Cognition, early polyphony, and interdisciplinary music studies

The *Journal of Interdisciplinary Music Studies* covers a series of conferences in which most papers are the combined effort of two or more authors, each from a different discipline. Ideally, one (or more) comes from the "sciences", the other(s) from the arts. This collection grows out of a topical workshop devoted to "Cognition of Early Polyphony" (University of Graz, April 2012), where it was held under the auspices of the European Science Foundation. The essays presented here and the responses to them have wandered somewhat from the original focus and span a musically broad range of times (roughly from 1400 to 1900), extended further and farther by some of the responses from scholars not involved in the original undertaking.

  While dissonance was a central focus of the workshop, the final results treat more various topics such as learning, artificial listening, and musical expectation. Contributors include learning and memory specialists, psychoacousticians, systematic musicologists, ethnomusicologists, and music theorists.

Cognition is treated flexibly enough to include perception and early polyphony through traditional music (an embrace that has existed since the dawn of ethnomusicology in the last years of the nineteenth century) in the contribution by Rytis Amvrazevičius on the Lithuanian *Sutartinés*, a diaphanous rendering in which he traces the relationship between roughness and dissonance. He gives particular attention to anhemitonic scales (those that do not contain conventional semitones) and the role of "beating" in describing the particular qualities of sounding dissonance. Roughness is associated with larger interval sizes. *Sutartinés* are found to ignore the Krumhansl key-finding profile and dissipate "towards the margins of the scale". Ross points out in a commentary that Sutartinés contain a number of unusual characteristics. Among these there is no sense of octave equivalence. The average harmonic interval is about 180 cents, and the genre is polytonal rather than being circumscribed by one tonality.

Eerola and Pearce consider a very broad terrain, stretching from. Their aim is to develop a predictive model of historical audiences, for which reason they work from several quite disparate collections of encoded music, ranging from madrigals published in the seventeenth century to folksongs collected from German-speaking lands in and around 1900. Little of this music was either pre-tonal or notable dissonant, but the range is such that pitch palettes are non-comparable and rhythmic factors are ignored. They pursue the concept of implicit learning as a basis for projecting "listener" profiles on these diverse repertories. The Coppini collection of 1607 contains contrafacta of secular pieces, and these offer the possibility of comparing with their models, although that lies outside the scope of this paper. Most of the data comes from the KernScores website and represents the work of diverse contributors. Ceulemans' commentary raises the pertinent question of whether or not melodic expectations of that time were mode-dependent. Denis Collins's commentary suggests the need for more particular attention to modes of listening and avoidance of constructing a "typical" listener who may not be typical at all. Tom Collins is skeptical of the entire approach on account of the absence of a "concrete musicological question" and of vertical

dependencies. The main value in the Eerola-Pearce contribution may lie in their effort to consider short- and long-term-memory in a balanced way. Huron generally agrees that implicit learning is fundamental to enquiries about historical listeners but calls attention to refinements that could be introduced from studies of gesture and affect.

The study of Jürgensen, Pearson, and Knopke has some similarities to that of Eerola and Pearce but the repertories and approach are entirely different, but it spans an earlier period. Its emphasis is on a training paradigm to detect differences of musical style. When introducing a style of music with which listeners are unfamiliar, how might a teacher proceed? The hypothetical lesson considered is one of "unconventional" dissonance treatment in the Italian *seconda prattica*, which departed from the flowing polyphony of the Renaissance in the years shortly after 1600. In the training sets for the *prima* and *seconda prattiche* they used two madrigals each by Palestrina and Monteverdi. Roughly equal numbers of music and psychology students served as subjects. Although students demonstrated some progress, the overall success was limited to increases in familiarity (moreso with Palestrina than with Monteverdi).

  The work by Omigie, Dellacherie, and Samson on dissonance judgments is focused on perception with clear emphasis on early music but with also with a generous review of perceptual literature from the nineteenth-century onward. They probe the role of emotion in making dissonance judgments and encourage a re-examination of harmonicity as a factor in eliciting emotional response to dissonance. Their discussion of recent studies of harmonicity vs "beating" is one of several that readers may want to consider. Their retrospective comments on learning in relation to "emotional judgments of dissonance", in contrast, revisits studies published more than a century ago. While Max Meyer's "Experimental studies" (1903) is still noteworthy, countless refinements have emerged over subsequent generations. Partly based on rat studies, they make the case that familiarity breeds positive affect. Their study becomes more pertinent as it switches to neuroimaging. Here they call attention to the involvement of adjacent brain areas in the processing of emotion and dissonance. Despite their extensive list of references, it is likely that a great deal more debate about neural links and correlates (with and without applicability to their goals) lies ahead. Their main point is to demonstrate the viability of tackling a question from multiple perspectives.

        Wolfgang Auhagen's commentary cites Carl Stumpf's differentiation (1911) of sensory and functional aspects of consonance and dissonance together with the recent work of Kopiez and Platz on "listening expertise" (*Music Perception*, 2009) as well as G. A. Sorge's advice to composers before they compose (*Vorgemach der musikalischen Composition*, iii, 1747). Somewhat in parallel, C. A. Beckett calls attention to the authors' lack of differentiation between "chords" (triads) and dyads and also to the gradually rising threshold for dissonance in musical practice. Jay Rahn cites the widely different tunings of fifths (~533+, ~720+) and thirds (~343+) in various parts of Southeast Asia and the Southwest Pacific and the implications such tuning systems have for generalizations about intervals, harmonicity, and "well-formedness". The authors respond with agreements to Müllensiefen's call for a much broader study and with the general observation that commonly used terms may take on divergent meanings across multiple fields of enquiry.

In some ways Richard Parncutt's effort to bring major-minor tonality together with the Schenkerian notion of prolongation and recent studies (mainly by Huron) of expectation and emotion takes on a magisterial presence among these contributions. It clearly demonstrates that virtue of single-author publications and in common with Ambravitius's study is coherent in and of itself. The synthesis of material is quite amazing. One element of his study is that the prolongational theories of Heinrich Schenker accord reasonably well with a lot psychacoustical theories and therefore deserve to be factored in to studies of tonality.

Where his position is less compelling is in his assumption that modes had emotional correlates. Medieval modes took their ontological stances from the natural world. The number of tones in a mode was considered to mirror the number of planets [sic], days of the week [a cultural construct], and other givens of the societies in which they were used. The threatening part of the breakdown of the theoretical underpinnings of the modes, which had been firmly prescribed for centuries in the context of liturgical practice, was that musical practice might diverge from its comfortable place "in the spheres" to which the *trivium* assigned it. (Note that the loosening of the modes around the year 1600 roughly paralleled Galileo's discoveries, which the Papacy at first welcomed but then soon found inimical. Science was good only insofar as the Papacy could control the information that reached the public.)

Theories of *Affect* (emotion) proliferated in the eighteenth century, mainly in Germany, somewhat retrospectively in relation to rules for tonal usage. Definitions of musical form dependent on particular tonal architectures enjoyed their heyday in the nineteenth century, again significantly lagging compositional practice. How listeners interpreted what they heard is almost beyond imagining today, since their opportunities to hear music (apart from folk music) were few compared to our today.

Rotter-Broman's study of contratenor parts on difference copies of the same late fourteenth-century ballata "El no me giova" shows how variant single parts added to a polyphonic context preserve function while assuming different styles. She challenges the view that three-voice settings were consistently preferred over two-voice ones. The contratenor was the third voice but was not consistently required. It was freer, when present, even though it was required to obey contrapuntal theory with respect to its relations with the tenor. Such two-voice relationships within three-voice polyphony have been the subject of much recent discussion. The subtlety here is that to those living in the fourteenth century vertical relationships existed only between particular pairs of voices.

Summary and conclusions

No guidelines exist to delineate the harmonization of these diverse approaches in this collection. One thing I miss in several contributions is an acknowledgment that tonality is difficult to evaluate in isolation from temporality. While it is common in computer analysis of musical data to weigh tones by their total sounding duration, it is common in music theory (GTTM and Schenker apart) to clock only onsets that define "events". *Affekten* became important when a particular key dominated a composition because without cumulative sounding times no discernible *Affect* could be deduced. The chant repertories that were so much defined by liturgical practical were expected to be

"correct" for the occasion. Religious practice in the middle ages and Renaissance was social practice, but no studies of group emotional experience from those centuries (with or without modal associations) are really available to link modes with emotions. A mountain of musicological evidence informs discussions of modes and the many ways in which they were, in various times and places, understood. See my list of "Pertinent annotated references" below. Younger musicologists such as Rehding (2011) are discussing relationships between theory and practice from new perspectives across a broad spectrum of centuries and styles. I would encourage interested readers to dip into the coverage represented in my appended list.

The claim that major and minor behave differently and generate different profiles of usage is hardly new. Statistical evaluations of different repertories continue to present challenging details. In our own profiles of sundry repertories in Themefinder (100,000 melodic exemplars; see Sapp, Liu, Selfridge-Field, 2004) we note a widespread tendency for works in a minor key to avoid starting on a third. One could speculate as to why this is so. My practical view is that both singers and instrumentalists may fear exposing a flawed sense of scale degree so sensitive to small flaws in pitch that it is best avoided at the outset. On the closer end of scholarly practice the many references to Krumhansl's key-finding algorithms all fail to acknowledge a half dozen refinements offered subsequently and the painstaking comparisons of Sapp (2011), which discloses the particular biases of each and further shows that some bias is unavoidable.

Coming principally from the field of historical musicology, I miss several often-cited studies that bear directly on the original topic of the workshop and, too often, on the discussions found herein. Long lists of citations within several of the articles cannot fully compensate for a failure to achieve a higher "sum" through collaboration than may be possible in two separate studies on a common topic. Multiple perspectives that run in parallel but do not truly complement one another do not really advance the goals of collaboration. The single-author articles are easier to follow and also, in large measure, to recommend. If multiple viewpoints are to be encouraged, then clearer formulations of the manner in which different kinds of research are to be integrated are necessary. The response from Omigie et al aptly calls for a reckoning of vocabulary to avoid discussions of different phenomena under common rubrics. This "looks/sounds the same but is not" phenomenon abounds in many cross-conversations of today's scholarly world and is no fault of the contributors, who faced the difficult task of interpreting the assignment as they saw fit. The conference itself was stimulating, and cross-conversations worked well *in situ*. Enabling them to work as well in text remains a work in progress. In particular an analogue to the mediating forces of group discussion remains elusive.

Pertinent annotated references

Bent, Margaret (1998). "The Grammar of Early Music: Preconditions for Analysis" in Cristle Collins Judd (ed.), *Tonal Structures in Early Music* (New York: Garland, 1998), pp. 15-59. Discusses the contrasting lapses of musical analysis conducted outside a historical framework and musical history that avoids analytical involvements. Both run the common risk of imposing modern notions on music as it was conceived by medieval and early-modern minds.

Collins Judd, Cristle (1992). "Modal Types and 'Ut, Re, Mi' Tonalities: Tonal Coherence in Sacred Vocal Polyphony from about 1500," *Journal of the American Musicological Society* 45/3, pp.428-467. http://www.jstor.org/stable/831714. Considers the modal theories of Pietro Aron (1525) and Glarean (1547) in relation to Josquin's motets, which sometimes (but only sometimes) submit to the modal typologies of diverse theorists.

Powers, Harold S. (1981). "Tonal types and modal categories in Renaissance polyphony," *Journal of the American Musicological Society,* 34/3, pp. 428-470. http://www.jstor.org/stable/831189?seq=1#page_scan_tab_contents. Based on his broad experience of European and Indian music, Powers confronts the Renaissance "systems" of 24 (and other) modes in the context of supposed "transpositions" to derive the roster of tonal types that later emerged from modal theory. In a broad-ranging essay he revisits the eight church modes and cites divergences between modal "doctrine" and polyphonic "theory".

Rehding, Alexander (2011). "Tonality between rule and repertory or Riemann's functions — Beethoven's function," *Music Theory Spectrum: the Journal of the Society for Music Theory,* 33/2, 109-123. Discusses relationships between principles of theoretical works and actual practices to which the theories are held to pertain, particularly in nineteenth-century usage. One of a series of articles on nineteenth- and twentieth-century musical practices under the microscope of harmonic theories. Some of his enquiries extend to popular music.

Sapp, Craig Stuart. "Computational methods for the analysis of musical structure," Ph.D. thesis, Stanford University. (14.59 MB download at https://searchworks.stanford.edu/view/9238521). Compares numerous refinements to the original Krumhansl-Kessler algorithm for key-finding, shows how different biases emerge at a hierarchy of levels of temporal resolution, and compares the biases in a series of post-Krumhansl algorithms.

Sapp, Craig, Yi-Wen Liu, and Eleanor Selfridge-Field, "Search Effectiveness Measures for Symbolic Music Queries in Very Large Databases," ISMIR 2004. Downloadable here: http://ismir2004.ismir.net/proceedings/p051-page-266-paper135.pdf. Themefinder, which provided the basis for this study, is found at http://themefinder.ccarh.org.

Schoenberg, Arnold (1959). *Structural functions of harmony*, tr. Leonard Stein (London; also New York, 1969). Schoenberg aims for a theory of monotonality in which sections of a large structure, such as sonata form, visit "regions" of the main key rather than contrasting "keys". This concept is succinctly communicated in his functional and key-specific charts.

Schubert, Peter (2008). *Modal Counterpoint, Renaissance Style*, 2nd edn. New York: Oxford University Press; and Schubert, Peter, and Christoph Neidhöfer (2006). *Baroque Counterpoint*. Upper Saddle River, NJ: Pearson Prentice Hall. These textbooks contain myriad musical examples carefully selected to show fine shades of difference between practices from place to place and time to time. They offer valuable evidence of widely variant practices against which to gauge theories of Western music over these centuries.

Volk, Anja, and de Haas, W. Bas (2013), "A corpus-based study of ragtime syncopation," ISMIR 2013 (Curitaba, Brazil), pp. 163-168. Just one of a series of papers aimed at identifying musical genres by their rhythmic profiles at multiple levels of temporal and "activity" resolutions. Downloadable at http://ismir2013.ismir.net/wp-content/uploads/2013/10/Proceedings-ISMIR2013-Final.pdf.

Werner, Eric (1948). "The oldest sources of octave and octōēchos," *Acta musicologica*, 20, pp. 1-9. One of Werner's numerous writings on ancient and early medieval conceptions of modes and the derivation over many centuries of the octave and progressively smaller musical intervals taken for granted by the 14th-16th centuries. He discusses liturgical links to divine numbers and calendrical systems which in their agglomeration imposed patterns on intervallic relationships over many more centuries.

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