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Reviews

Mari Riess Jones & Susan Holleran (Eds.), *Cognitive Bases of Musical Communication*. Washington, DC: American Psychological Association, 1992. 284 + xiv pp. \$40.

This volume is the result of a recent (1988) initiative of the American Psychological Association (APA), the Scientific Conferences Program. The eleventh conference supported by this program, on "Cognitive Bases of Musical Communication," was held at The Ohio State University in April 1990 and resulted in the present book. Not all of the conference papers have been included: There were 19 invited speakers, while there are only 15 chapters in the book, plus a brief introduction by the editors. Missing in particular is an invited lecture by Jean-Jacques Nattiez, which is mentioned only in the preface. Discussions are not included either. The chapters are brief and of fairly uniform length. Evidently, the editors had to follow strict guidelines from their sponsors. As indicated in the preface, one of the goals was to "bring some of the insights concerning communication via musical events into mainstream psychology" (p. xi). I take this to mean that the book was intended for a nonspecialist readership.

The 15 chapters are grouped into five sections: (1) Communication, Meaning, and Affect in Music; (2) The Influence of Structure on Musical Understanding; (3) Pitch and the Function of Tonality; (4) Acquisition and Representation of Musical Knowledge; and (5) Communicating Interpretations Through Performance. Each section is preceded by a brief introduction. The group of authors includes psychologists as well as musicologists and philosophers. Two participants are from England; the others represent the cream of the crop of American cognitive (psycho)musicologists.

In their brief overview, Mari Riess Jones and Susan Holleran review some historical background and hint at how the influential but disparate theories of Heinrich Schenker and Leonard Meyer reverberate through the writings of some of the present authors. The editors also point out that, in studying the communicative function of music, the problem of multiple interpretations plays a central role.

This problem of indeterminacy is addressed head-on by philosopher Robert Kraut. He begins by citing Quine's (1960) controversial claim that even language is indeterminate in that every utterance can be assigned distinct (though closely related) meanings, more like different perspectives

on the same event. He then raises the question of whether music can similarly be understood in different ways. Understanding music, he says, "is a matter of experiencing appropriate qualitative states in response to it" (p. 15). But what is the yardstick for appropriateness? Kraut's answer is that, in analogy to language, which is understood only by members of a reference population (viz., those who speak the language), proper understanding of music must be defined with reference to a special population of listeners. He variously defines this population as the one "which is *responsible for the musical event* in question" (p. 20, his italics) or (referring to Beethoven's works) as "Beethoven's sophisticated peers" (p. 17).¹ Nevertheless, he realizes that even within such a narrow population of specialists, there may still be room for different experiential responses. (In the extreme case, of course, the size of the reference population becomes one, which is not at all unusual in discourse about music.) Kraut's bottom line is that, the smaller and the more homogeneous the reference population, the more determinate musical events appear to be (though this is by no means proven, except for $n = 1$). He seems to consider the choice of a standpoint along this continuum a matter of personal preference.

This is a thought-provoking essay, although Kraut's oscillations of argument (probably relished by philosophers) made me quite dizzy. A serious problem of the discussion seems to me the abstractness with which the notion of understanding is treated. "Experiences of stability and tension, of metrical groupings, of tonal centers, or variations on harmonic, melodic, or rhythmic structures, and the like" (p. 15) is as far as Kraut gets in defining what musical understanding might actually entail. Thus there is a theoretical vocabulary in which musical experiences of a structural kind can be characterized fairly precisely. Moreover, there is a variety of psychological techniques available to assess these experiences indirectly in individuals who have no musical education and thus cannot describe what they perceive (see, e.g., Krumhansl, 1990). Once such techniques are applied, it becomes an empirical question whether and how often contrasting musical experiences can actually be observed. Kraut seems to assume (on logical rather than empirical grounds) that they are common. I find it more likely that the musical experiences of different listeners differ in degree of

1. Both definitions are problematic: the former (which I understand to refer to contemporary performers) because it neglects the fact that musical norms and experiences change continuously throughout history, the latter (which I understand as referring to musicians contemporary with Beethoven) because it refers to an extinct population that, moreover, probably had only a dim appreciation of Beethoven's pathbreaking achievements. A more promising definition might have made use of the criterion of production competence: Just as a speaker of a language is identified by his/her ability to converse in that language, it might be stipulated that competence in a musical style (such as Beethoven's) is evidenced by an ability to improvise, compose, or at least play competently in it. This might disqualify some competent listeners, but it would hardly misclassify a novice.

elaboration. The diversity of musical perception may be often overestimated; for example, there are many basic phenomena of auditory organization that ensure that listeners experience similar grouping structures when listening to music (cf. Bregman, 1990). The difference between the musical expert and the novice is likely to lie in the relative *richness* of the experience, in the ability to focus attention on different levels of detail, and often simply in the ability to verbalize and put technical terms to what is perceived. With regard to *emotional* experience, which Kraut dismisses early on as narrowly confined ("pending further discussion"—p. 12), the situation may be more egalitarian. Emotional experiences in response to music may be just as strong in the novice as in the expert, and they are also likely to be of the same kind, within broad limits (cf. Clynes, 1977, and Sloboda's article, discussed below). Moreover, the kind of unreflective response that can lead to a strong love and enthusiasm for music may constitute a form of musical understanding quite on a par with the more technical understanding evinced by musicologists (see Cook, 1990). Kraut makes no attempt to distinguish different forms of musical understanding; he treats it as if it were a single variable in some abstract logical calculus.

Continuing in a philosophical vein, Diana Raffman embarks on a (tentative) definition of musical semantics. With Lerdahl and Jackendoff's (1983) generative grammar as her starting point, she proceeds to argue that the grammar, "to have any explanatory force, must be motivated by an appeal to semantic considerations" (p. 24). She first illustrates this claim with reference to language, where the purpose of a grammar is to explain how language users understand what they hear (or, more often, what they read).² She argues that semantic context plays an important role in language understanding. The explanandum of music theory is said to be "the kaleidoscopic sequence of peculiarly musical feelings we experience on hearing a performance" (p. 28). These feelings are probably identical with the musical experiences Kraut referred to, but Raffman is barely more specific than her colleague in defining them. She argues that they may be analogous to contextual-semantic factors in language, and thus may be regarded as semantic themselves. Following Kraut's technique of immediately retreating once an advance has been made, she promptly casts doubt on her own proposal but concludes that, whatever these feelings are, they are what music theory is trying to explain. I understand this as

2. Raffman seems to exhibit a "written language bias" (Linell, 1982) here. In discussing the famous example, "They are frying chickens", she fails to consider that the apparent ambiguity of the written version is commonly resolved by prosody in spoken language (cf. Farnetani, Torsello, & Cosi, 1988; Price, Ostendorf, Shattuck-Hufnagel, & Fong, 1991) and not just by pragmatic context. An instance of the analogous "written music bias" occurs when she says that the input to the musical grammar is a "mental score," when in fact it is a stream of sound organized by a performer.

paraphrasing the commonplace observation that music theorists rely on their own intuitions about music in formulating grammatical rules, just as linguists do in constructing their grammars.

I find myself on firmer ground with John Sloboda's empirical study of emotional responses to music. Here, at last, is a clear-cut and objectively measurable definition of what we are talking about: crying, shivering, accelerated heart beat. To be sure, these are extreme and correspondingly rare reactions, but they are important because of their salience in long-term memory and because they may motivate an individual's lifelong occupation with music. Sloboda reviews several studies that required adults to provide a description of emotional responses to music heard recently or in the distant past, but the most interesting part is his recent attempt to link reports of the aforementioned physiological reactions to particular structural properties of the music. The fact that music can elicit such plainly observable responses at all is a fact worth contemplating (cf. Clynes, 1977).³ Sloboda's data must be considered quite preliminary, but they constitute a powerful point of entry into the connection between sound and emotion. Incidentally, that connection does not seem to exhibit the indeterminacy that plagues cognitive analyses of musical structure.

The second part of the book has the curious title, "The Influence of Structure on Musical Understanding," which suggests that the object of understanding is not the structure itself. Indeed, the editors' introduction refers to "musical ideas" that need to be understood, but without specifying their nature. If ideas are not structural themselves, what are they? There is a lot of undefined vocabulary floating around in these initial discussions.

However, no such vagueness can be found in Ray Jackendoff's article. He defines musical understanding as "the unconscious construction of abstract musical structures," as set forth in his influential book with Fred Lerdahl (Lerdahl & Jackendoff, 1983). Here Jackendoff begins to outline the form that a theory of real-time musical processing might take. He illustrates the gradual development of a structural representation in a hypothetical listener's mind with the help of a concrete musical example and then goes on to discuss how the "processor" (a term that strikes me as ugly and inhuman) might deal with indeterminacy. After considering a serial single-choice model (which continuously makes decisions and backtracks to correct mistakes) and a serial indeterministic model (which delays decisions until they can be made with virtual certainty), Jackendoff

3. Not long ago, I found myself repeatedly moved to tears while playing the central variation of Guy Ropartz's *Ouverture, Variations et Final* (a very rewarding piano composition in the style of César Franck), a section full of appoggiaturas and harmonic sequences—exactly the factors that Sloboda's informants reported to be associated with tearful experiences!

argues in favor of a parallel multiple-analysis model that entertains multiple structural hypotheses, even though only one structure may be available to consciousness at any one time. These ideas are analogous to those proposed in psycholinguistics to account for real-time language processing, and given the recent history of cognitive psychology, the serial hypotheses seem moribund from the beginning. On the other hand, the parallel hypothesis may be too general to be refutable; it may be more of an appropriate mode of thought on the part of the investigator.

Jackendoff concludes by arguing that the musical processor is modular in Fodor's (1983) sense: It generates structures and expectations autonomously, so that it is unaffected (or indeed enriched) by the familiarity of a musical piece. This explains why surprising musical events retain their interest on repeated listening. Less appealing is Jackendoff's notion of "musical affect," which he ties to the generation of musical structures, among other things. Emotional responses to music tend to be far more differentiated and deserve a richer characterization (as, for example, attempted by Cooke, 1959). Nor is it clear that they have much to do with the structure building discussed here. Jackendoff's "affect" is analogous to a child's feelings while building a Lego construction. Apart from this reservation, this is an extremely lucid and instructive presentation that leads directly to some empirically testable predictions. It is too bad that its cash value, as it were, is reduced by the fact that an expanded and thus even more informative version has already been published *and* reprinted (Jackendoff, 1991, 1992).⁴

Eugene Narmour's subsequent essay covers some basic concepts of his theory of melodic structure, described at length in his book (Narmour, 1990), which appeared soon after the conference and has received much attention in the meantime. Therefore, not much needs to be said about this preview (or postview), in which Narmour illustrates how melodic implications at one level may be enhanced or contradicted by implications at a higher level. In addition to postulating initially a distinction between top-down and bottom-up expectations, which would come into conflict, Narmour sees another conflict-generating mechanism within the bottom-up level, arising from the hierarchical levels of musical structure. What is not clear to me is whether implications at higher levels can be assumed to be as "bottom-up" as those at the foreground level. Temporal distance and hierarchical abstraction may well weaken the perceptual immediacy of the Gestalt laws on which bottom-up implications are

4. I am a little baffled by this cloning of publications. Don't we have enough reading material already? However, I was glad to notice that "processor" has been changed to "parser" in the reprinted version—better, but still a machine-in-the-mind metaphor. I prefer to say that *listeners* (or their brains) do the parsing.

thought to rest. Thus the higher-level implications may actually be top-down effects.⁵

In the final article in this section, Mari Riess Jones argues that music can be attended to in different ways that correspond to different time spans in the hierarchical structure (see also Jones & Boltz, 1989). Analytic attending (over short time spans or short "serial integration regions," essentially rhythmic groups) is said to be incompatible with more global ("future-oriented") attending. Because of this flexibility of attentional focus, Jones argues that there are different ways of mentally representing a piece of music. The validity of that conclusion, however, rests on what "attending" is really meant to be. If it just refers to what the listener is *conscious* of, subconscious processing and representation of other hierarchical levels is by no means ruled out (cf. Jackendoff above). Jones's theory may then simply refer to listeners' ability to focus at will on different levels in the structural hierarchy. In a complex structure, it may take time and experience to discover some of the higher levels, but it is difficult to see how the lowest level (the musical foreground) could ever not be represented in the listener's mind, regardless of attentional strategy. I have some difficulty with Jones's claim that attending determines structural representation; it seems to me that, on the contrary, attending to higher levels presupposes that a structural framework has been erected. Without such a framework, attention will remain at the level of primary musical events, which I take to be rhythmic groups or gestures. Jones offers an analogy with the visual inspection of an art object: The viewer may focus on detail by standing close or on global structure by standing back. In the auditory modality, however, there is no "standing back," except in a metaphorical sense. The information always enters at the same time scale, and higher-level regularities must be abstracted from the input.

Proceeding now to the third section on "Pitch and the Function of Tonality," we find a paper by Diana Deutsch on the tritone paradox. This work has been presented in several other places, including two recent articles in this journal (Deutsch, North, & Ray, 1990; Deutsch, 1991) and one in a popular science magazine (Deutsch, 1992), so even nonspecialists may have a feeling of *déjà vu*. Of course, this does not diminish the importance of the research, which demonstrates striking individual differences in the perception of the relative pitch height of two Shepard tones forming the interval of a tritone. Not only has Deutsch shown that percep-

5. At the end of his paper, Narmour comes close to actually suggesting an experiment to test his theory. This openness to empirical approaches is remarkable in a musicologist (as it is in Jackendoff, a linguist and philosopher) and bespeaks the interdisciplinary cross-fertilization that the cognitive science movement has fostered. However, Narmour should have acknowledged Krumhansl and Shepard (1979) as the inventors of the probe tone method he proposes.

tion of these tones as rising or falling in pitch depends on their pitch class, but that the pattern of this dependency is quite different for listeners from California and from Southern England. For the Californian subjects, there appears to be a relationship to the range of fundamental frequency in speaking (Deutsch, 1991); corresponding evidence for the British subjects has yet to be presented. Deutsch's claim that speakers have a language- or dialect-based pitch template in their heads is provocative, but it stands on three legs only and is in urgent need of additional support.

In the following chapter, Helen Brown takes psychologists to task for simplistic approaches to the concept of tonality. Using stimuli from several published experiments as examples, she demonstrates that in many instances tone sequences classified *a priori* as "atonal" can be shown to have tonal interpretations when notated with enharmonic substitutions. Even more importantly, Brown demonstrates with musical examples and results from earlier experiments of her own that the temporal sequence of tones is a crucial determinant of tonal implications. Her valuable discussion emphasizes the fact that the psychology of music is an interdisciplinary enterprise that requires the musicologist's analytic acumen as well as the psychologist's methodological skills.

David Butler, Brown's occasional collaborator, continues in a similar vein by reporting some informal experiments that demonstrate that listeners can infer the tonality of a melodic excerpt in both major and minor modes. This is preceded by a discussion of interval frequencies in the two modes, which leads to the prediction that the tonal center might be more difficult to determine in the minor than in the major mode. Butler's observations seem to refute that idea, but the demonstrations are so limited as to reinforce the second half of the conclusion stated at the end of the preceding paragraph. A more extensive and better controlled study is called for to address the hypothesis in a rigorous manner.

The section concludes with Fred Lerdahl's "pitch-space journeys" through two Chopin preludes. Extending the theoretical apparatus developed in Lerdahl and Jackendoff (1983), he graphs the melodic/harmonic progression of one prelude as a path in "regional" (i.e., key), chordal/regional, or scale-degree space. Consideration of the unresolved harmonies of the second prelude leads to a "regional prolongational analysis," which represents implicit as well as explicit tonicities. This is sophisticated stuff and, in Lerdahl's own words, "an exercise in theoretical rather than experimental music psychology." It warrants careful study but may be a bit too advanced for the nonspecialist.

The next section, on "Acquisition and Representation of Musical Knowledge", opens with a chapter by Carol Krumhansl on "Internal Representations for Music Perception and Performance." Of all the authors in this book, she seems to have taken most seriously the assignment of writ-

ing for a general readership. The questions she addresses are very basic and important, but they are dealt with in summary fashion, evidently due to the space constraints. As a result, the answers provided are sometimes uncomfortably reductionistic; at other times, they seem too obvious to me. The conclusion that music cognition requires both iconic (surface) and symbolic internal representations is an example of the latter.⁶ At the end of the chapter, Krumhansl reports some results from a study of musical memory (Krumhansl, 1991) which show that surface characteristics are retained after a single hearing.

The following two chapters both deal with connectionist computer models of tonal structure, but in quite different ways. Jamshed Bharucha's brief summary of some basic features of his MUSACT model is lucid and readily understandable by the nonexpert. The model employs an "unsupervised" learning algorithm (i.e., without feedback) to construct chord and key representations from chordal inputs. It illustrates how a quasi-neural network can extract systematic relationships from structured input, without being taught these relationships explicitly. Of course, the relationships are implicit in the input, and the demonstration is perhaps less impressive when one thinks of the surface properties of the input as a manifestation of its underlying organization to begin with. That is, as long as the model only recovers the structure we already know, we learn more about the model than about the object of study.

Robert Gjerdingen's approach is more ambitious and reveals the musicologist behind it. He begins with a homage to Leonard Meyer and then discusses briefly some harmonic/melodic schemata in Mozart's music. In contrast to the sober precision of the preceding chapters, Gjerdingen's words dance on the page and entice the reader to join him in his metaphoric exploration of musical phenomena. How welcome these lively stylistic touches are in discourse about music! The innocent reader, having accepted Gjerdingen's invitation to the dance, is whirled through an increasingly complex succession of connectionist modeling efforts dealing with harmonic, rhythmic, and melodic schemata considerably more advanced than those considered by Bharucha. This is very interesting stuff, but difficult to follow in such a condensed presentation. Luckily, more detailed discussions are available elsewhere (e.g., Gjerdingen, 1990). Still, the glimpses provided here are sufficient to reveal a fundamental differ-

6. Personally, I feel very uneasy with the notion of "internal representation," which, as Krumhansl says, is so fundamental to cognitive science approaches. Internal representations always end up being something that actually characterizes the perceptual object, and I prefer to think of these "representations" as "presentations," that is, as objective properties rather than as internal states. I cannot share the feeling of discovery that many cognitive scientists seem to have when they find that internal representations mirror external reality. They always do.

ence between Bharucha's and Gjerdingen's approaches: Whereas the former, true to his psychological background, is concerned primarily with modeling the knowledge of musically untrained listeners, Gjerdingen's aim is to show that neural networks can be as sophisticated and multifaceted as a master analyst such as Leonard Meyer. However, unless they can go beyond human ingenuity, the project will remain an exercise in artificial intelligence. And does human ingenuity *need* to be exceeded?

We come now to the final section, "Communicating Interpretations through Performance," containing two chapters. The first of these, by Caroline Palmer, is a slightly expanded version of a paper published previously (Palmer, 1989). Palmer is concerned with how pianists use expressive timing variations to convey different structural interpretations of the same score. This is an interesting and important issue. In a first example, taken from a Chopin prelude, the timing profile of an expressive performance is compared with that of a deliberately inexpressive performance.⁷ The phrase-final lengthening evident in the former is absent in the latter, which suggests that it is part of the performer's strategy to emphasize structural groupings. Palmer's second example, the beginning of Brahms' Intermezzo in A major, op. 118, no. 2, is more problematic. Pianists were asked to indicate their "phrasing interpretation" by placing slurs in the unmarked score; a single pianist subsequently performed the excerpt according to two alternative markings, and performance analysis revealed timing variations that corresponded to the intended phrasings. Palmer concludes that the different phrasings conveyed different structural interpretations—different "phrase structures." However, the melodic/rhythmic grouping structure is quite unambiguous in this example, and it is difficult to imagine an alternative structural interpretation.⁸ The different "phrasing interpretations" are merely different choices of surface articulation within the same underlying structure. One could imagine many alternative examples, however, where different phrasings do disambiguate underlying structural alternatives.

In the second half of her chapter, Palmer reports on a study of errors in piano performance. (It is not clear why the pianists committed so many errors to begin with.) The most frequent type of error, deletions (i.e.,

7. The timing patterns are shown as percentage deviations from a hypothetical mechanical performance, plotted as a straight line, a convention that goes back to Gabrielsson (e.g., 1987). However, this reference seems both arbitrary and superfluous to me; it is more informative to plot the raw durations on a logarithmic scale.

8. In one version, the "phrase" ends with a sixteenth note following a dotted eighth note, whereas the next "phrase" begins with a long note on the downbeat. In such a sequence, the sixteenth note always functions as an anacrusis, and the dotted eighth note most likely also. A nonlegato connection is quite commendable, however, to emphasize the onset of the note on the downbeat. Slurs that cross group boundaries and/or terminate within rhythmic groups are frequently found in musical scores; they almost always have implications for articulation, but they affect the structural interpretation only if there is structural ambiguity.

omission of a note), is shown to occur almost never at “phrase” boundaries, whereas perseverations (repetition of a note) are more frequent at boundaries than within groups. The definition of boundary location is not always clear, however, and relies in part on the “phrasing interpretation” manipulation described above. Therefore, the error pattern may well be more closely related to surface articulation patterns than to the underlying grouping structure. The distinction between these two semi-independent aspects needs to be addressed more carefully in future work.

In the final chapter, L. Henry Shaffer provides a preliminary but intriguing examination of four pianists’ multiple performances of a virtually unknown piece by Beethoven. Global timing curves and dynamic traces at the bar level are provided. One pianist, who was provided with a score from which all expression marks had been deleted, produced more variable performances than the others, which suggests (not surprisingly) that expressive marks in the score are not redundant. Shaffer makes a valiant attempt to characterize the different performances but concludes that his descriptions “need to be superseded by a language better suited to the task of analyzing expression” (p. 277). That, of course, is a crucial problem. When Shaffer says that one pianist “misses a sense of wonder in the modulation and a feeling of uplift in the semitone-raised melody” (p. 275), he is talking about his subjective impressions rather than about well-defined objective correlates of these qualities. Nevertheless, Shaffer’s descriptive analysis is insightful and instructive. It is embedded in a tentative theoretical framework, according to which music provides an abstract narrative: “we can think of the musical structure as describing an implicit event, and the gestures of musical expression as corresponding to the emotional gestures of an implicit protagonist who witnesses or participates in the event. Thus, the performer’s interpretation can be viewed as helping to define the character of the protagonist” (p. 265). Later he appropriately describes these ideas as having “some heuristic value in opening up the empirical study of expression” (p. 277). This is a promising alternative to musicologically tinged approaches, and I look forward to Shaffer’s future explorations in this direction.

To sum up, this book has some strengths and some weaknesses. The weaknesses are in large part a consequence of forcing this group of excellent authors to write short presentations for a general audience, rather than expanding on their latest ideas in depth. As a result, the book holds little attraction for the specialist to whom much of the work described will be familiar from more detailed presentations elsewhere. Clearly, the book has more to offer to the general reader who wants to inform him/herself about what is going on in music psychology. Some of the contributions (Jackendoff, Deutsch, Brown, Bharucha) are admirably suited for that purpose. Others (Kraut, Narmour, Jones, Lerdahl, Gjerdingen) may tax

the nonspecialist. Some of the contributions (Raffman, Butler, Palmer, Shaffer) have a very preliminary character, and at least one author (Krumhansl) seems to have bent over backwards to write in a tutorial manner, at the cost of originality. So, what the book ultimately adds up to is a collection of visiting cards from some of the best people in the field. At the very least, it may provide an incentive for nonspecialists or graduate students to delve more deeply into the literature. Through its mixture of authors from different backgrounds and their individual styles, it also illustrates the gap that still separates psychologists from musicologists and philosophers. Thus it reinforces the need for communication and cooperation across traditional disciplinary boundaries—an effort on which the further progress of psychomusicology will crucially depend and to which the conference at Ohio State undoubtedly contributed.⁹

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References

- Bregman, A. S. *Auditory scene analysis*. Cambridge, MA: MIT Press, 1990.
- Clynes, M. *Sentics: The touch of emotions*. New York: Doubleday, 1977.
- Cook, N. *Music, imagination, and culture*. Oxford, U.K.: Clarendon Press, 1990.
- Cooke, D. *The language of music*. London, U.K.: Oxford University Press, 1959.
- Deutsch, D. The tritone paradox: An influence of language on music perception. *Music Perception*, 1991, 8, 335–347.
- Deutsch, D. Paradoxes of musical pitch. *Scientific American*, 1992, 267, 88–95.
- Deutsch, D., North, T., & Ray, L. The tritone paradox: Correlate with the listener's vocal range for speech. *Music Perception*, 1990, 7, 371–384.
- Farnetani, E., Torsello, C. T., & Cosi, P. English compound versus non-compound noun phrases in discourse: An acoustic and perceptual study. *Language and Speech*, 1988, 31, 157–180.
- Fodor, J. A. *Modularity of mind*. Cambridge, MA: MIT Press, 1983.
- Gabrielsson, A. Once again: The theme from Mozart's Piano Sonata in A major (K. 331). A comparison of five performances. In A. Gabrielsson (Ed.), *Action and perception in rhythm and music* (pp. 81–103). Stockholm, Sweden: Royal Swedish Academy of Music (Publication No. 55), 1987.
- Gjerdingen, R. O. Categorization of musical patterns by self-organizing neuronlike networks. *Music Perception*, 1990, 7, 339–370.
- Jackendoff, R. Musical parsing and musical affect. *Music Perception*, 1991, 9, 199–230.
- Jackendoff, R. Chapter 7 in *Languages of the mind: Essays on mental representation*. Cambridge, MA: MIT Press, 1992.
- Jones, M. R., & Boltz, M. Dynamic attending and responses to time. *Psychological Review*, 1989, 96, 459–491.
- Krumhansl, C. L. *Cognitive foundations of musical pitch*. New York: Oxford University Press, 1990.
- Krumhansl, C. L. Memory for musical surface. *Memory & Cognition*, 1991, 19, 401–411.

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- Krumhansl, C. L., & Shepard, R. N. Quantification of the hierarchy of tonal functions within a diatonic context. *Journal of Experimental Psychology: Human Perception and Performance*, 1979, 5, 579–594.
- Lerdahl, F., & Jackendoff, R. *A generative theory of tonal music*. Cambridge, MA: MIT Press, 1983.
- Linell, P. *The written language bias in linguistics*. Linköping, Sweden: University of Linköping, 1982.
- Narmour, E. *The analysis and cognition of basic melodic structures: The implication-realization model*. Chicago, IL: University of Chicago Press, 1990.
- Palmer, C. Structural representations of music performance. In *Proceedings of the Cognitive Science Society*. Hillsdale, NJ: Erlbaum, 1989, pp. 349–356.
- Price, P. J., Ostendorf, M., Shattuck-Hufnagel, S., & Fong, C. The use of prosody in syntactic disambiguation. *Journal of the Acoustical Society of America*, 1991, 90, 2956–2970.
- Quine, W. V. *Word and object*. Cambridge, MA: MIT Press, 1960.