This is a section of doi:10.7551/mitpress/14186.001.0001

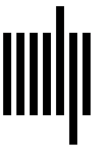
The Science-Music Borderlands

Reckoning with the Past and Imagining the Future

Edited by: Elizabeth H. Margulis, Psyche Loui, Deirdre Loughridge

Citation:

The Science-Music Borderlands: Reckoning with the Past and Imagining the Future
Edited by: Elizabeth H. Margulis, Psyche Loui, Deirdre Loughridge
DOI: 10.7551/mitpress/14186.001.0001
ISBN (electronic): 9780262373043
Publisher: The MIT Press
Published: 2023



The MIT Press

Introduction

Do you hear *Laurel* or *Yanny*? The realization that one person might be hearing something very different from another person in the same sequence of sounds spurred urgent headlines about the audio clip that "divided America" (Salam & Victor, 2018). A train of questions followed: Which is the "right" way to hear it? What should we make of individuals hearing different things with equal conviction? Why is the disagreement so shocking in the first place?

Morphing the original sound clip revealed that one person's perception could switch between *Laurel* and *Yanny* and that one's current percept was dependent on one's immediate prior percept (Pressnitzer et al., 2018). This persistence of the past, known as perceptual hysteresis, tantalizingly gestures at a system's dependence on its own history. Perception, a topic typically thought to occupy the realm of psychological science, seems intertwined with history, a topic typically thought to occupy the realm of the humanities.

The Laurel-Yanny phenomenon is more than linguistic, bleeding into the musical. In fact, it is around music that one finds richly developed theories and practices—robust traditions of knowledge—relevant to explaining the Laurel-Yanny phenomenon, among them neural, cognitive, cultural, historical, and technological processes. As both a physical and a perceptual phenomenon, sound entwines the natural and cultural, and with them the sciences and the humanities. In music, the idea that perception in the moment depends on what has come before is hardly surprising, this basic feature of experience being the subject of theories of learning and memory, expectation, groove, and repetition. On a longer time scale, the idea that present perception is predicated on the past is also built into historical and anthropological approaches that assume a cultural production of the senses.

Rifts

Music studies is a rich and multifaceted domain populated by researchers with expertise in history, ethnography, music analysis, technology, psychology, linguistics, physics,

neuroscience, philosophy, performance, computer modeling, and more. One might think that a sustained inquiry from multiple perspectives would help build a precise, multidimensional account of music's identity and functions or well-developed practices for sharing knowledge across specializations. Yet despite the unique opportunities for confluence afforded by the more than century-long existence of humanistic and scientific inquiry into music, and despite the potential offered by the decades-long existence of a society that strives to foster interdisciplinary collaboration (the Society for Music Perception and Cognition [SMPC], whose inaugural president Diana Deutsch reflects on the field's history in this volume), rifts between the approaches persist. Instead of finding papers about music and the brain on the syllabus of musicology classes or papers about musical culture on the syllabus of psychology classes, one is more likely to find scholars from one area eviscerating the work of the other on Twitter or—perhaps worse—entirely ignoring it.

What's the problem with this state of affairs? Can't musicology and psychology maintain the status quo of independent work, leaving interaction to the minority of scholars engaged with the SMPC? A commitment to this future misses the powerful opportunity presented by a model of interdisciplinarity that "springs from a self-conscious dialogue with, criticism of or opposition to the aesthetic, ethical or political limits of established disciplines" (Barry & Born, 2008, p. 29). This practice needn't be overly conflict based; it simply "stems from a commitment or desire to contest or transcend the given epistemological and ontological foundations of historical disciplines" (Born, 2010, p. 211). Given that the "standard reductionist agenda" underpinning conventional work in the psychology of music may never scale up to connect with the questions that animate humanistic work (Hartley & Poeppel, 2020, p. 597), failing to attempt a radical mutual reckoning amounts to a capitulation to the limits of knowledge before those limits have even been explored or tested.

But that is the palest and most distant of possible consequences. Graver and more immediate is the danger of scholarship that is wrongheaded, with impoverished designs and weak, erroneous, or actively harmful conclusions. Consider, for example, a (not atypical) goal that might be articulated for a scientific project on music: identifying the features that enable a piece of music to relax someone, make that person happy, or facilitate some sort of healing, and then using this knowledge to concoct an off-the-shelf musical prescription available to anyone. But if a person's experiences, body, and culture all contribute to that individual's sensibilities regarding music, there is no one universal set of musical features that can be expected to reliably act on the brain in the way this study's design assumes. Instead, relaxing, happiness-inducing, or healing effects must be reconceptualized in terms of a constellation of relevant factors.

As argued by Hasson, Nastase, and Goldstein (2020) and by Siegel et al. (2018), scientific and computational tools exist to facilitate these complex models, but for them to be usefully applied, scientific questions must be asked in new and humanistically informed ways. Understanding cutting-edge accounts of culture and musical interaction in the humanities is foundational to good science.

Concerning, too, are tendencies to forswear vast fields of inquiry because of particular problems or challenges. It is always possible to ask whether there are counterexamples to generalized claims, whether a concept or measure is valid across cultures, how histories of exploitation and dehumanization influence the present, who is left out and whose interests are being served. These questions are important, and historians and anthropologists of music specialize in the analyses that can answer them. In practice, however, such questions are often lobbed against scientific approaches to invalidate them a priori—with assumed answers about their limitations and complicities—rather than as a genuine inquiry into a study's aims, methodologies, implications, and possibilities. Such tendencies are especially apparent in cross-cultural comparisons, due to the understandings developed over many decades of ethnomusicological self-critique that comparative methods emerged from and supported a colonial world order wherein hierarchy was presupposed, and to compare was to measure against Western art music. The perpetuation of a colonial world order is a serious risk, but comparative work can take other forms, and there are questions about music as well as modes of collaboration that make cross-cultural comparison something to consider anew.

Humanistic and scientific approaches to music *must* interact for new and potentially transformative insights to occur within their own domains, let alone insights that transcend them. Such interaction moves beyond imagining that humanities expertise exists either to serve science or to critique it. Chapters in this volume by Witek; Tomlinson; De Souza; Kragness, Hannon, and Cirelli; and Sykes, for instance, articulate state-of-the-art accounts of the co-constitutive roles of environment and interactions in shaping musical behavior—accounts that entail the social worlds of music making to which music historians and anthropologists have long devoted attention. In contrast, much research in the psychology and neuroscience of music assumes a unidirectional causal flow from the brain to musical behavior and posits that the structure and organization of the mind and brain can be inferred from musical behavior itself. In such a landscape for music research, humanistic and scientific accounts cannot continue to proceed in parallel as if they have nothing to do with each other; in fact, they are actively contradictory. If humanistic accounts are correct, then many experiments in the psychology of music are built on faulty assumptions. If scientific accounts are correct, then the humanistic assumptions are wrong.

This volume aims to turn attention and energy away from rifts and toward the borderlands—contact zones where the generative potential of interaction can be realized. Although rifts have been the sites of outrage cycles and acrimonious exchanges in recent years, researchers have also been steadily working toward new paradigms informed by developments across disciplinary boundaries and the global conditions of the twenty-first century. The contributors to this volume include both scholars at the forefront of such developments and emerging researchers. Together, they point the way to a future where sustained interaction among disciplines can lead to richer understandings of musical life.

What Is Musicality?

An inescapable question bedevils efforts at humanistic and scientific interaction: what is musicality? There is no shortage of definitions of music or musicality in the literature; in fact, the shift to understanding musicality as a suite of capacities for music making, rather than some bounded set of actions describable as music, was important in enabling confluence among scholars who think about behavior and scholars who think about sound. By considering how a fundamental question like "what is musicality" is refracted through multiple voices from diverse disciplines, this volume charts a path forward for work at the intersection of these approaches. To Patel (chapter 1), musicality refers to the "widespread and spontaneously developing mental and physical abilities that underlie the human capacity for music"—that is, developing without explicit instruction. Feld (chapter 19) takes a somewhat different perspective, referring to musicality as an enculturated system of knowledge that is developed through repeated interactions with the culture. Kragness, Hannon, and Cirelli (chapter 8) posit that "the musical mind does not develop in isolation from other domains"; this is echoed by Ilari and Habibi (chapter 17), who see musical development resulting from "musical participation and affordances, contexts, and culture over time." These two chapters view musicality as an emergent property of the developing mind and body. Thus, the chapters in this volume represent diverse perspectives along a spectrum ranging from nativist (Patel) to emergentist (Feld) views of musicality, with others falling somewhere in between (Kragness, Hannon, and Cirelli; Ilari and Habibi). Together, they cover a variety of views on the origins of musicality. The goal is not to arrive at one definition of musicality but rather to help readers understand the multiplicity of views, providing a sense of where they are truly incompatible, where they reflect mutually consistent but different approaches, and how they might be integrated to drive research forward within individual fields.

Another aspect of musicality that gives rise to a spectrum of views concerns where musicality is situated. At issue is the relation between body and mind. How large a part does the body play in music processing? Is it a vessel, an instrument, or an active contributor? Does music originate in the mind of its conceptualizer, as suggested by Miranda (chapter 10)? He describes the paramusical ensemble, wherein a brain-computer interface enables musical ideation in the absence of bodily movement, employing a distributed set of agents to enact musical ideas. Or, as De Souza (chapter 6) discusses, does music emerge from "an interaction between sound and mind," where the mind includes mental representations of grammatical structures but is also "embodied and situated in a world, alongside objects and others"? Witek (chapter 7) reviews different claims related to embodiment, entrainment, and theories of the relationship between brain and body in musicality. Perhaps the most all-encompassing view comes from Tomlinson (chapter 2), who offers an account of the evolution of music making via the plastic responsiveness of the genome in moment-to-moment interaction with its environment, a model he terms radical niche construction.

What Is an Experiment?

Another overarching theme that cuts across the chapters in this volume relates to experimentation as a means of generating knowledge. What constitutes an experiment, and how can experiments, broadly construed, contribute to knowledge in different disciplines? Most would agree that the design and implementation of experiments are classic elements of training in the sciences. Yet experimentation is not exclusive to scientists; many researchers in the humanities and the arts have employed empirical observations or manipulated different variables to observe their effects on certain outcomes as a way to learn about musicality. Deutsch (chapter 14) provides some early examples of musical artists as scientists, and Leslie (chapter 13) describes scientist-composers whose perceptual experimentation guided their music making, and vice versa. Our interviews with Pamela Z (chapter 15) and Steven Feld (chapter 19) also reveal how the spirit of experimentation goes hand in hand with music making: Pamela Z is inspired by found objects and their usefulness for sonic art, whereas Feld describes recording sessions with Ghanaian artist Nii Otoo Annan as a way of learning about musical knowledge and how it is constantly negotiated through interactions ("acoustemology as relational ontology").

The feedback loop between experimentation and sound making precedes disciplinary boundaries between sciences and the humanities. Raz (chapter 5) chronicles how empirical experimentation led to the rise of new physiological theories of music's effects on the mind and body in the eighteenth and nineteenth centuries. By the 1920s, music

psychologist Carl Seashore was pushing for empirical experimentation as a way to learn about musicality. This entailed a shift in thinking about musicality—from an exceptional state (possessed by few) to a combination of continuous variables (possessed by many). This shift, though useful, also sowed the seeds of some deep problems in the science of music, motivated by eugenic selection, as discussed by Cowan (chapter 16).

Though one core of experimentation in contemporary music psychology centers around statistical learning, mental representations, and the grammatical structures of music in humans, the field has recently shifted toward experimentation that takes into account the role of the body in enactive perceptual experiences (Witek, chapter 7) or embodied metaphors (De Souza, chapter 6). Observing embodied behaviors is a central component of experiments with nonhuman animals in the study of musicality across different species (Duengen, Sarfati, and Ravignani, chapter 3) and of experiments involving infants to study the development of the musical mind (Kragness, Hannon, and Cirelli, chapter 8).

Seeking to push the boundaries toward more flexible, inclusive, and forward-thinking experiments, Faber and McIntosh (chapter 12) use music as a metaphor to describe theoretical tools that characterize the mind and brain as an intricate system of networks where hidden states may reveal important information about injury or illness. In an effort to understand musicality through neuroscience using more flexible, experiential approaches, Williams and Sachs (chapter 11) describe naturalistic music listening studies that span the continuum between ecological validity and generalizability. And to attain a richer cross-cultural understanding of musical behaviors, Savage et al. (chapter 18) offer some best-practice suggestions for building sustainable collaborative networks that move beyond the traditional overreliance on WEIRD (Western, educated, industrialized, rich, and democratic) music or musicians.

To escape an impoverished level of interdisciplinary interaction that remains mired in the abstract, this volume moves readers into the specifics and the stakes, balancing the value of deep domain expertise with the value of accessibility and translatability so that each chapter speaks to specialists and nonspecialists alike. Each chapter reflects conversations among the authors and editors that took place before, during, and after a workshop where drafts were circulated and their contents and cross-cutting themes were earnestly and openly discussed. Thus, the chapters strive to reach a common understanding rather than merely juxtapose incompatible viewpoints.

Past, Present, and Future

In some ways, it is harder than ever to keep up to date with the cutting edge of knowledge and approaches outside any one specialty, especially across the humanities-sciences

divide. Yet, as we hope to show in this volume, state-of-the-art work on music from diverse fields has opened up new possibilities for dialogue and collaboration. Where there was previously a focus on clearly differentiating biological and cultural components of music, there is now more concern with how the biological and the cultural work together. As Creanza, Kolodny, and Feldman write in a discussion of gene-culture coevolution, "attempting to answer the question of what are the extensions of human biology through culture leads to a striking conclusion: There are few aspects of human biology that have not been shaped by our culture. Human culture has also affected the biology, even the survival, of nonhuman species" (2017, p. 7785). For humanities scholars, interests have likewise extended into the natural world and nonhuman species. As Ochoa Gautier argues in a call for "acoustic multinaturalism," the climate crisis makes the early twenty-first century a time of "radical transformation of the conditions for posing questions regarding what historically in the West have been considered the differential fields of nature and culture" (2016, p. 108).

Reflecting a commitment to the notion that sensitive consideration of the past can help illuminate the present, this book is divided into four sections, each of which engages the history, current status, and future of a myth surrounding the scientific study of music. The first section addresses the apparent clash between music as a product of nature and music as a product of nurture, a false dichotomy that newer models, such as gene-culture coevolution, move beyond. Research based on the assumption of an inherent opposition between biology and culture, such as asking what kind of music the brain likes before experience intervenes, turns out to be poorly conceived when considered in light of contemporary work on the co-constitutive aspect of culture and biology. Patel (chapter 1) evaluates the repercussions for the design of experiments in music cognition, and Tomlinson (chapter 2) lays out a state-of-the-art model of meaning that places neural architectures and environmental niches in continual interaction. Duengen, Sarfati, and Ravignani (chapter 3) and Mundy (chapter 4) consider, from a humanistic and scientific perspective, how animal musicality illuminates the construction of and alternatives to a nature-nurture dichotomy.

The second section addresses the myth that the human experience of music can reflect how the mind works, a notion that becomes increasingly insufficient as one moves away from conceptions of the mind as something unitary and disembodied. Studying musical behaviors may not uncover the workings of some amodal cognitive processor because cognition emerges out of a brain in a body that is constantly interacting with its environment. De Souza (chapter 6) argues that both music and the mind are inherently relational, and Witek (chapter 7) delineates how the musical mind emerges out of embodied interactions. Kragness, Hannon, and Cirelli (chapter 8) trace how these feedback loops between mind, behavior, and environment develop

in the earliest stages of life, irrefutably demonstrating that rather than being passive blank slates, babies are active participants in knowledge building. Sykes (chapter 9) interrogates the conceptions of music and self that have governed music-humanities and music-sciences alike and introduces concepts from anthropology and his own fieldwork—including sound as a gift exchanged between and beyond humans—that open up new framings. This section is bookended by interludes by Raz (chapter 5), who explores how historical links between nerves and vibration have shaped modern neural sciences, and Miranda (chapter 10), whose compositions involve overt interactions between performance and neural signals, thus presenting a test case that vividly illustrates the consequences of the other chapters' ideas.

The third section addresses the notion that specific components of music can be understood and manipulated separately, a common tenet in experimental approaches that reduce music to untenable or distorted musical experiences. Williams and Sachs (chapter 11) evaluate the extent to which using full-fledged, realistic musical stimuli addresses the dangers of reductionism. Faber and McIntosh (chapter 12) consider how tools drawn from complex systems research can help make less reductive research designs tractable. Leslie (chapter 13) argues that music cognition researchers and composers share a suite of experimental techniques, illuminating what science can learn from artistic practice. In a pair of interludes, Deutsch (chapter 14) and Pamela Z (chapter 15) offer insights based on their experimental practice. A pioneering researcher in music cognition, Deutsch reflects on how computer technology enables the empirical study of more complex musical phenomena. A musician and multimedia artist, Pamela Z reflects on the role of tools in her creative work and how she uses perceptual phenomena such as the manipulable boundary between speech and music.

The fourth section addresses the division between musicians and nonmusicians, a dichotomy common in the scientific literature that has the effect of building prior assumptions about the kinds of experiences and abilities that constitute proof of musicality into results. Cowan (chapter 16) traces the relationship between the eugenics movement and early psychological notions of musical ability, providing firm evidence that contemporary research practice can be understood only by closely studying its history. Ilari and Habibi (chapter 17) consider how naïve notions of what constitutes a musician versus a nonmusician can hold research back, and Savage et al. (chapter 18) provide practical steps to move the field forward to a more pervasively cross-cultural approach. In chapter 19, Feld joins the volume editors and Jacoby for a multidisciplinary conversation about the challenges of and opportunities for collaborative research that would integrate cognitive and cultural understandings of musical life.

By bringing scholars from the sciences and the humanities together around these four key issues, this volume encourages sustained attention to core disciplinary questions for music studies. The organizing myths map out the existing problems in music science, while going beyond them brings to light people, musics, and approaches that typically fall through the cracks of this parcellated space. This volume also provides the scientific study of music with its first major reckoning, integrating the field's past with the project of imagining its future. Grappling with the tension between the reductionist, universalizing impulses in scientific approaches to music and the commitment to the particular in humanistic approaches, for example, enables one to envision ways to negotiate between them. *The Science-Music Borderlands* thus charts a path forward for music studies that combines insights from the sciences and the humanities. Connecting these divergent branches requires that we address questions at the core of how knowledge is produced, providing an example for other disciplines facing similar issues. We hope that by immersing readers in a diverse field, this volume lays the groundwork for further conversations and collaborations.

References

Barry, A., & Born, G. (2008). Logics of interdisciplinarity. *Economy and Society*, *37*(1), 20–49.

Born, G. (2010). For a relational musicology: Music and interdisciplinarity. Beyond the practice turn. *Journal of the Royal Musical Association*, *135*(2), 205–243.

Creanza, N., Kolodny, O., & Feldman, M. W. (2017). Cultural evolutionary theory: How culture evolves and why it matters. *Proceedings of the National Academy of Sciences*, *114*(30), 7782–7789.

Hartley, C., & Poeppel, D. (2020). Beyond the stimulus: A neurohumanities approach to language, music, and emotion. *Neuron*, *108*, 597–599.

Hasson, U., Nastase, S., & Goldstein, A. (2020). Robust-fit to nature: An evolutionary perspective on biological (and artificial) neural networks. *Neuron*, *105*(3), 416–434.

Ochoa Gautier, A. M. (2016). Acoustic multinaturalism, the value of nature, and the nature of music in ecomusicology. *Boundary*, *2*, *43*(1), 107–141.

Pressnitzer, D., Graves, J., Chambers, C., de Gardelle, V., & Egré, P. (2018). Auditory perception: *Laurel* and *Yanny* together at last. *Current Biology*, *28*(13), R739–R741.

Salam, M., & Victor, D. (2018, May 15). Yanny or laurel? How a sound clip divided America. *New York Times*.

Siegel, E. H., Sands, M. K., Van den Noortgate, W., Condon, P., Chang, Y., Dy, J., Quigley, K. S., & Barrett, L. F. (2018). Emotion fingerprints or emotion populations? A meta-analytic investigation of autonomic features of emotion categories. *Psychological Bulletin*, *144*(4), 343–393.

The MIT Press would like to thank the anonymous peer reviewers who provided comments on drafts of this book. The generous work of academic experts is essential for establishing the authority and quality of our publications. We acknowledge with gratitude the contributions of these otherwise uncredited readers.

This book was set in Stone Serif and Stone Sans by Westchester Publishing Services.

Library of Congress Cataloging-in-Publication Data

Names: Margulis, Elizabeth Hellmuth, editor. | Loui, Psyche, editor. | Loughridge, Deirdre, editor.
Title: The science-music borderlands : reckoning with the past and imagining the future / edited by Elizabeth H. Margulis, Psyche Loui, and Deirdre Loughridge.
Description: Cambridge, Massachusetts : The MIT Press, 2023. | Includes bibliographical references and index.
Identifiers: LCCN 2022014716 (print) | LCCN 2022014717 (ebook) | ISBN 9780262047647 (paperback) | ISBN 9780262373036 (epub) | ISBN 9780262373043 (pdf)
Subjects: LCSH: Music—Psychological aspects. | Musical ability. | Cognition. | Neuropsychology.
Classification: LCC ML3830 .S293 2023 (print) | LCC ML3830 (ebook) | DDC 781.1/1—dc23/eng/20220328
LC record available at https://lccn.loc.gov/2022014716
LC ebook record available at https://lccn.loc.gov/2022014717