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EDITORIAL

As an unreformed interdisciplinarian who moves back and forth between humanistic and scientific approaches to music, I'm accustomed to people questioning the basic tenets that underlie one framework or the other. One of my favourite examples comes from an editorial board meeting for a journal. Most of us had flown in and spent the morning around a conference table, introducing ourselves and our work. One of the board members, who had skyped in later owing to a time difference, missed this initial conversation but was nevertheless asked to introduce himself. He outlined some of his interests, taking special care to delineate them from what he termed 'that awful American type of music cognition that measures responses to artificial stimuli'. I don't view myself as a practitioner of an awful type of music cognition, although judging by the awkward looks shot in my direction, some of the other board members suspected I might.

In fact, I view these kinds of comments (which emerge from both sides, by the way; I've heard colleagues in science protest that they can't figure out what a particular ten-thousand-word humanities paper is actually saying and why we should care about it) as a productive and reliable self-check mechanism. I'm less in danger than many academics of succumbing to the kind of mild brainwashing than can occur when you only interact with people that share your foundational assumptions.

When I consider the critique about artificial stimuli, I immediately think about the projects that use materials based on sine waves or MIDI progressions in an attempt to create more perfect control conditions than can arise in live performances. But a significant and growing body of work in music perception and cognition uses fully fledged musical examples as materials, in the form of audio recordings played over headphones or video recordings of performances presented on a screen, or live performances taking place in a concert hall or other environment outside the borders of the traditional laboratory. Most significantly for this journal's readership, these more fully fledged musical examples stem not infrequently from music of the long eighteenth century. Surveying this repertory's use in contemporary music cognition research can illuminate present-day assumptions about how it functions; surveying participant responses can reveal how it tends to be heard. Since many of these studies use participants with little to no formal training in music, they can be particularly useful for getting inside the ear of listeners who might have very different experiences from people who regularly perform, teach or write about this repertory.

Perhaps no other scientific study makes as infamous a use of eighteenth-century music as the paper that gave rise to the so-called Mozart effect (Frances H. Rauscher, Gordon L. Shaw and Catherine N. Ky, 'Music and Spatial Task Performance', *Nature* 365 (1993), 611). Although this paper uncovered a short-term benefit for performance on a spatial-reasoning task for college students who listened to W. A. Mozart's Sonata for Two Pianos K448, and although the effect was subsequently discovered to be attributable to the brief arousal conferred by listening to any relatively upbeat music – whether it be hip-hop or classic rock or simply what one listens to while walking on a treadmill – the impression that science had identified special brain-boosting power in Mozart proved difficult to retract. In the late 1990s the Governor of Georgia proposed distributing Mozart CDs to all new mothers in the state, and the legislature in Florida passed a law mandating that accredited child-care centres listen to classical music every day. Baby toys sold at major retail outlets are still likely to play *Eine kleine Nachtmusik*, almost thirty years later. The beguiling misinterpretation of this research speaks to the power of underlying cultural assumptions about the mysterious genius of the classical period's canonical composers, and the embodiment of this genius in the sounds of their music. The tacitly held theory seems to be that children, like zombies, will be mystically pulled in edifying directions by the mere sounding of these sequences of notes. Yet given that the same music has been deployed in public spaces to repel people of insufficient economic means (Theodore Gioia, 'Bach at the Burger King', *Los Angeles Review of Books* (17 May

2018)), it is clear that these sounds are anything but abstract and purely mathematical, and in fact carry substantial associative residue, including implications about social class and identity.

These associations were foregrounded in one of my own projects, which used an unusual method for exploring musical experience: asking people to report on the stories they imagined while listening to instrumental excerpts (Elizabeth H. Margulis, 'An Exploratory Study of Narrative Accounts of Music', *Music Perception* 35/2 (2017), 235–248). In response to a movement from a Telemann suite, eighty-eight per cent of participants who reported a story used one of these words: ballroom, dance, celebratory event, fancy party, royal wedding. Moreover, participants overwhelmingly tended to characterize the event as taking place in the past, although they disagreed about the precise timeline, with some placing it in 'medieval times', others 'the eighteenth century', some 'the turn of the century' and others merely 'long ago'. Without any contextual information, and without prior experience of this particular excerpt, participants produced highly specific descriptions that matched each other's closely, despite the fact that the study was carried out one participant at a time in a small sound-attenuated booth, with volunteers from the general psychology participant pool at the University of Arkansas. This matching of responses was subsequently replicated with a separate set of participants at Michigan State University, suggesting that these associations are broadly shared, at least among college students enrolled at public institutions in the middle of the United States. Ongoing work using this method broadens the participant pool to different age brackets, backgrounds and geographic regions, in an effort to understand the cultural fault-lines along which particular associations accrue.

Across several years of studies that use imagined stories as a dependent measure, it has become clear that this is not only a response that people without formal musical training *can* indulge in; it's a response that they often *do* indulge in. And when they do imagine stories, the consensus on the specific contours of the story can be strikingly similar for individual excerpts even within broadly defined population groups (such as college students at public universities in the United States Midwest). Thus when thinking about eighteenth-century music in particular, it can be interesting to learn that many people share quite particular associations, even though these details might diverge substantially from what a scholar of this music might assume. Moving outside the confines of the long eighteenth century to provide a particularly telling example, an excerpt from the Mephistopheles movement of Liszt's Faust Symphony was heard by almost three quarters of participants as a cat-and-mouse chase: hardly the diabolical connotation that might be assumed. Finding out what people do with this kind of music before they've been inculcated with a particular variety of formal training can be immensely interesting for pedagogues, arts presenters and anyone engaged with questions about how music comes to be meaningful.

Listeners' visual, expressive and formal associations can also differ from what scholars might expect. Erin S. Isbilen and Carol Lynne Krumhansl ('The Color of Music: Emotion-Mediated Associations to Bach's *Well-Tempered Clavier*', *Psychomusicology: Music, Mind, and Brain* 26/2 (2016), 149–161) showed that people both with and without formal training, regardless of whether they possessed absolute pitch, reported stable colour associations with individual preludes from Book 1 of Bach's *Well-Tempered Clavier*. These visual associations correlated with emotional ones, raising the possibility that both are mediated by semantic associations of the type just described. Dorottya Fabian and Emery Schubert ('Expressive Devices and Perceived Character in 34 Performances of Variation 7 from Bach's *Goldberg Variations*', *Musicae Scientiae* 7 (2003), 49–71) asked trained participants to identify the character of thirty-four different performances of Variation 7 of Bach's *Goldberg Variations*. Articulation, tempo and loudness affected the performances' perceived character more strongly than the way the dotted rhythms were performed, despite historical accounts that emphasize the centrality of this particular element. Their findings reinforce the notion that twenty-first-century listeners might not be attuned to the same cues that defined affect for eighteenth-century listeners.

Roni Y. Granot and Nori Jacoby examined listeners' sensitivity to structural functions within a Mozart piano sonata ('Musically Puzzling I: Sensitivity to Overall Structure in the Sonata Form?', *Musicae Scientiae* 15/3 (2011), 365–386) and a Haydn piano sonata ('Musically Puzzling II: Sensitivity to Overall Structure in a Haydn E-minor Sonata', *Musicae Scientiae* 16/1 (2011), 67–80) by presenting them to participants in segments (ten in the case of the Mozart piece; eight in the case of the Haydn) and asking them to

assemble the segments into 'a musically logical and coherent succession' ('Musically Puzzling I', 371). Very few people (two out of the eighty-odd participants in each experiment) ordered the segments as they actually occur in the sonatas, but the orderings listeners did produce revealed broad sensitivity to formal functions. People tended to place more unstable material in the middle, and more stable passages toward the beginning and end, producing a kind of ABA structure with an arc of tension over the course of the piece. Moreover, they often positioned the first and last segments of the piece correctly, suggesting that listeners recognize the rhetorical cues and performance inflections (for example, unison textures, cadential formulas, ritardandos) that signal beginnings and endings. Participants' orderings revealed little concern for global harmonic structure – even when one passage contained a harmonic resolution of the preceding one, these two were rarely placed in succession. This was true even for participants with extensive formal musical training.

Participants in a study by Zohar Eitan and Roni Y. Granot ('Growing Oranges on Mozart's Apple Tree: "Inner Form" and Aesthetic Judgment', *Music Perception* 25/5 (2008), 397–417), instead of rearranging segments themselves, rated intact and hybrid versions of two Mozart piano sonatas on aesthetic scales including liking, interest and coherence. Despite the fact that the hybrid versions mixed sections from the two sonatas together, participants both with and without formal musical training showed no preference for the original, unhybridized versions. This finding seems to undermine the notion that an alleged organic unity singularly produced by a 'great' composer consistently gives rise to aesthetic experiences that transcend other ones.

Yet convictions about a particular composer's greatness, or a particular performer's brilliance, can materially affect the way a performance is experienced and evaluated. Contrast the indifference that met violinist Joshua Bell's incognito performance in the subway system (famously chronicled by *Washington Post* reporter Gene Weingarten on 8 April 2007) with the rapture that can meet his performances in the world's influential concert halls. I was at Carnegie Hall in 2000 when pianist Martha Argerich played a solo recital for the first time in almost twenty years. The uproar when she first appeared on stage – complete with yelling, foot stomping and relentless applause – revealed an audience in a maximally receptive state. I remember thinking that with an audience in this condition, there were almost no sounds she could have produced on the piano that would not have been received ecstatically.

A number of studies speak to the power of this anticipatory state. When told beforehand that one performance (in several cases of eighteenth-century music) was played by a world-renowned professional and the other by a conservatory student of piano, people reported enjoying the one the they had been told was the work of a professional, regardless of the actual source of the performance (Gökhan Aydogan, Nicole Flaig, Srekar N. Ravi, Edward W. Large, Samuel M. McClure and Elizabeth Hellmuth Margulis, 'Overcoming Bias: Cognitive Control Reduces Susceptibility to Framing Effects in Evaluating Musical Performance', *Scientific Reports* 8 (2018), 6229). When people made these same judgments while lying in an fMRI scanner, the timeline of this bias could be traced. As participants viewed the information that they were about to hear the performance of a world-renowned professional, reward pathways critical to pleasurable experience started engaging, even before they'd heard a note. This activity intensified across the start of the performance, peaking around thirty seconds in and remaining stable for the full seventy-second duration of the excerpt. When listeners successfully resisted the bias, registering a preference for the performance they were told was played by a student over the one they were told was played by a professional, they had to rely on the executive control network, a region associated with monitoring and selecting behaviours in pursuit of a goal: a sort of willpower network. The expectations listeners bring to a musical experience can, in other words, powerfully shape its contours.

It's not just information about supposed quality that can affect the way a piece of music is received. Listeners heard excerpts (including several drawn from the eighteenth century) as sadder or happier depending on the intent they were told the composer had when writing it (Elizabeth H. Margulis, William H. Levine, Rhimmon Simchy-Gross and Carolyn Kroger, 'Expressive Intent, Ambiguity, and Aesthetic Experiences of Music and Poetry', *PLOS ONE* 12/7 (2017), e0179145). Moreover, when people with extensive lifelong experience playing an instrument heard excerpts of music by Bach for their own instrument, their brains' motor circuitry engaged in a way it did not when listening to music by Bach for some other instrument (Elizabeth

H. Margulis, Lauren M. Mlsna, Ajith K. Uppunda, Todd B. Parrish and Patrick C. M. Wong, 'Selective Neurophysiologic Responses to Timbre in Musicians with Different Listening Biographies', *Human Brain Mapping* 30/1 (2009), 267–275). Performers, it seems, can't help but listen to music for their own instrument in terms of the physical movements required to produce the sounds. Even the way a performer moves can affect how listeners evaluate the sound of the performance (Jennifer Huang and Carol Lynne Krumhansl, 'What Does Seeing the Performer Add? It Depends on Musical Style, Amount of Stage Behavior, and Audience Expertise', *Musicae Scientiae* 15/3 (2011), 343–364).

Many of the experimental designs just summarized rely on judgments made after the fact, once a performance has concluded. When researchers in music cognition want to understand what is happening on a more moment-by-moment basis, they often use some kind of continuous response method. In this approach, participants move a slider to indicate how a perceived attribute – often tension – is fluctuating as the music progresses. For example, a study might ask participants to move a slider forward as they hear tension build, but move it backward as the music relaxes. By aligning the patterns of these responses with the events taking place in the music at the corresponding points, more can be understood about the dynamic, real-time experience of an unfolding musical performance.

Participants in another study of mine (Elizabeth H. Margulis, 'Expectation, Musical Topics, and the Problem of Affective Differentiation', in *The Oxford Handbook of Topic Theory*, ed. Danuta Mirka (New York: Oxford University Press, 2014), 629–641) continuously rated excerpts from eighteenth-century string quartets along a particular expressive dimension – for example, playfulness. They moved a slider forward to indicate that the music was getting more playful, and back to indicate that it was sounding less playful as they listened to the progress of the excerpt. Unbeknownst to the participants, some excerpts featured a grand pause interpolated after the cadential 6/4. The analysis of interest pertained to listeners' slider motions during the pause. Since Leonard B. Meyer's classic study *Emotion and Meaning in Music* (Chicago: University of Chicago Press, 1956), theorists have postulated that events generate affect when they violate expectations, but little explanation has been offered for how surprise comes to be experienced not unidimensionally, but rather through an affective prism – as moments of excitement, mournfulness, tranquillity or any of the other characteristics commonly attributed to music (as listed, for example, in Emery Schubert, 'Update of the Hevner Adjective Checklist', *Perceptual and Motor Skills* 96/3 (2003), 1117–1122).

My study 'Expectation, Musical Topics, and the Problem of Affective Differentiation' dropped the same pause into pieces featuring different musical topics, ranging from *tempesta* to siciliano. If topics can conjure up affective worlds, then this surprising event (in this case, a general pause) inserted into different topical environments might be experienced as especially ominous in one case or especially playful in another. According to this theory, the surprising pause elicits some kind of affective intensity, but precisely which kind is determined by the preceding topical context. Indeed, this proved to be broadly the case, with pauses in contexts characterized by the brilliant style (for example) elevating impressions of playfulness but not ominousness. Participants without special musical training, in other words, experienced markedly different affective responses to pauses depending on the topical context within which they were embedded. This suggests not only that topical associations can be learned through largely passive exposure, but also that it might be necessary to combine two ordinarily separate strands of music theory – expectation theory and topic theory – to understand the dynamics of affective experiences of music.

When work in music cognition moves beyond beeps and boops and instead uses materials like fully fledged pieces of eighteenth-century music, it not only introduces exciting new potential, but also provocative new problems. Every musical style brings its own history, idiosyncrasies, social implications and typical uses; all participants bring their own listening biography, personal background and social situatedness. Responses emerge from the intersection of these characteristics, making interpretation a sensitive and difficult undertaking. For work to move forward most successfully, theorists, musicologists, ethnographers and psychologists should read and listen generously among each other's disciplines, exchange framing questions and discuss interpretations. In some cases, this might mean thinking one level more broadly than is customary – thinking about the question behind the question, peeling away the specific way a project is framed within

the language of a discipline to reach the motivating impetus behind it. To understand something as complex and multifaceted as human music-making would seem to require collaborative teams capable of connecting at this level. I hope that ten years from now interactions within these kinds of teams will be sufficiently commonplace that people from different corners of the universe of music scholarship will meet around a boardroom table with the starting assumption that interconnections between their work exist, if only the relevant parties could articulate their aims and methods clearly enough.

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