.

3. Music in a tonal system.

I claimed above that it is Perle's implicit view that music is tonal if it is "in" a tonal system. In section 2 I defined a tonal system as a precompositional ordering of harmonic material derived from a basic scale in accordance with a single unifying principle implied by that scale. Now, I think Perle also has a conception of what it is for music to be *in* a tonal system. I take this to be the following:

Music is in a tonal system only if (i) it is possible to distinguish between foreground and precompositional system with respect to it, yet (ii) all of its foreground events are referable to the precompositional system.

The second clause of this formulation is implied by the passage from Perle (1977) quoted above:

> In the traditional tonal system every simultaneity and every progression is referable to a single type of chord structure, the triad, and to the complex of functional relations postulated in the concept of a "key center."

It seems obvious that the same will be true of compositions: the first movement of Beethoven's Seventh Symphony, for example, is *in A major* because all of its constituent simultaneities and progressions (and, I would add, its *design*) are referable to the set of triads and functional relations that constitute the key of A major. Moreover, it is thereby "in" the structure of interrelated tonalities we call the diatonic tonal system.[8]

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available), there is no necessity that symmetrical structures appear on the surface of twelve-tone tonal music. To say that there is a basic "chord type" in twelve-tone tonality refers to the constructive principle, and not to a particular kind of intervallic structure that uniformly results from its application.

7 Arrays consist of sets of chords with common axes of symmetry; families of arrays will be grouped around higher-order axes of symmetry.

8 There is at present no analogue in twelve-tone tonality to the *tonalities* (sets of functionally related triads) of the diatonic system; nor is it clear that there will or should be such analogues.

That Perle takes referability of foreground events to a precompositional system in itself *not* to be sufficient for tonality is evident from his criticisms of Schoenberg's twelve-tone music.

Clearly, given the complex of a tone row, its transforms and transpositions as a precompositional system, the events of a composition in strict compliance with Schoenberg's serial technique will all be referable to it. Yet, Perle argues, "[t]he tone-row as employed by Schoenberg provides no substitute for the tonal basis of [the diatonic tradition]" (Perle (1952), p. 280).

The problem is, it would seem, that Schoenberg's method does not allow for foreground/system differentiation in compositions based on it. This is due, ultimately, to the fact that the totality of Schoenbergian row-complexes is not a *tonal* system: it is not *unified* by a pervasive constructive principle. Given the kinds of orderings of the twelve pitch-classes permissible as basic sets in Schoenberg's system, any internally derived principle for the generation of simultaneities will produce chords that exhibit no consistent, predictable precompositional relations. Thus, in spite of Schoenberg's intention that the twelve-tone row provide a precompositional frame of reference in which any tone and its neighbor notes become an identifiable harmonic unit through constant association (see Schoenberg (1975), p. 246), Perle argues, "[t]he principle of verticalization provides no basis for a total and systematic control of the harmonic dimension when it is applied to the general Schoenbergian set..." (Perle (1977), p. 25).

Chords constructed on the Schoenbergian set will be related to each other only because they are derived from the same row. They will maintain their identity and coherence in a composition only through constant explicit association with their source sets. This will necessitate constant surface reiteration of the precompositional materials, resulting in a failure of foreground/system differentiation:

> The Schoenbergian series was simply a disguised twelve-tone ostinato. It was almost like defining the tonality of a piece in E major simply by playing the scale of E major over and over again (Perle (1990), p. 133).

> Schoenberg's confusion between the motival and extra-motival functions of the row often makes it impossible to distinguish between the theme and its frame of reference (Perle (1952), p. 281).

In contrast, if *cyclic* sets are used, derived chords will have systematic identity and relations in virtue of their pitch-class content alone, and there will be no need for explicit association of simultaneities and their source sets.[9]

9 Recall that axis-dyad chords represent the arrays from which they are derived,

If precompositional structures and relations are to be *exploited*, and not just *presented*, they cannot be merely stated on the surface of the music. Thus:

> [T]o move from the abstract precompositional structure of triadic and tonal relations to the composition itself means to interrupt and then to restore those relations. The same thing is true of symmetry in twelve-tone tonality. It is only in the precompositional array that this symmetry is always literally and uninterruptedly unfolded. The compositional interpretation of the precompositional symmetrical array constantly interrupts and restores that symmetry (Perle (1990), p. 190).

Precompositional relations are "interrupted" insofar as they are not literally stated; they are "restored" insofar as surface events are nonetheless referable to them.[10]

The differentiation of precompositional system and musical surface necessary for tonality – let us call this *dimensionality* – is thus possible only in the context of a *unified* (tonal) precompositional system; for only in such a context can precompositional relations be non-literally restored.

4. What tonality is.

Tonal music is music that is *unified* and *dimensional*. Music is unified if it is exhaustively referable to a precompositional system generated by a single constructive principle derived from a basic scale-type; it is dimensional if it can nonetheless be distinguished from that precompositional ordering.

I take this answer to our main question to be implicit in George Perle's work as a theorist and composer. This work thus represents at once a deep generalization about the nature of tonality and an application of that generalization in the construction of a new tonal system and the composition of a new kind of tonal music. Its importance lies not merely in the insight it provides into the nature of tonality, but in its inauguration of a *new compositional practice* which appears to be as rich in possibilities as the practice it supersedes.

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through their dyadic content.

10 My interpretation of Perle's remarks here is supported by the following comment on Scriabin's use of the octatonic system:

> Scriabin's compositional exploitation of the new hierarchical relations and new referential harmonic structures sometimes tends to be literal and mechanistic. ... It is almost as though he were so intoxicated with the excitement of his discovery of a new tonal system that he sometimes forgot that to *compose* means something more than the literal surface restatement of background structural relations (Perle (1984), p. 116).

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