

Remarks on the Significance of Rules of Musical Style

Dalia Cohen

Department of Musicology
The Hebrew University of Jerusalem
91905 Jerusalem, Israel

Abstract

The present study explores the principles governing rules of musical style with respect to types of experiences derived from the different styles. The assumption is that the rules and experiences are related to each other on some universal level and that the types of experiences reflect aesthetic ideals of extra-musical frameworks (culture, era, region, etc.). Some of these ideals are related to other arts belonging to the same framework, where they are manifested in the same principles of stylistic rules, although the rules pertain to different media, depending on the specific art. The overall goal is to gain a deeper understanding of the principles and significance of musical rules—"learned" and "natural"—and of rules in other arts, as well as the significance of the specific choice of rules (whether conscious or unconscious) in different cultures and eras, and thereby to contribute to a precise formulation of stylistic rules in future studies, taking into account the many factors involved in shaping a style.

Background

Discussions of musical style refer mainly to three inter-related aspects:

1. Stylistic rules characteristic of the rules of organization on various levels that are shared by a group of pieces (e.g., rhythmic versus arhythmic; melismatic versus syllabic; monophonic versus polyphonic; pentatonic versus scales with many notes)

2. Extra-musical frameworks of pieces that are considered to have the same style, such as culture, region, era (*ars antiqua* versus *ars nova*; Baroque versus Renaissance style), function (church versus theatrical music; folk versus art music), the individual composer or even the specific piece, the specific musical instrument, and so on. In each framework the different levels of rules are important (the rules that differentiate between Bach's style and Mozart's do not relate to the raw material). Moreover, the choice of a framework is itself significant from the standpoint of the culture. In the West, for instance, unlike in most other cultures, the era, the individual composer, and even the individual piece are and have been extremely important, whereas in some other cultures the function and even the musical instrument are salient factors, making it possible at times to distinguish between these frameworks on the basis of the pitch framework, too. (In Japan different instruments had different scales and even different ways of teaching

solfège [Malm 1966]). Recently, however, there has been an increased tendency in some non-Western cultures to magnify the importance of the composer and even the individual piece (a special conference held in Cairo in the 1990s focused on this problem with respect to the "Great Arab Tradition"); in addition, Western culture and "world music" have had an impact.

3. The message or idea expressed in aesthetic experiences that are supposed to result from listening to pieces belonging to a particular stylistic framework: "calm style" (according to Palestrina [Reese 1959; Cohen 1971]) versus "agitated style" (Monteverdi [Stevens 1980]), "gallant style" (in the eighteenth century), static versus flowing, clear versus blurred, simple versus complex, and so on. Scholars have given this concept various names: *ideal* (Sachs 1946), *intention* or *poiesis* (Nattiez 1976); *the composer's voice* (Cone 1974); and *aesthetic ideal* or *ideology* (Meyer 1989). Here I have chosen to use the term *aesthetic ideal* (and sometimes *stylistic ideal*).

The concept of style is also related to the complex distinction between the "what" (the "content," or the material that is organized) and the "how" (the specific way the material is expressed or organized). It is customary to view any style as representing the rules pertaining to "how." Such a distinction prevailed in the theory of rhetoric that had a powerful impact on the classification of musical styles by sixteenth- and seventeenth-century theorists. It was emphasized by Kant (Mundt 1959) and served as a topic of discussion in connection with the significance of style in the visual arts (Philipson 1961; Shapiro 1961). Many scholars have explicitly objected to this distinction (e.g., Goodman 1975; Pascall 1980), but despite its limitations (since the two can be seen as complementary contrasts), it helps us compare arts. As for the "what," in all arts other than music, the "raw material" being organized (colors and shapes in painting, body movements in dance, words and ideas in literature) is familiar to us from non-artistic contexts, too, evokes emotional associations, and intervenes in the artistic experience (especially in literature). In contrast, in music much of the learned raw material—especially that based on the parameter of pitch, which makes possible extremely complex organization (pitch and interval systems, scales, chords)—is man-made, is not found in extra-musical contexts, and is culture-dependent (though not necessarily arbitrary!). In order for

us to produce it, someone has to have manufactured musical instruments that are useless outside music;¹ thus organization plays an extremely important role in music. (“Music has only style,” wrote Bruce Gustafson [1986, p. 811].)

Poetic style represents an interesting combination of verbal and musical organization in terms of the audible aspect of the words: Poetic meter, rhyme, and the ways these are organized on various levels on the time axis reflect musical rules.

Recitation style has to do with organization of the verbal material as expressed in the audible, prosodic layer—especially organization that relates to the ranges of occurrence and curves of change of the psychoacoustic parameters of pitch, duration, and intensity. These are commonly known as “intonation” or the “musical factors in speech,” and (along with syntactic symbols) they express the speaker’s emotional attitude toward the listener and the topic. In this case we can read the same text (which expresses specific emotions in the lexical layer) in different styles (with or without concurrence between the emotions expressed in the two layers) or we can read different texts in the same style. Research shows that the contours in the prosodic layer in speech are similar to those in music in terms of the types of emotions that they express (Bolinger 1972; Fónagy and Magdics 1972; Sundberg 1982; Cohen and Inbar 2000).

More and more studies on the characterization and classification of style are being conducted by computer scientists, musicologists, ethnomusicologists, and cognitive scientists, usually focusing on specific aspects of each individual style. Some of the studies are based on theories having to do with man-made, learned rules specific to musical material; others rely on various general theories such as information theory (e.g., Moles 1966; Rhodes 1995; Knopoff and Hutchingson 1983); Von Forster’s theory (Koppel, Atlan, and Dupoy 1992; Shanon and Atlan 1990), which concerns the way in which organization on a particular hierarchical level influences the possibility of organization on a more general level; and theories about the rules of symmetry (in the journal *Symmetry, Culture and Science*). The following are just a few of the topics relevant to characterizing musical style with respect to composition or performance: precise formulation of musical raw materials in different cultures (in Western tonal music [Balzano 1980; Agmon 1989]; in Chinese pentatonic music [Gouldin 1983]; in Vietnamese music [Keefe et al. 1991]); formulation of the rules of composition of specific periods or composers (the most precise formulation is in the rules of Palestrina counterpoint and the late sixteenth century);

¹ The organization of pitch that is familiar to us in the prosodic layer of speech is produced, of course, by the human voice. However, although these are very important, they are not defined quantitatively in terms of exact sizes (e.g., intervals) and do not allow for complex organization.

principles behind stylistic rules of various cultures (Cohen and Katz 2001); the relationship between characteristics of selected social frameworks and rules of musical style (Lomax 1968, regarding the “type of society”); factors contributing to specific emotions in musical performances (Gabrielsson and Juslin 1996; Sloboda 1991; Todd 1992); universal rules involved in determining units on various levels (Lerdahl and Jackendoff 1983; Boroda 1990; Singer 2004); perceptions of culture-dependency in differences and similarities between musical units (Cohen 2003); characterization of styles in various arts in various eras (Wölfflin 1950; Sachs 1946; Gjerdingen 1984); similar responses to rules of organization (symmetry/asymmetry, contour types, deviations from expectations, etc.) in music and the visual arts (Marks 1978; Bregman 1990).

Nevertheless, there has been no comprehensive discussion of the aesthetic ideals of the stylistic frameworks, of the variables relevant to determining types of experiences, and of the relationship between stylistic rules and the resultant experiences. Here I attempt to provide a general summary of important principles of organization (without going into explanations); the idea is for the summary to serve as assumptions in matters related to the topic of discussion: the variables of the aesthetic ideal; hierarchical levels in stylistic rules and their relationship with types of stylistic frameworks; learned and natural schemata; and especially principles of natural schemata that characterize various styles and types of experiences (and most of which are relevant to other arts as well).

Principles Governing the Characterization of Styles

The following principles relate directly to musical style. Nevertheless, some of them can be adapted to apply to other arts.

1. *The variables of the aesthetic ideal (or kinds of experiences)*: Each stylistic framework is guided by an aesthetic ideal manifested in three types of variables:

(a) The very existence or nonexistence of a deliberate relationship with the extra-musical world that is involved in determining the characteristics of a piece. The extra-musical factors can be described in terms familiar from non-artistic contexts, as in “functional” or program music. This affects our “listening mode” (Huron 2000). One of the characteristics of the differences between “Western” and “non-Western” (which are today being blurred) is the degree of connection with the extra-musical world; outside the West, there are numerous strong, predetermined relationships (Cohen 1987). The separation is manifested in two typical Western institutions: the museum and the concert hall.

(b) Excitement versus calm (in extremely general terms), or “ethos” versus “pathos” (the terms used by Curt Sachs [1946]). For example, stylistic changes in the various arts in the West represent cyclic movement between these two

poles (ars antiqua/ars nova; Renaissance/Baroque; Classical/Romantic). Interestingly, one characteristic of these two poles in the West is the degree of segregation between different arts. It is no coincidence that opera first appeared at the start of the seventeenth century, i.e., the beginning of the Baroque period.

(c) Types of directionality and complexity (Cohen 1994): (1) *directionality*—clear (when one can predict where the musical progression will go, when, and by what means, as in the Classical phrasing unit) versus suspensive (varying degrees of uncertainty); momentary (attention to the moment) versus overall (superstructure); (2) *complexity*—little versus a lot; momentary versus overall. For example, African music marked by complex polyrhythm has extreme momentary complexity but lacks overall complexity and directionality. The Classical sonata is characterized by a combination of maximum clear overall directionality and overall complexity. It was not by chance that harmony developed only in the West, since it makes possible overall directionality with complexity—one of the characteristics of the aesthetic ideal of Western tonal music. In contrast, in most non-Western cultures the overall organization is not complex and there is a strong focus on the moment. “Perpetuation of the moment” is also part of the aesthetic ideal of many twentieth-century Western pieces, which adopted some of the principles of non-Western music, as their composers even say explicitly.

2. *Hierarchical levels in stylistic rules*: The stylistic rules may be manifested on various levels of hierarchical organization, with each level imposing constraints on the options for organization on the next level (Shanon and Atlan 1990). In general, we can discern five main levels, each of which can be divided into sub-levels (Cohen and Granot 1995): (1) the raw material (regarding pitch, in the West we have the complete dodecatonic system, from which the seven notes of the diatonic system are selected, with the modes being obtained from these systems and the major and minor scales being selected from among the modes; in Arab music, we have the division of the octave into 24 equal parts, from which numerous heptatonic systems are obtained, with several *maqām* scales being derived from each system); (2) the various rules of composition (the rules of counterpoint, harmony, etc., in Western tonal music); (3) the rules of the specific piece (which represents one realization of the rules of composition); (4) the rules of performance (with each performance representing one possible realization of the written piece); (5) listening, i.e., perception and response to the rules of organization, dependent partly on age, knowledge, cultural background, and the individual traits of each listener and partly on the universal aspects of perception.

The principles governing rules of excitement or kinds of experiences are universal, but they are realized differently in different cultures due to “learned schemata” (as will be explained in the next section). In every tradition, a sudden change or deviation from expectations evokes excitement,

and it is accentuated or prohibited depending on the aesthetic ideal. But perceptions of and responses to stimuli are always in the context of rules that took shape in our brains at a young age (e.g., Donchin and Coles 1986; Leman 1995), and they vary from one stylistic framework to another. Therefore, someone from one culture may be powerfully moved by minute changes in certain rules, whereas a person from a different culture will not notice them and will remain apathetic (Cohen 2003). Similarly, having studied music may have an impact by enhancing sensitivity to the various rules. Age imposes natural constraints on perception. Despite the uniqueness of music, the effect of the listener on his or her perception of music is comparable to the effect of the person perceiving other arts (regarding painting, see Gombrich 1960; regarding literature, see Ingarden 1983; Iser 1978).

The rules on all of these levels are subject to “external” influences of culture, era, environment, and so on (in accordance with their aesthetic ideal), as well as to “internal” influences of cognitive, psychoacoustic, physiological, and other constraints.

The broader the stylistic frameworks are, the more basic the level of the stylistic rules on which they can be distinguished from one another. For example, Bach and Mozart used the same raw material; their styles differ due to the hierarchy among the harmonic degrees, which is much stronger in Mozart’s works than in Bach’s (Cohen and Michelson 1999); the degree of nonconcurrency of simultaneous events or units (Cohen and Wagner 2000); and so on. In contrast, different cultures can be distinguished from one another even by the choice of raw material.

3. *Learned and natural schemata*: The principles governing the rules of organization can be described by means of “schemata” (a concept first introduced in psychology by Bartlett in 1932 and widely accepted today in various realms of cognitive activity). These schemata link events and create expectations that may or may not be met; the specific selection of schemata depends on the aesthetic ideal.

We can distinguish between “learned” and “natural” schemata.

The *learned schemata* are the principles governing the rules of the selected raw material that are the subject of many musical theories. Some of them were mentioned above: scale and interval systems, chords, harmonic patterns, meters, and so on. They are represented quantitatively, are culture-dependent, and are generally not familiar in extra-musical contexts, although they are not necessarily arbitrary.

The *natural schemata* represent principles of organization that are familiar to us from various areas of life. They are meaningful from the standpoint of our feelings and our experiences. Unlike the learned schemata, they are not defined in precise quantitative terms. Some of them are characteristic of properties of texture (Cohen and Dubnov 1997). They are relevant to every style, and they are espe-

cially salient in contemporary musical styles, which ignore learned schemata. The following are the main overarching variables that are relevant to defining the natural schemata

1. The range of occurrence of the various parameters (and additional factors such as density and degree of variability), with attention to the normative range. Any deviation in either direction constitutes a deviation from expectations (Hargreaves 1986).

2. The curves of change of the various parameters (ascending/descending, convex/concave, zigzag/flat, and various combinations of these), which are significant and may appear on various levels.

3. The degree of definability (also called “ambivalence,” “ambiguity,” and “uncertainty”), which has numerous manifestations on various levels of organization with respect to the learned and natural schemata. Here I will mention only concurrence/nonconcurrence between parameters, between learned or natural schemata, and between different units that appear simultaneously (Cohen and Wagner 2000).

4. Categories of operations that may be regarded as cognitive operations (and represent different manifestations of symmetry [Cohen 1996]) and may pertain to different parameters and levels of organization: (a) contrast; (b) expansion and reduction; (c) shifts in cyclic systems; (d) segregation and grouping; (e) equivalence. Each category represents a principle of difference familiar to us from everyday life, making it a coherent cognitive principle. It is worth stressing that difference and repetition underlie all forms of organization (Tversky 1977).

5. Various manifestations of deviation from expectations (Meyer 1956; Schmuckler 1989; Yeger-Granot 1996), including prevalence/rarity. The ultimate is an unexpected conclusion to a directional schema (common in Schubert’s later works).

These abstract principles of natural schemata (the possible realizations of which are being studied more and more, although I have barely mentioned them here) can be used to characterize at least some of the stylistic rules in light of the various aesthetic ideals (which pertain to types of experiences) and to compare different styles that many musicologists (Forte 1962) thought could not be compared. Furthermore, the natural schemata are relevant to the characterization of styles in arts other than music, too.

A Few Examples (without Explanations or Details) of Manifestations of Natural Schemata in Different Musical Styles

1. *Range of occurrence*: Experiments have shown that events outside the normative range, whether greater than or less than normative, alter the subjective conception of time (Hornstein 2004) and characterize the concept of “dramatic” versus lyric (in the normative range). The direction of the deviation (greater or less than normative) in the prosodic layer of speech characterizes externalized versus

internalized emotions (Cohen and Inbar 2001), and bird-calls in states of excitement by “subordinate” (greater than normative calls) versus “dominant” birds (less than normative calls) (Cohen 1983). The two famous genres of Japanese musical drama, No and Kabuki, represent the two extremes; the rules of Palestrina counterpoint (PC), which are supposed to express calm, adhere in all respects to the normative range of not too much and not too little.

2. *Curves of change*: The convex curve (also known as an *arch*) allows for maximum directionality and prevails in most folk songs that are not meant to excite (Nettl 1977; Huron 1997). It also prevails in the rules of PC for the parameters of pitch and duration, both on the immediate level and on the level of the phrase. It appears in the superstructure of the Classical sonata, in birdcalls by tranquil birds, and so on. The concave curve appears in the Rig Veda hymns, which are meant to excite (Cohen 1986), in the melodic curves and superstructure of nineteenth-century music (with the idea of “pathos”), and so on. A curve of gradual intensification for various parameters in the superstructure is common in various non-Western cultures and has even been given special names. Lack of change (multiple repetitions of small units) elicits tension under certain conditions. It is prohibited in PC and is salient in Bach’s works. Sudden changes (zigzags) are prohibited in PC but are salient in various respects in works by Beethoven and in many Romantic pieces.

3. The *degree of definability* is meaningful both in its direct appearance (definability or indefinability of an interval, scale, chord, harmonic phrase, tonal center, rhythmic unit, phrase unit, etc.) and in terms of its indirect effects on possibilities of organization on various levels. This is significant regarding types of directionality and complexity. The degree of definability that permits overall complex organization is at a maximum for the raw material in Western tonal music, both regarding the scale and interval systems and regarding the rhythmic organization. There are several reasons for this: the clear separation between parameters; conditions of coherence regarding interval and scale systems (Balzano 1980; Agmon 1989); and the prevalence of binary factors—two types of seconds (major and minor), of beats (stressed and unstressed), of meter (duple and triple), of scales (major and minor), and so on. Non-Western music has large numbers of elements and schemata. In Arab music theory there are roughly one hundred metric patterns, as well as interconnections and lack of separation between the parameters that define the schemata. For instance, timbre is involved in determining rhythmic patterns, and the various modes (*maqām*, *raga*, etc.) are defined by a large number of musical and even extra-musical factors. These and other relationships reinforce the focus on the moment and prevent overall directionality and complexity (a complex hierarchical superstructure), in accordance with Von Forster’s Law (Koppel, Atlan, and Dupoy 1992).

Nonconcurrency appears in various ways: emphasis on an unstressed beat; ascent on a diminuendo (highly typical of the melodic lines in the opening of Wagner's opera *Tristan and Isolde*), which expresses longing; the existence of various boundaries of simultaneous units defined by various parameters, and so on. It contributes to complexity, uncertainty, and tension and extends the subjective sense of time (Zakay 1989). It appears in abundance in obvious and hidden ways in the works of Bach, is prominent in Beethoven's music, and is rare in Mozart's. It is characteristic of birdcalls in an excited state (as opposed to concurrence between pitch and intensity, both with convex curves, in a tranquil state).

The rules of PC treat nonconcurrency as an exciting factor expressed in syncope. They do not permit excessive nonconcurrency, such as a peak on an unstressed beat with relatively rapid notes. Certain aspects of jazz and blues are manifested in nonconcurrency in various respects.

4. *Operations*: Of all the five categories of operations, I will mention only "segregation and grouping." This operation has various manifestations, one of which is the schema 2^n , which makes possible maximum prediction regarding the continuation of a progression and is effective in complex hierarchical organization. It dominates rhythmic organization in the West and reached its peak in the Classical period, which is highly typical of a time when the ideal was clear directionality. In sonatas by Mozart and Beethoven, we find deviations from the schema in the first subject but not in the second subject. In the West this operation appeared in the seventeenth century, along with the development of major and minor, clear tonality, and clear harmonic progressions. The ways in which it appears or does not appear are one of the characteristics of the style. In the West, the various operations are used extensively and in a sophisticated manner on various levels of musical organization; non-Western music tends to be characterized by simple use of the operations.

5. *Deviation from expectations* and rarity have been confirmed as causes of excitement by ERP experiments (brainwave responses to stimuli). Deviations from expectations affect the subjective perception of time and are salient in Schubert's later works.

Schemata in Other Arts

The natural schemata may characterize styles in other arts as well. For example, with respect to rules of organization, a literary style may be characterized by the range of occurrence, with attention to the normative range (density versus sparsity in terms of the number of characters, types of characters, types of cultures, plots, and so on); curves of change over time in the plot or plots (concurrent or non-concurrent); degree of definability; deviation from expectations; and so on.

Here we will compare poetic organization with musical organization in the East (Arab culture) and West from two

standpoints: (1) types of directionality and complexity; (2) a binary system versus multiplicity.

1. Types of Directionality and Complexity in the Styles of Eastern and Western Poetic Structures. As stated above, regularity in poetic structures represents musical regularity concerning difference or similarity (in terms of rhyme and poetic meter) between units on various levels—stichs in a line, lines in a stanza (and the refrain, if there is one) and stanzas in the poem as a whole. Our comparison (Cohen and Katz 1993) of selected structures from the "East" (poems written in Arabic and Hebrew in medieval Spain—*muwaššah*, *zajal*, and *qaṣīdah*) and West (the *terza rima* in Dante's *Divine Comedy*, the Shakespearean sonnet, the Petrarchan "cycle sonnet," and Edgar Allan Poe's *The Raven*) shows that the differences between them reflect differences between Eastern and Western musical structures. In the East there is a great deal of momentary complexity with a lot of flexibility and no superstructure; all Western structures have precise superstructures of various kinds. As an example, Eastern poetry has, on the one hand, an extremely simple structure (the *qaṣīdah*) based on one rhyme and only one poetic meter in each poem. The poem is made up of numerous stanzas, with each stanza consisting of two units (stichs), the first of which (X) varies in its rhyme and the second of which (a) has fixed rhyme. This structure can be summed up by the

formula $2a + \sum_{i=1}^n (X_i + a)$, $n > 10$. On the other hand,

there is an extremely complex structure (the *muwaššah*, more than two thousand of which have been written) based on two types of stanzas: variable (B) and fixed (A). Its general formula, similar to that of the *qaṣīdah*, is

$A + \sum_{i=1}^n (B_i + A)$. (Note that a and b are stichs, whereas

A and B are stanzas.) The stanzas are divided in various ways into lines and stichs and contain multiple rhymes and meters.

In contrast, in simple Western poems the structure is

usually $\sum_{i=1}^n A_i$, where A has a symmetrical structure and

contains four lines with two types of rhyme (a and b): $2a+2b$; $2(a+b)$; $2(x+b)$. In other words, there is one level of organization with two types of rhyme and the symmetry typical of the music in many Arabic songs. Western art music is more complex. The organization relates to more than one level, and there are multiple relationships between the levels; as a result, there is overall directionality and the beginning and the end are different from each other.

2. A Binary System versus Multiplicity (Contributing to the Degree of Definability) in Western Schemata as Opposed to Those in Arab Culture—in Music and Poetic

Organization. In the West we find a binary system for many types of schemata that allow for multiple clear contrasts and long-range complex organization (in keeping with the aesthetic ideal); outside the West (here our focus is on Arab culture) we find complex schemata that are not well defined, that increase the momentary complexity, and that lessen the possibility of overall directional organization.

In music: In the West, there are two types of seconds (one twice the size of the other), scales (major and minor), beats (stressed and unstressed), and meters (duple and triple); in Arab music there are five basic seconds, ten scales (of *maqāmāt*), three types of beats, more than one stressed beat in each cycle, and highly complex meters (more than one hundred).

In poetry: In the West, there are two cyclic systems of stressed and unstressed syllables, and each cycle has one stressed syllable. One of the systems has two syllables per cycle, and two meters can be obtained through shifts; the other system has three syllables per cycle, and three meters can be obtained through shifts. Thus there are five different meters altogether. In Arabic poetry there are three cyclic systems of three, four, or five syllables per cycle, with more than one stressed syllable per cycle. Shifts (not of all the options) produce eight different patterns, from which 16 meters can be obtained; each of these meters is made up of three or four measures. The meters are divided into five categories.

Thus there is some similarity in the different cultures between the principles of schemata in music and those in poetic organization. The selection of schemata (whether conscious or unconscious) reflects the stylistic ideal.

In conclusion, I have tried to summarize the many phenomena that are related to the concept of musical style and the influences on the conscious or unconscious selection of rules governing a style: the relevant stylistic framework (the culture, period, region, function, etc.); the aesthetic ideal of the framework; “learned” and “natural” schemata; rules of organization on various levels and the principles behind these rules; types of artistic experiences; a universal connection with the principles behind the rules; and the impact of the listener’s background. Although the focus here is on musical style, most of the principles apply to other arts as well.

References

- Agmon, E. 1989. A Mathematical Model of the Diatonic System. *Journal of Music Theory* 33:1–25.
- Ashley, R. 2004. Cross-Model Interaction in Melodic Processing. Paper presented at the 8th International Conference on Music Perception and Cognition, Evanston, IL.
- Atlan, H. 1981. Hierarchical Self-Organization in Living Systems: Noise and Meaning. In M. Zeleny, ed., *Autopoiesis, a Theory of Living Organizations*. New York: North Holland.
- Balaban, M.; Ebcioglu, K.; and Laske, O. eds. 1992. *Understanding Music with AI: Perspectives on Music Cognition*. Menlo Park, Calif.: AAAI Press; Cambridge, Mass.: MIT Press.
- Balzano, G. J. 1980. The Group-Theoretic Description of 12-fold and Microtonal Pitch Systems. *Computer Music Journal* 4(4):66–84.
- Bartlett, F. 1932. *Remembering: A Study in Experimental and Social Psychology*. Cambridge: Cambridge University Press.
- Bolinger, D. ed. 1972. *Intonation: Selected Readings*. Harmondsworth, England: Penguin.
- Boroda, M. G. 1990. The Organization of Repetitions in the Musical Composition: Towards a Quantitative-Systemic Approach. *Musikometrika* 2:53–105.
- Bregman, A. S. 1990. *Auditory Scene Analysis: The Perceptual Organization of Sound*. Cambridge, Mass.: MIT Press.
- Cohen, D. 1971. Palestrina Counterpoint—A Musical Expression of Unexcited Speech. *Journal of Music Theory* 5:84–111.
- Cohen, D. 1982. “Separation” and “Directivity” as Guiding Principles in the Comparison between Eastern and Western Music. In *Proceedings of the World Congress on Jewish Music, Jerusalem, 1978*, 127–147. Tel Aviv: Institute for the Translation of Hebrew Literature.
- Cohen, D. 1983. Birdcalls and the Rules of Palestrina Counterpoint: Towards the Discovery of Universal Qualities in Vocal Expression. *Israel Studies in Musicology* 3:96–123.
- Cohen, D. 1986. The Performance Practice of the Rig Veda: A Musical Expression of Excited Speech. *Yuval* 6:292–317.
- Cohen, D. 1987. Some More about Style: On Comparison of Musical Styles of the East and of the West. *Israel Studies in Musicology* 4:1–20.
- Cohen, D. 1994. Directionality and Complexity in Music. *Musikometrika* 6:27–77.
- Cohen, D. 2003. Perception and Responses to Schemata in Different Cultures: Western and Arab Music. In *Proceedings of the ESCOM 5 Conference*.
- Cohen, D., and Dubnov, S. 1997. Gestalt Phenomena in Musical Texture. In M. Leman, ed., *Music, Gestalt and Computing*, 386–405. Berlin: Springer.
- Cohen, D., and Granot, R. 1995. Constant and Variable Influences on Stages of Musical Activities: Research Based on Experiments Using Behavioral and Electrophysiological Indices. *Journal of New Music Research* 24:197–229.

- Cohen, D., and Inbar, E. 2001. Musical Imagery as Related to Schemata of Emotional Expression in Music and the Prosodic Level of Speech. In R. I. Godøy, ed., *Musical Imagery*, 91–113. Lisse, The Netherlands: Swets & Zeitlinger.
- Cohen, D., and Katz, R. 2001. Universal Constraints Concerning the Choice of Stylistic Rules in Various Cultures. *European Meetings in Ethnomusicology* 8:73–93.
- Cohen, D., and Michelson, I. 1999. Directionality and the Meaning of Harmonic Patterns. In I. Zamos, ed., *Music and Sign: Semiotic and Cognitive Studies in Music*. Systematica Musicologica 2, 278–298. Bratislava: Asco Art and Science.
- Cohen, D., and Wagner, N. 2000. Concurrence and Non-concurrence between Learned and Natural Schemata: The Case of Johann Sebastian Bach's Saraband in C Minor for Cello Solo. *New Music Research* 29:23–36.
- Cone, E. T. 1974. *The Composer's Voice*. Berkeley: University of California Press.
- Cope, D. H. 1992. Pattern Matching as an Engine for the Simulation of Musical Style. *Computing in Musicology: An International Directory of Applications* 8:107–110.
- Deutsch, D. 1982. Organizational Processes in Music. In M. Clynes, ed., *Music, Mind and Brain*, 119–133. New York: Plenum.
- Donchin, E., and Coles, M. G. 1988. Is the P₃₀₀ component a manifestation of context updating? *Behavioral and Brain Science* 11:357–374.
- Fónagy, I., and Magdics, C. 1972. Emotional Patterns in Intonation and Music. In D. Bolinger, ed., *Intonation*, 286–312. Harmondsworth, England: Penguin.
- Forte, A. 1962. *Tonal Harmony in Concept and Practice*. New York: Holt, Rinehart and Winston.
- Gabrielsson, A., and Juslin, P. 1996. Emotional Expression in Music Performance: Between the Performer's Intention and the Listener's Experience. *Psychology of Music* 24:68–91.
- Gjerdingen, R. O. 1984. A Musical Schema: Structure and Style Change, 1720–1900. Ph.D. diss., University of Pennsylvania.
- Gombrich, E. H. 1960. *Art and Illusion. Studies in the Psychology of Pictorial Representation*. New York: Pantheon.
- Goodman, N. 1975. The Status of Style. *Critical Inquiry* 1:799–811.
- Gouldin, R. 1983. The Cycle-7 Complex: Relations of Diatonic Set Theory to the Evolution of Ancient Tonal Systems. *Music Theory Spectrum* 5:39–55.
- Hargreaves, D. J. 1986. *The Developmental Psychology of Music*. Cambridge: Cambridge University Press.
- Hornstein, S. 2004. Supersaturation: A Phenomenon in Contemporary Music on the Background of the Perception of Time. Ph.D. diss., Hebrew University of Jerusalem.
- Huron, D. 1997. The Melodic Arch in Western Folksongs. *Computing in Musicology* 10:3–23.
- Huron, D. 2000. *Music Cognition Handbook: A Glossary of Concepts*. Ohio State University School of Music.
- Ingarden, R. 1983. *The Cognition of the Literary Work of Art*. Evanston, Ill.: Northwestern University Press (originally published in German in 1956).
- Iser, W. 1978. *The Act of Reading*. Baltimore: Johns Hopkins University Press.
- Keefe, O. H.; Burns, E. U.; and Nguen, Ph. 1991. Vietnamese Modal Scales of the Dan Trank. *Music Perception* 8:449–468.
- Knopoff, L., and Hutchingson, W. 1983. Entropy as a Measure of Style: The Influence of Sample Length. *Journal of Music Theory* 27:97.
- Koppel, M.; Atlan, H.; and Dupoy, J. P. 1987. Triviality and Alienation in Systems: Proof of Von Forster's Conjecture. *International Journal of General Systems*.
- Leman, M. 1995. *Music and Schema Theory: Cognitive Foundations of Systematic Musicology*. Berlin: Springer.
- Lerdahl, F., and Jackendoff, R. S. 1983. *A Generative Theory of Tonal Music*. Cambridge, Mass.: MIT Press.
- Lomax, A. 1968. *Folk Song Style and Culture*. Washington, D.C.: American Association for the Advancement of Science.
- Lomax, A. 1977. Universals in Song. *The World of Music* 19(1/2):117–129.
- Malm, W. P. 1966. *Japanese Music and Musical Instruments*. Rutland, Vt.: Charles E. Tuttle Co.
- Marks, L. 1978. *Unity of Senses: Interrelations among the Modalities*. New York: Academic Press.
- Meyer, L. B. 1956. *Emotion and Meaning in Music*. Evanston, Ill.: Northwestern University Press.
- Meyer, L. B. 1989. *Style and Music: Theory, History and Ideology*. Philadelphia: University of Pennsylvania Press.
- Moles, A. 1966. *Information Theory and Esthetic Perception*. Transl. J. E. Cohen. Urbana: University of Illinois Press.
- Mundt, E. K. 1959. Three Aspects of German Aesthetic Theory. *Journal of Aesthetics and Art Criticism* 17:287–310.
- Nattiez, J. J. 1976. *Fondements d'une sémiologie de la musique*. Paris: Union Générale d'Éditions.
- Nettl, B. 1977. On the Question of Universals. *The World of Music* 19:2–7.
- Pascall, R. J. 1980. Style. In *The New Grove Dictionary of Music and Musicians*, vol. 18, 316–321.
- Philipson, M. 1961. Style: Form and Content. In M. Philipson, ed., *Aesthetics Today*, 79–141. Cleveland: World Pub. Co.

- Reese, G. 1959. *Music in the Renaissance*. New York: Norton.
- Rhodes, J. 1995. Musical Data as Information: A General-Systems Perspective on Musical Analysis. *Computing in Musicology: An International Directory of Applications* 10:165–180.
- Sachs, C. 1946. *The Commonwealth of Art*. New York: Norton.
- Schmuckler, M. A. 1989. Expectation in Music: Investigation of Melodic and Harmonic Processes. *Music Perception* 7:109–150.
- Shanon, B., and Atlan, H. 1990. Von Forster's Theory: Semantic Application. *New Ideas in Psychology* 9:81–90.
- Shapiro, M. 1961. Style. In Philipson, *Aesthetics Today*, pp. 81–113.
- Singer, J. 2004. A Model Representation: Towards an Implementation of Music Information Retrieval. Ph.D. diss., Hebrew University of Jerusalem.
- Sloboda, J. 1991. Music Structure and Emotional Response: Some Empirical Findings. *Psychology of Music* 19:110–120.
- Sundberg, J. 1982. Speech, Song and Emotion. In M. Clynes, ed., *Music, Mind and Brain*, 137–148. New York: Plenum.
- Sundberg, J.; Friberg, A.; and Fryden, L. 1991. Common Secrets of Musicians and Listeners: An Analysis by Synthesis Study of Musical Performance. In P. Howell, R. West, and I. Cross, eds., *Representing Musical Structure*, 161–197. London: Academy Press.
- Todd, N. P. McA. 1992. The Dynamics of Dynamics: A Model of Musical Expression. *Journal of the Acoustical Society of America* 91:3540–3550.
- Tversky, A. 1977. Features of Similarity. *Psychological Review* 84(4):327–352.
- Wölfflin, H. 1950. Principles of Art History: The Problem of the Development of Style in Later Art. Transl. M. D. Hottinger. New York: Dover (originally published in German in 1916).
- Yeger-Granot, R. 1996. The Concept of Musical Expectancy Examined by Brainwave Recordings (ERP) and Verbal Responses. Ph.D. diss., Hebrew University of Jerusalem.
- Zakay, D. 1989. Subjective Time and Attentional Resource Allocation: An Integrated Model of Time Estimation. In I. Levin and D. Zakay, eds., *Time and Human Cognition: A Life-Span Perspective*, 365–393. Amsterdam: North Holland.