Interview with Richard Cohn

MusMat Research Group

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I. How did you get interested in Mathematics in the beginning of your research?

As a child I always played with numbers in my head, and also enjoyed solving puzzles, but my formal math education ended in secondary school. My studies in atonal pitch-class theory with Robert Morris, as a PhD student, showed me how mathematical modes of exploration and expression could help me see more deeply into music that I cared about, and communicate my observations to others. My dissertation applied those modes to 20th-century music, with a focus on the music of Béla Bartók. My exposure to the writings of David Lewin and John Clough showed me how those modes of exploration and expression could be productively applied to historically earlier repertories, giving me the tools to understand some aspects of the music of Schubert, Brahms, and Wagner, which I loved, and for which my tonal and Schenkerian training were unsatisfactory. Lewin and Jeff Pressing, also suggested some ways to apply atonal pitch-class theory to rhythms and meters, and seeing the power of that generalization over time opened new doors for me.

Most of my mathematical work since then has emerged very clearly from specific music-analytic problems that I encountered. But the mathematics that I became comfortable with, in my analytic work, also merged with my pleasure in puzzle-solving, and sent me off in some more systematic directions, most specifically in my *Music Theory Online* article in 2004, in which I proposed a tetrahedral model for voice-leading among tetrachord classes. That really stretched my mathematical capacities to the limit.

All along the way I've had help from colleagues and students who got interested in musical problems that I identified, and taught me the mathematics to explore and express them. The late Jack Douthett, above all, was extraordinarily generous in teaching me how to think and write using math. I've also benefited, at different times, from correspondence or conversation with Julian Hook, Ian Quinn, and Dmitri Tymoczko, all of whom have done towering work. I've learned so much, both directly and indirectly, from their companionship and modelling, as well as from mathematically adept PhD students such as Adrian Childs and Clifton Callender, who studied with me at Chicago in the 1990's.

II. How do you see the collaboration between musicians and mathematicians, and how can it be more effective?

In my own experience, that collaboration just emerged naturally, as mathematicians became intrigued by the musical problems that I posed in a sort of quasi-mathematical language (which I'm sure seemed like a strange dialect to them). The resources now are so tremendous, largely thanks to the work of the Society for Mathematics and Computation in Music, since 2007, and corresponding societies, such as yours. And they will be boosted by Julian Hook's forthcoming book from Oxford U.P., *Exploring Musical Spaces*, which is bound to be the starting point for both musicians and mathematicians concerning structuring of pitch and time. Jay's training is ideal, as he has doctorates in both fields, and he is also a skilled teacher. Of course it would be wonderful if everyone had that sort of cross-training, or if at least there were some post-graduate programs in mathematical music theory, where students were encouraged to pursue advanced work in both fields. The pioneering program at Georgia State is paving the way in the US. But the field needs to reach a certain level of critical mass for that possibility to become a reality more broadly.

III. In 1998, you wrote the introduction of the Journal of Music Theory volume dedicated to Neo-Riemaniann theory. How do you see the current status of Neo-Riemannian theory in the world today?

That's a complex question, because the boundaries of neo-Riemannian theory are difficult to determine. Within mathematical music theory, there is a steady stream of articles in the *Journal of Mathematics and Music*, and in the biennial proceedings of the Society for Mathematics and Computation in Music, that share neo-Riemannian concerns with voice-leading parsimony, with voice-leading properties of particular chords and scales, and with graphic and geometric models of musical systems. The most powerful recent work in this broad stream does not identify specifically with neo-Riemannian theory, but explicitly merges some of its questions, methods, and particular instruments with those of atonal pitch-class theory and diatonic scalar theory: the OPTIC model of Callender, Quinn, and Tymoczko; Tymoczko's multi-dimensional voice-leading orbifolds, as well as new approaches in his forthcoming book; the Discrete Fourier Transformation paradigm that that emerged from Ian Quinn's dissertation and is powerfully developed in a series of publications of Emmanuel Amiot and Jason Yust, among others; Leah Frederick's models of diatonic voice leading spaces, among many others that one might cite.

Within the field of music analysis proper, there are important recent applications to film music, by Frank Lehman and Scott Murphy. These writings are mostly rooted in a post-Lewinian transformational paradigm, though, that in the Buffalo sphere was already being absorbed into a more graphic and systematic orientation by the late 90's. As for analytical applications to 19$^{\text{th}}$-century harmony, there has been a surge in the UK of work that traces roots in neo-Riemannian theory. There is little interest, though, within the American analytical community, in modelling music of the 19$^{\text{th}}$ century, or any historical repertories for that matter. To the extent that there is current interest in pre-1980 repertories, it is directed primarily to large questions of musical form rather than to small-scale questions of harmonic progression. But I have been heartened to learn that my *Audacious Euphony* is being translated into Czech and Chinese, and so by the time that American analysts find a new interest in 19$^{\text{th}}$-century harmony there may well be some new international models from which they might take inspiration.

IV. Do you think that Music might someday provide problems to Mathematics the same way Physics did, historically speaking?

I think a mathematician is in a better position than I am to respond to this question. But my impression is that already in classical antiquity and the Middle Ages there was quite a bit of traffic in the pipeline from music to mathematics. In the early-modern era, one can point to Leonhard Euler, who already is beginning to work out graph-theoretic problems in his exploration of the properties of the *Tonnetz*, five years before his 1736 paper on graph theory initiated that branch of mathematics. In our own time, the late Jack Douthett, in collaboration with Richard Krantz, productively applied their theory of maximally even sets to spin configurations of electrons. I understand that Jack's last paper, completed (with several collaborators) just days before he passed away in 2021, generalizes that work to solve a somewhat more complicated mathematical problem, the so-called "Three-color problem". We are really fortunate that music theory has, from time to time, drawn the interest of transcendentally brilliant people who are able to function across magisterially broad terrains!

V. We had the honor of publishing your article *Teaching Atonal and Beat-Class Theory, Modulo Small* in our first issue of **MusMat Journal**. In this number, we have been working in the state of the art of Music and Mathematics in Latin America. What is your opinion about the research in this realm and what kind of impact Latin American music may have on the research made in other countries?

There is so much tremendous music from so many different parts of South and Central America and the Caribbean islands; I regret that I have so far only become familiar with a small corner of this vast repertory. There is already a productive stream of research that applies beat-class set theory to the cyclic rhythms of many of these regional repertories. Since many of these repertories are improvised or orally disseminated rather than notated, and some of them are quite thickly layered, the biggest challenge is a musical one: to capture an initial representation through transcription. This requires the work of expert practitioners such as Stephen Guerra, who has transcribed a number of Baden Powell's solos, and is aided by the crafty pedagogical use of digital technology, as in the virtual *roda* of Jason Stanyek and Fábio Oliveria. Once the music is transcribed, there are significant research opportunities employing mathematical modelling, adapting techniques from pitch theory to achieve deeper understanding of multi-layered cyclic rhythms. Separately, there are also significant initiatives dealing with microtiming patterns as they unfold in continuous rather than digitally quantized time. Sophisticated technology broadly available to researchers has opened a number of doors, and there is an interest within the community of analysts, especially those associated with Analytical Approaches to World Music, and so this is a great time for learning more about these repertories.

VI. The entry "analysis" from New Grove presents a series of tools and analytical possibilities. Do you see an amplification of this fragmentation? Or maybe the opposite: is there a tendency toward synthesis or concurrent work of methodologies?

This is a really complicated question! I don't think I have a good answer for it, but maybe I can walk around it for a while. The intellectual paradigm under which music theorists operate has fundamentally changed since 1980, when Ian Bent's extraordinary entry on analysis was published in the New Grove. At that time the field was operating under an "unnatural confluence" (in William Benjamin's terms) of soft European connoisseurship and hard behaviorism. The cognitive revolution was just coming to the attention of the music-research community, and the fields of music perception and cognition were just beginning to operate on the remarkable international scale that they have since maintained, and intensified with the help of globalizing communication technology. Forty years later, the field of music theory and analysis lies cracked wide open in so many different respects.

On the one hand, the cognitivist orientation led music theorists to see that even the simplest musical action, by the least trained of individuals, is unfathomably complex (I think here of the stunning 1991 book of Jeanne Bamberger, *The Mind Behind the Musical Ear*, which playfully explores how children mentally model *Twinkle Little Star*). Even after forty years of intensive work in behavioral sciences, and more recently in neuroscience, we still don't know how the human brain decides which pitch-class is the tonic, which beat-class is the downbeat, how the brain connects musical events into streams, how it processes multiple musical streams and multiple meters, how it groups events into motives, and how improvising musicians are able to keep it all going at such a fast pace in real time. And so there is no limit to the musical repertories that can be profitably studied, as the ethnomusicologists had been trying to persuade us throughout the 20th century.

On the other hand, the behavioral sciences have helped us to identify some aspects that are at the core of humanity's musicality. To some degree, those aspects seem to transcend cultural and other sorts of differences, and thus can stand as a starting place for the modelling of musical behavior and its artistic products. And those aspects, strangely, are the ones that benefit from mathematical modelling. They include categorical perception, which quantizes the continuum of pitch into discrete categories; bodily entrainment, which does the same for continuous time; pitch-class and beat-class equivalence, which convert linear phenomena into cyclic ones; and auditory streaming, which David Huron has brilliantly shown to underlie polyphonic practices. So whereas entropy has fractured the analytic enterprise into as many pieces as there are distinct musical cultures, the identification of quasi-universal attributes in the human body and mind has brought the enterprise back together again in a way that is well explored by mathematical concepts and modes of representation. Since those attributes exist at such an abstract level, they are ramified in so many varied ways in different micro-cultures that, as soon as one proposes a general mathematical model to unify the study of music, the whole enterprise then diffracts out again in an entropic explosion. I personally find the dialectic process exhilarating, and am happy to be a music theorist working in today's environment.