Music Analysis East and West (review)

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are introduced to particular ways of thinking about space in mathematics that prepare a discussion of 'surface' in music, equating the idea of suspension in tonal music to that of an 'extended surface'. Rothstein reveals the multiple surfaces of Bach's music and extends this to the notion of 'tonal topology' in Beethoven. It is this mode of thinking that seems particularly energizing for the musician in developing an enriched understanding of the multidimensionality of music, by transcending the spaces of tones and semitones to arrive at new concepts of musical space, shedding light on the enigmatically huge sense of spatial motion that can be experienced through the smallest harmonic shift (such as the motion from I to ♭II in the opening bars of the *Appassionata*). Through such concepts, we are brought closer to perceiving music's raw action in time and space and to our actual experience of it, in a way that transcends stylistic boundaries. Moreover, it is through the abstract systems developed through mathematics to understand physical space that we can approach a narrative for music's extraordinary command over time.

While these considerations of space are where the most specific content of this book lie, 'truth' and 'beauty' are also given detailed examination through discussion of form, ratio, proportion, and knowledge. The author's concern with truth and beauty is apparent in the way the book itself is structured to create the sense of an emerging plot. At the volume's golden section (approximately two-thirds of the way through, on pp. 167–8) one finds the most direct, even bold-faced, defence of the preoccupation with analogy upon which this plot turns. Rothstein speaks through Ghyka, who drew attention to the relevance of analogy to both science and art, culminating with Aristotle's statement that 'the greatest thing of all is to be a master of the metaphor ... it is the only thing which cannot be taught by others; it is also the sign of original genius, because a good metaphor implies the intuitive perception of similarity and dissimilar things' (pp. 167–8). It is at this point that it becomes plain that *Emblems of the Mind* is as much about the essence of the bond between mathematics and music and the very texture of thought as about actual correspondences. 'Beauty is experienced as a form of knowledge because it is through the archetypal rational act—that of analogy and metaphor—that we come to know the beautiful' (p. 168). We are prepared in this way to contemplate Plato's Divided Line, to which the final, relatively brief, chapter of the book is confined.

The book's title and cover design signpost its somewhat romanticized prose, which launches, via invocations of Wordsworth, into images of starry heavens, moonlit mists, and the laborious journey of the poet—a theme that is threaded throughout the text—priming us to anticipate crystalline perceptions of the highest order. Music is frequently referred to as 'mysterious', and the book's narrative presented as an attempt to 'solve' its secrets. This populist skin is nevertheless worth peeling to witness what is essentially a thoroughly developed, incisive train of thought, framed as a particular kind of experience in its own right. Indeed, Rothstein's skill in presenting complex concepts in a way that is both comprehensible and enlightening to non-specialists in either field is exceptional. However, while it succeeds in elucidating a particular way of thinking, the book falls short in some of its detail. Diagrams and examples are intended for the amateur but are disappointingly unadventurous in such an audacious terrain. Actual musical examples are confined to the familiar ground of works such as Bach's C Major Prelude from *The Well-Tempered Clavier*, Book 1, Mozart's variations from the Sonata in A, K. 331 and *Ah, vous direz-je maman*, Beethoven's 'Appassionata' Sonata, Chopin's A minor Prelude, with a bare whiff of the twentieth century in the form of Webern's Cantata no. 2, Op. 31. While composers as diverse as Josquin, Stockhausen, Schumann, and Xenakis are mentioned or quoted, their music itself is not addressed. This limits the potential impact of the book's contribution to the field since the aspiration for transcendence it nurtures with such persuasion is not fully tested against its own criteria.

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This volume is part of a series that began as a directory of research projects and software in musicology using computers but that within a decade had become a themed collection of articles. The back-cover blurb accurately states: 'This volume of *Computing in Musicology* considers approaches to the computer representation and analysis of early and non-Western music.' The 'early' music is not all so early (some as late as Chopin) and the representations are not exclusively for early music, but the characterization is a fair approximation. One might expect as

much from the title's 'East and West', but West still precedes East in the organization of the volume, whose chapters proceed geographically from Europe to the Far East. The title does not prepare us for the blurb's reference to 'representation', but research in musicology with computers has been continually sidetracked into issues of representation since its beginning. Indeed, six of the thirteen chapters in this volume are explicitly concerned in the main with representation or software design, and of the remainder only four claim to have made new findings of a musicological nature. The common characteristic, shared by almost all the chapters, is description of ongoing research projects (the series thus remains true to its roots), and it is as a means of learning from what others are *doing* that this publication is most useful.

The first two chapters concentrate on XML (Extensible Markup Language), a widely used framework for representation schemes. One concerns MusicXML (by its originator, Michael Good), which aims to provide a means of representing the information contained in printed scores from the seventeenth century onwards. Other representation schemes have attempted this before, but the basis of MusicXML in XML makes its manipulation by different pieces of software much easier and, as described in the chapter, it has the advantage of adoption as an interchange format by a number of pieces of commercial music software. The second chapter (by Eleanor Selfridge-Field) is a survey of musicological applications of XML, ranging from a database of Chopin editions to the encoding of neumes. While XML does not solve issues of representation, it does provide a framework for their solution and facilitates interoperation.

Representation is also the explicit concern of two of the 'Eastern' chapters: one concerning Indian tabla (by Parag Chordia) and the other Japanese koto (by Craig Stuart Sapp and Sachiko Deguchi). Both present schemes which make use of David Huron's *Humdrum* framework (<http://music-cog.ohio-state.edu/Humdrum/>), demonstrating both the flexibility of that software and its degree of acceptance by the musicological community.

Five chapters describe software systems. By now databases are a firmly established computing tool, and most of us probably use them nearly every day without realizing it. However, each new musicological project still tends to present challenges because of the nature of the material to be stored and related. One chapter (by Christine Jeanneret) describes a database designed for seventeenth-century Roman keyboard music. This must juggle references to manuscripts, pieces of music, composers, copyists, patrons, musical events and occupations, and locations, plus selected images from the manuscripts themselves. Another chapter (by Annalisa Doneda) also describes a database system grappling with a variety of types of material, but this time focusing more on musical content, specifically Byzantine chant. A variety of neumatic notation systems has been used for this music, giving different kinds of information. The database system relates images of notations to encodings, allowing researchers to investigate the meaning of some poorly understood neumatic notations.

Three other chapters concern different kinds of software system. One (by Laurent Pugin and Christine Jeanneret) describes the music notation software *Wolfgang* specifically designed for scholarship and capable of dealing with various kinds of early music. Frankly, the value of a chapter like this is not clear: one learns the capabilities of the software but no information that might help someone not considering using it. Laurent Pugin also gives a description of software, the system *Aruspix*, which aligns images of two sources of music printed with movable type to facilitate the discovery of differences. However, he goes beyond mere description to discuss the kinds of differences that occur and the image-processing techniques involved. Alexandra Uitdenbogerd and Iman Suyoto go even further in describing the underlying theory and functioning of software for matching melodies with microtonal tunings (here specifically as found in Sundanese music from Java, but the system has general application). They make explicit comparisons with other work in 'music information retrieval' (as seen in the annual ISMIR conferences) and give a quantity of useful information for researchers either using or designing similar systems.

The four chapters focusing on specific musicological questions also cover the spread from West to East. Japanese koto music features once again, in a study by Sachiko Deguchi and Katsuhiko Shirai that examines the melismas contained in some traditional songs of koto players. Occurrences of two-, three-, and four-note sequences are counted in both melismatic and non-melismatic sections of six songs, each taken from two different sources. The distributions are found to vary, allowing the researchers to conclude that a restricted repertory of melodic patterns with smaller range is used in the melismatic sections. Furthermore, the melismas show greater variability between the sources than do other sections of the songs.

A similar process of statistical argument underlies Joshua Veltman's study of text underlay and metre in sixteenth-century motets. This investigates the much debated question of the degree to which sixteenth-century European vocal polyphony is metrical. Veltman counts the occurrence of stressed and unstressed syllables at different rhythmic points in seven settings of the *Pater noster* by Willaert, Lassus, and Palestrina. The statistical analysis is accurate and sophisticated, and broadly indicates that the composers did place stressed syllables according to a metrical hierarchy.

Arvindh Krishnaswamy's examination of ornamentation and tuning also addresses a much debated question: whether or not Indian classical music uses more than twelve distinct pitches. In this case the argument proceeds by discussion of examples rather than statistics, examining pitch–time graphs of sung sequences claimed to make use of more than twelve tones. These show the moment-to-moment change in pitch, and the putative microtonally pitched notes are revealed instead to be characteristically different patterns of inflection between two or more relatively fixed pitch positions within the dodecaphonic scale. Krishnaswamy argues that notes in such music must be considered as two-dimensional (pitch–time) entities instead of attempting to characterize them on an elaborate one-dimensional pitch scale.

The essay by Panayotis Mavromatis discusses experiments to model the production of Greek church chant with a Hidden Markov Model. This is a well-established kind of computing tool that has similarities to a grammar (familiar to the computational-musicology community in the seminal works of Baroni, Steedman, and Kippen and Bel), but has the advantage of well-defined mechanisms for its derivation (or 'learning') from a corpus of examples rather than having to be constructed 'by hand' (as was the case for the earlier examples of musical grammars). Furthermore, unlike some other machine-learning systems such as artificial neural nets, the final state of a Hidden Markov Model is amenable to analysis to discover precisely what the system has learned and not simply how well it has learned to mimic the repertory in question. Panayotis's study is small-scale, and can only really be considered a proof of concept, but it does reveal interesting findings concerning decision points and the transposability of opening formulas in contrast to cadential formulas.

Of these four chapters, only one specifies the computer tools that have been used (the one by Veltman, which used the *Humdrum Toolkit*),

which seems odd in a volume dedicated to computer applications. Nevertheless, they do neatly provide examples of the three kinds of ways in which a computer may be a useful musicological tool: by empirical statistical analysis of large quantities of data (the text underlay and koto melisma studies), by revealing data not discoverable simply by ear (the study of pitch in Indian classical music), and by implementing theoretical models (the Greek church chant study). It is encouraging to see computer-based studies like this bearing fruit, and particularly, in two cases in this volume, to see new light being shed on otherwise unresolved musicological questions. Though these musicological results themselves are likely to be of interest to disparate musicological communities, and in any case have apparently also been reported elsewhere, the real value of this volume is in its demonstration that convincing and musicologically useful empirical results can come from computer-based studies. The accompanying discussions of representation and software show that achieving results can still be problematic, but computer-based research is moving away from the preserve of a small band of highly trained specialists and into the mainstream of musicology.

The production quality of the volume is good. It has many useful illustrations and diagrams, of which only one is barely readable. The editors have done an efficient job in imposing consistency of style, but they might have gone further in ensuring that authors were always complete in their explanations. An index of names and musical concepts is provided.

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Mozart's Piano Music. By William Kinderman. pp. x + 236. (Oxford University Press, New York and Oxford, 2006, £19.99. ISBN 0-19-510067-0.)

The keyboard played an overwhelming part in Mozart's life. His earliest recorded composition, a ten-bar C major Andante, K. 1a, was for keyboard (harpsichord, probably) and dates from early 1761, shortly after his fifth birthday. Almost thirty years later, he completed his last piano concerto in B flat, K. 595 (though the work had been started in 1788). In addition to eighteen or so solo sonatas, the twenty-seven concertos, a handful of variation sets, and other occasional pieces such as the chromatic Minuet, K. 355, the Rondos K. 485 and K. 511, a few Baroque-style trifles perhaps composed in emulation of J. S. Bach, and the