Atonality, Information, and the Politics of Perception

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When we speak of *tonality* we are referring to a perceptual phenomenon—one in which the relationships within a collection of tones orient that collection toward some single most important tone, the *tonic.* This phenomenon is hierarchic. The root of a chord, a scale degree reinforced by a secondary dominant, and the key center of a phrase are all manifestations of tonality, but at different levels of structure. Although attempts have been made to establish an acoustical foundation for tonality,[1] there is evidence that tonality is a learned response to a collection of musical data.[2]

Tonality lies at one end of a continuum whose other extreme is *atonality*. Finding a precise definition of atonality is problematic. George Perle has felt that "it is impossible to state the fundamental conditions of atonality *in general,* except in a negative way, merely stipulating the absence of a priori functional connections among the twelve tones of the semitonal scale, . . . "[3] while Roger Sessions has equated it with "music that one does not find intelligible."[4]

In the following pages I'll make a case for atonality as a condition of human data processing, describe how the mind works to overcome that condition, and then go on to discuss how cultural factors influence musical perception.

The Appearance of Atonality

Memory mechanisms. There is general agreement among psychologists that we possess two memory mechanisms: *long term memory* and *short term memory.* Long term memory is a more or less permanent storage of data that we have previously experienced and assimilated. Short term memory is a temporary storage that enables us to hold incoming data for a few seconds while we attempt to process and assimilate it.

Although long term memory has no practical limit to the amount of data it can store, there is a definite limit, or *channel capacity,* for short term memory. The channel capacity is approximately seven perceptual units.[5] It is possible for input to exceed our channel capacity, crowding data out of short term memory before we have fully dealt with it. This occurs when the rate of input is high, when the input is complex, or both.

In formation. Complexity can be described in terms of information theory. As used here the word 'information' is a technical term, differing in meaning from our everyday use of the word. Let us approach its definition by way of a musical example that's pertinent to our discussion. Suppose that the harmonic vocabulary of a composer includes sonorities *m* and x. When he uses sonority *m* he resolves it rather freely, sometimes going to *n,* sometimes to *o,* sometimes to *p.* sometimes to *q*, etc. But when he uses sonority *x*, he treats it much more strictly: it only resolves to *y* or *z.* Sonority *m,* offering a greater number of choices for continuation, is said to be higher in information than sonority x, whose consequents are very restricted. Information is, then, a measure of the randomness with which one harmonic event is followed by another. The information of an event can be expressed mathematically, but for our purposes that is not necessary.[6]

The informational value that a harmonic event holds for the listener arises from the composer's *harmonic style* taken in the context of the listener's *musical experience*.

> *Each musical style, and within it each better-than-average composer has its (or his) own inventory of forms and internal structures (equivalent to certain probabilities of symbol combinations). Likewise, every listener has his inventory of forms and structures derived from his listening experience. For music to be understandable semantically, the composer's. . . inventory of forms and structures must coincide with that of the listener . . . to a certain degree. . . .*[7]

To the extent that a musical event matches the listener's inventory with respect to its content and usage, it has low informational value for him.

Dissonance and in formation Harmonic structures fall into two broad categories: those comprised of all consonant intervals and those containing one or more dissonant intervals. A further division can be made in the case of structures that contain dissonant intervals. On the one hand, there are harmonies in which the dissonant interval results when a *non-chord tone* sounds simultaneously with members of a consonant chord. On the other hand, there are actual *dissonant chords* in which some member of the chord is dissonant with some other member.

Throughout much of Western music history these dissonant structures have contributed to the intelligibility of music. This is because composers have traditionally treated dissonances in a more restricted and, therefore, predictable way than consonances. While consonances have freely moved to either a consonance or a dissonance, dissonances—generally speaking—have moved only to a consonance, with the dissonant tone resolving by step.

Since the listener easily learned to anticipate the consequence of a dissonance, dissonance had low informational value for him. This was particularly true with regard to dissonant chords like the major-minor seventh, the half-diminished seventh and the French augmented sixth; by the early 1800s they received such stereotyped treatment that the resolutions of their constituent tones were highly predictable. In the following decades, however, significant changes occurred in composers' treatment of dissonance.

The changing role of dissonance. One change in dissonance usage concerned the treatment of non-chord tones. It became increasingly common for a composer to use several non-chord tones in succession. A representative example, taken from Frederic Chopin's *Ballade in F Minor, op. 52* (1842), is given in Figure 1 and shows a circled succession of three dissonances. This kind of writing violated the harmonic norms of previous musical styles and left the listener with some uncertainty about the path the melody would follow.

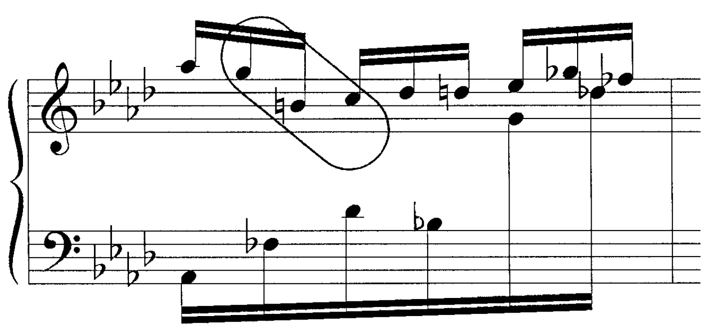

Figure 1

Another change concerned the treatment of dissonant chords. Previously these chords resolved predictably, but now they progressed to chords unanticipated by any listener who used the norms of earlier music as a frame of reference. Moreover, the chords progressed to were themselves dissonant, as shown in Figure 2, a reduction from the "Prelude" to Richard Wagner's *Tristan and Isolde (1857-59).*

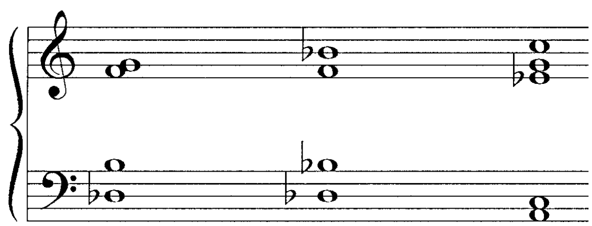

Figure 2

A third change of great importance appeared when composers began to experiment with new kinds of dissonant chords. An early example of this is the opening of Hugo Wolf's *Das Ständchen* (1888), shown in Figure 3. Chords like these were foreign to the listener, who had not heard them in earlier music and had little basis for anticipating their movement.

Figure 3

This kind of harmonic organization became more prevalent. And a few years later works appeared in which consonant sonorities all but disappeared, being replaced by experimental dissonances—works like the first movement of Arnold Schoenberg's *Three Pieces for Piano, Op. 11* (1909).

In the period from Chopin to Schoenberg, an evolutionary process was going on: the communicational function of dissonance was undergoing a reversal. Originally a contributor to intelligibility because of its low information role, dissonance was now contributing to perceptual confusion because of its new role as an element of high information.

Information and short term memory. As dissonance increased in information, it occupied a greater "space" in short term memory. And since there was more dissonance present in the newer music, the listener was bombarded with it to the point where the input rate surpassed the output rate. Channel capacity was exceeded and data was forced out of short term memory before it could be fully processed and assimilated.

Musical relationships arise from a succession of events unfolding in time. Since these events are not physically simultaneous, the relationships that they create are perceived when we associate the events in short term memory.[8] It then follows that to perceive a collection of tones as *tonal*, we must be able to maintain that collection in short term memory—an inability to recall the collection precludes our detecting any relationships within it. *When unprocessed data is continuously crowded out of short term memory, we perceive atonality.*

The Reappearance of Tonality

Changing perceptions. After a musical style has been in existence for a time, the perception of it changes—first for a few individual listeners and later for the general listening public. Chopin's music was once characterized as "a motley surface of ranting hyperbole and excruciating cacaphony,"[9] but we don't hear it that way today. Nor do we regard Strauss, Reger, Mahler, and Debussy as atonal composers, although the term was originally applied to their music.[10]

These changing perceptions can be explained. In our daily lives we are subjected to vast amounts of sensory input. Nature has equipped us with a way to gain control of such input.

Patterning and channel capacity. When we first hear a musical work in an unfamiliar style, we try to match its materials with previous musical experiences that we have stored in long term memory. If we find no match, we seek out new patterns in its tones. (It may take many hearings before any pattern becomes apparent to us.)

As we have seen, the channel capacity of short term memory is limited to a more or less fixed number of perceptual units. The limit, however, is independent of the amount of data contained in each perceptual unit.[11] The amount of data that can be held in short term memory is a function of the way the listener patterns it. This is confirmed by Robert Lundin's report that in tests of melodic memory, the average span is five or six tones when the subject perceives the tones as unrelated, but increases to twelve or more tones when he perceives them in configurations.[12] Each pattern that we discover reduces the number of perceptual units to be dealt with: the mind combines separate tones into a conceptual unity. When data that originally occupied several perceptual units is patterned into a lesser number of units, space becomes available in short term memory for additional data.

Once we have found a pattern, further simplification is possible. We can isolate a significant tone of the pattern and let it stand for the whole pattern. This tone is the tonic. The process proceeds hierarchically, for we can then form a higher order pattern of significant tones and from that pattern isolate a higher order tonic.[13] This reduces the number of perceptual units still further and permits the extraction of a yet *higher order* tonic—a tonic that remained undetected until the tones of its generative pattern could be collectively maintained in short term memory. Because a higher order tonic cannot be isolated until there are patterns of lower order tonics from which to isolate it, tonality will first be perceived at the more basic structural units of motive and phrase. Only later can it be perceived at higher levels of structure.

The principles by which we pattern, the general tenets of Gestalt psychology, are consistent throughout humankind. They are tempered, however, by the unique musical experience of each person. Since this is so, the perception of tonic in a new musical style may be an individual matter until such time as cultural influences are brought to bear.

The Politics of Perception

When the general listening public finally accepts a musical style that it formerly rejected, it has changed the way it patterns musical information. But that patterning may not have been independently discovered by each listener. It may have stemmed from the experience of some one person, maybe a theorist or composer, who perceived a musical order that others had not yet noticed.

When such a person systematizes those new perceptions into a conceptual model of musical organization (perhaps superseding past models, perhaps including them as subsets of a more comprehensive musical view), those new perceptions can be explained others. If influential persons accept the new model as a guide, it can then make its way into the institutions of musical culture—conservatories, the community of performers, the musical press, the recording industry.

These institutions are the real disseminators of musical world views: they shape our notions about what there is to hear and from what perspective it is to be heard. This is not to say that they brainwash us; rather it is to point out that our hearing is mediated by generally accepted conceptualizations, which we adopt and impose on our individual musical experiences.

In the case of modern music, no perceptual model has yet won the general acceptance of the musical establishment—although models powerful enough to accommodate contemporary styles have been formulated.[14] This being so, we can attribute the continued perception of atonality not only to the public's insufficient exposure to contemporary music (exposure too limited to reveal the tonality that exists in complex music), but also to the institutional rejection of conceptual frameworks which, if applied, could bring about a revolution in musical perception.

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1. See, for example, Molly Malcolmson Gustin, *Tonality* (New York: Philosophical Library, 1969). Of interest also is Arthur Komar's review of Ms. Gustin's book in *Perspectives of New Music,* Vol. 8, No. I (Fall-Winter 1969), pp. 146-5 1.

2. Consider the following:
   a. Although the roots assigned to certain chords can be substantiated acoustically, the general population has difficulty hearing which of the chord tones is, in fact, the root; even for some musically sophisticated persons the task is not easy.
   b. If tonality is not learned, but an acoustical property of a collection of tones, then a given set of tones should always have the same focus. This is not always the case, however. The formation F-A-CD has been regarded by some theorists as centering on F, while others have felt that it centers on D. The founder of modern music theory Jean Phillippe Rameau in his *Traite de l'harmonie* of 1722 considered its focus to be on F in some instances and on D in others.
   c. Certain collections of tones imply a tonic not contained in the collection. The formation G-B-D-F, even when isolated from any musical context, will set up a tonic of C in the minds of many listeners. The most reasonable explanation of this is that through the repeated association of G-B-D-F with C, the listener has been conditioned to expect the latter when he hears the former.

3. George Perle, *Serial Composition and Atonality* (2d ed. rev.; Berkeley: University of California Press, 1968), p.1.

4. Roger Sessions, *Questions about Music* (Cambridge: Harvard University Press, 1970), p. 114.

5. See "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information," rpt. in George A. Miller, *The Psychology of Communication* (Baltimore: Penguin Books, 1969), pp. l4-44.

6. Claude E. Shannon and Warren Weaver, *The Mathematical Theory of Communication* (Urbana: The University of Illinois Press, 1964).

7. Werner Meyer-Eppler, “Musical Communication as a Problem of Information Theory,” *die Reihe,* VIII, ed. Herbert Eimert and Karlheinz Stockhausen (Bryn Mawr: Theodore Presser Company, 1968), p. 10.

8. Even in the case of an isolated chord it appears that one’s ability to comprehend its relationships is related to his ability to recall it after it has ceased to sound.

9. Nicolas Slonimsky, *Lexicon of Musical Invective* (New York: Coleman-Ross. *1953),* p. 84.

10. Rudolph Reti, *Tonality in Modern Music* (New York: Collier Books, 1962). p. 18.

11. Miller, “The Magical Number Seven.” p. 36.

12. Robert W. Lundin, *An Objective Psychology of Music* (New York: Ronald Press, 1953), p. 116.

13. An analogous hierarchy is the basis of traditional music theory: (a) two tones form an interval; (b) combinations of intervals form a chord; (c) chords having the intervallic structure or are inversions of a chord having the intervallic structure ; (d) a six-three chord and a six-four chord are inverted forms of a five-three chord; (e) each chord within the harmonic system can be assigned to a tonic, dominant or subdominant function class; (f) certain successions of chords "prolong" a single harmonic function; (g) a succession of harmonic functions creates a tonal center; and (h) a succession of tonal centers creates a higher order tonal center.

14. See Paul Hindemith, *The Craft of Musical Composition,* Book I, trans. Arthur Mendel (4th ed. rev.; New York: Associated Music Publishers, Inc., *1945).*