# Introduction to the Special Issues on Corpus Methods

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This is the first of two special issues of *Music Perception* devoted to musical corpus research. In recent years, and especially within the last decade, activity and interest in this area has increased dramatically. In view of *Music Perception*'s longstanding dedication to scientific, empirical approaches to music research, we felt that a special issue of the journal focusing on corpus methods was both appropriate and timely. The response to our call for papers exceeded our expectations; due to the large number of fine submissions we received, the originally planned single issue has been expanded to two. (The second issue will appear in issue 3 of this volume.)

Musical corpus research—that is, research involving statistical analysis of large bodies of naturally occurring musical data—does not have a long history. We can find nothing from before the twentieth century that fits this description. Perhaps the earliest true example is the work of Jeppesen (1927), who compiled counts of various contrapuntal features in the music of Palestrina. Isolated examples of corpus work can be found in the following decades, such as the statistical studies of harmonic progressions undertaken by Budge (1943) and McHose (1947). Researchers in the 1950s and 1960s (e.g., Cohen, 1962; Youngblood, 1958) approached corpus research from the perspective of information theory, using corpus data to measure the complexity of musical repertoires and to generate new compositions.

The origins of modern musical corpus research might well be traced to the work of Meyer (1956, 1967). Though he did not use corpus methods per se, Meyer put forth a crucial proposition: that listeners' musical experiences and responses—in particular, their expectations—are shaped by statistical regularities in the music that they hear. From this perspective, corpus research becomes an important part of the field of music perception: gathering statistical information from music simulates the listener's learning process, and provides parameters needed for the modeling of expectation and other aspects of perception. Also influential in this regard was the work of Krumhansl (1990) showing that the perceived stability and "fit" of scale-degrees (pitch-classes in relation to a tonal context) is highly correlated with their frequency in corpora. In recent years, the idea that people learn from the statistical frequencies of events in their environment—so-called "statistical learning"—has become highly influential, not only in music cognition but also in language and other domains of cognitive science (Saffran, Aslin, & Newport, 1996).

Another crucial contribution to musical corpus research has been the work of Huron (2001, 2006). While Meyer emphasized the effect of composition on perception, Huron focuses on the reverse relationship, exploring ways that compositional practice is constrained by principles of auditory perception. The compositional phenomena at issue include not only traditional rules (such as the avoidance of parallel fifths and octaves), but also hitherto unknown regularities that were discovered through corpus analysis. As one example, changes of texture involving the departure of a single line from the texture appear to be less common than additions of a single line; Huron explains this in perceptual terms, noting that single-line departures are less easily perceived than single-line additions (Huron, 1990). Huron (along with colleagues at the Center for Computer Assisted Research in the Humanities at Stanford University) has also led the way in the development of tools and resources for musical corpus research, such as the Humdrum toolkit (Huron, 1999) and the computer-encoded version of the Essen Folksong Collection (Schaffrath, 1995). An invited essay by Huron begins the current issue.

Corpus research in music may serve a variety of goals. Jeppesen's aim was to characterize the compositional practice of a specific composer, ultimately for pedagogical purposes. Some recent corpus studies have also focused on specific musicological issues, such as Gjerdingen's (1988) study of 18th-century schemata and Tymoczko's (2003) study of common-practice harmonic progressions. Other researchers have investigated the abovementioned connection between corpus statistics and music perception, building models of perceptual processes based on corpus data (Bod, 2002; Quinn, 2010; Sadakata, Desain, & Honing, 2006; Temperley, 2007). Other corpus-based studies have focused on cognitive processes of composition and improvisation (Mavromatis, 2009;

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Pearce & Wiggins, 2004) or on cross-cultural correlations between music and language (Patel & Daniele, 2003; VanHandel & Song, 2010). Corpus methods are also central to the new field of music information retrieval, where they are used in the service of a variety of practical goals such as transcription (Klapuri, 2004) and genre classification (Aucouturier & Pachet, 2003).

Regarding methodological issues arising in corpus research, little can be said of a general nature, since so much depends on the specific purpose of the study; but a few points can be made. Creation of the corpus—unless an existing one can be used—is often a major and labor-intensive undertaking, raising significant issues and problems. One must decide what kind of information the corpus will represent and how it will be represented. In some cases, the kind of information needed can be extracted from scores in an objective way (for example, pitches or rhythmic values); in other cases, a significant amount of interpretation is involved (such as harmonic analysis or identification of phrase boundaries). If the focus of the study is on phenomena of composition, standard statistical techniques can be used to determine whether a pattern observed in a sample of pieces can reliably be generalized to the larger population under investigation. It is important to decide exactly what that "larger population" is—the music of a single composer, a specific compositional school or style, or a broader musical idiom (e.g., "common-practice Western music")—and to sample it appropriately. If the purpose of the corpus analysis is to set the parameters of a perceptual model, it is important for the model to be tested in some manner, necessitating the use of corpora in another way; here it is desirable to use a different corpus for testing (or at least a different part of the same corpus) from that used for parameter-setting.

The articles in the current issue reflect a variety of goals and methods, representative of the field as a whole. Huron's essay explores general issues in corpus research: problems in hypothesis testing and the implications of the rise of "big data." Three of the following six articles focus directly on issues of composition and musical style. An article by Daniele and Patel builds on earlier work by these two authors, investigating cross-cultural correlations between musical and linguistic rhythm using the nPVI measure; they offer a cultural explanation for changes in the nPVI of German music over the common-practice period. A study by Broze and Huron identifies a correlation between pitch height and speed—higher notes tend to be faster—and considers several possible explanations for this phenomenon. Broze and Shanahan explore changes in harmonic practice in jazz, and discuss possible musical and extramusical reasons for these changes.

Three other articles in the issue use corpus methods as a way of addressing issues in music perception. Duane's article is an experimental study of the factors involved in stream segregation, using stimuli drawn from a corpus of classical string quartets; as well as predicting when two melodic lines are heard as being part of the same textural stream, Duane's model predicts when two lines are heard as part of the same piece as opposed to different pieces. Albrecht and Shanahan propose a novel key-finding method based on the concept of Euclidean distance, finding that it performs well in comparison to other available models. London addresses the problem of developing a classical music corpus that is representative of present-day listening habits, and proposes a methodology for solving this problem.

We are grateful to the authors and reviewers whose efforts made this special issue possible, and to editor Lola Cuddy and the University of California Press for support. We hope readers find the following articles as stimulating as we do, and that they contribute to the further growth of this exciting area of research.

## References

Aucouturier, J., & Pachet, F. (2003). Representing musical genre: A state of the art. *Journal of New Music Research*, *32*, 83-93.

Bod, R. (2002). A unified model of structural organization in language and music. *Journal of Artificial Intelligence Research*, *17*, 289-308.

Budge, H. (1943). *A study of chord frequencies based on the music of representative composers of the eighteenth and nineteenth centuries* (Unpublished doctoral dissertation). Columbia University, New York.

Cohen, J. E. (1962). Information theory and music. *Behavioral Science*, *7*, 137-163.

Gjerdingen, R. O. (1988). *A classic turn of phrase: Music and the psychology of convention.* Philadelphia, PA: University of Pennsylvania Press.

Huron, D. (1990). Increment/decrement asymmetries in polyphonic sonorities. *Music Perception*, *7*, 385-393.

Huron, D. (1999). *Music research using Humdrum: A user's guide*. Stanford, California: Center for Computer Assisted Research in the Humanities. http://www.musiccog.ohio-state.edu/Humdrum/guide.toc.html

Huron, D. (2001). Tone and voice: A derivation of the rules of voice-leading from perceptual principles. *Music Perception*, *19*, 1-64.

Huron, D. (2006). *Sweet anticipation: Music and the psychology of expectation*. Cambridge, MA: MIT Press.

Jeppesen, K. (1927). *The style of Palestrina and the dissonance*. New York: Oxford.

Klapuri, A. (2004). Automatic music transcription as we know it today. *Journal of New Music Research*, *33*, 269-282.

Krumhansl, C. L. (1990). *Cognitive foundations of musical pitch*. New York: Oxford University Press.

Mavromatis, P. (2009). Minimum description length modeling of musical structure. *Journal of Mathematics and Music*, *3*, 117-136.

McHose, A. (1947). *The contrapuntal harmonic technique of the 18th century*. New York: F. S. Crofts.

Meyer, L. B. (1956). *Emotion and meaning in music*. Chicago, IL: University of Chicago Press.

Meyer, L. B. (1967). *Music, the arts, and ideas*. Chicago, IL: University of Chicago Press.

Patel, A., & Daniele, J. (2003). An empirical comparison of rhythm in language and music. *Cognition*, *87*, B35-B45.

Pearce, M., & Wiggins, G. (2004). Improved methods for statistical modelling of monophonic music. *Journal of New Music Research*, 33, 367–385.

Quinn, I. (2010). Are pitch-class profiles really 'key for key'? *Zeitschrift der Gesellschaft für Musiktheorie*, *7*, 151-163.

Sadakata, M., Desain, P., & Honing, H. (2006). The Bayesian way to relate rhythm perception and production. *Music Perception*, *23*, 269-288.

Saffran, J. R., Aslin, R. N., & Newport, E. L. (1996). Statistical learning by 8-month-old infants. *Science*, *274*, 1926-1928.

Schaffrath, H. (1995). *The Essen folksong collection* (D. Huron, Ed.). Stanford, CA: Center for Computer–Assisted Research in the Humanities.

Temperley, D. (2007). *Music and probability*. Cambridge, MA: MIT Press.

Tymoczko, D. (2003). Function theories: A statistical approach. *Musurgia*, *10*, 35-64.

VanHandel, L., & Song, T. (2010). The role of meter in compositional style in 19th century French and German art song. *Journal of New Music Research*, *39*, 1-11.

Youngblood, J. E. (1958). Style as information. *Journal of Music Theory*, *2*, 24-35.