

This is a section of [doi:10.7551/mitpress/14186.001.0001](https://doi.org/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:

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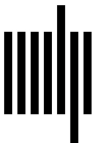
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DOI: 10.7551/mitpress/14186.001.0001

ISBN (electronic): 9780262373043

Publisher: The MIT Press

Published: 2023



The MIT Press

III Beyond Reductionism

Volume Editors

Perhaps no issue is a more obvious flashpoint for humanistic and scientific approaches than reductionism. The opposing tendencies to favor either irreducible complexity or isolable causal factors, to prize the particular or the generalizable, come to the fore around cultural phenomena such as music. The potential utility and pitfalls of reductionism operate at multiple levels of research design and interpretation, from the isolation of discrete, measurable musical parameters to the explanation of complex results in terms of single deterministic causes. As Iyer has observed, something as commonplace as discussing a study's results in terms of what "people" tended to do—when the study recruited as participants only undergraduates at a single institution—can, at best, constitute a faulty overgeneralization and, at worst, seem to imply that only certain kinds of responses are "human" (personal communication, May 21, 2021; see also Iyer, 2016; Sears, 1986).

Examples of this kind of interpretive slippage abound. Broesch et al. (2020) trace the history of a task commonly used to assess whether children have developed the capacity for self-recognition. A mark is surreptitiously placed on their forehead, and if they reach up to inspect it after catching a glimpse of their reflection in a mirror, it suggests that they understand they're seeing an image of themselves. Most children attain this developmental milestone at around eighteen months of age. But when scientists started using this paradigm cross-culturally, even older children did not show this response. It turned out that in these cultural contexts, the experimenter who placed the mark on the forehead was viewed as an authority the children did not want to offend by seeming to protest or even notice the mark. Without cultural knowledge to inform interpretation, these results would falsely indicate the absence of a cognitive ability. Similarly, in a study based on field interviews in the Rimrock area of Arizona, McAllester (1954) posed a question he understood to be about aesthetic response: "how do you feel when you hear a drum?" Participants (who knew drums as instruments accompanying songs in particular ceremonies and healing rites) understood this question as an inquiry

about their state of health. Without substantive knowledge about culture, experimental tasks designed to measure one thing might in fact reveal the influence of another.

The same principle holds true when designing stimuli and selecting samples. Consider, as a hypothetical case, a study that asked participants from a single US university to rate how much they enjoyed excerpts that had been manipulated to sound more like either jazz or electronica. Let's say the participants consistently rated the jazz-like excerpts higher. The researchers summarize their findings as indicating a preference for jazz over electronica, and media outlets run with the claim that science has shown the superiority of jazz. Such an interpretation ignores numerous variables relevant to the participants' ratings. It could be that the modifications to the electronica stimuli were less stylistically successful than the jazz modifications—the electronica stimuli were less electronica-like and the jazz stimuli were more jazz-like. Or it could be that the student body at this university listens extensively to jazz and little to electronica, whereas in other communities (not studied by the researchers), the opposite is true. To a humanist who has devoted a career to studying music within social and cultural frameworks, the problems with the relationship between experimental design and claimed findings are blaringly obvious: not just reductive but fundamentally wrong.

We see this state of affairs less as a crisis and more as an opportunity. Collaboration at the outset of a project between people with humanistic, scientific, and musical expertise can make it more likely that studies are framed, designed, and interpreted accurately. Proposing best practices for sustained collaborations among globally distributed researchers, Savage et al. (chapter 18) outline some of the considerations necessary to realize such integrations of diverse expertise, from the epistemological and methodological (e.g., the potential need not just for language translation but also for conceptual reframing of questions to suit local communities and cultural contexts) to the ethical and infrastructural (e.g., how to appropriately credit different kinds of research from contributors working within different structures of value). Leslie's chapter 13 argues that when composers are setting up musical experiences, they are often acting as a kind of music cognition researcher, and when music cognition researchers design stimuli and procedures for experiments, they are acting as a kind of composer. Leslie, an electronic musician and music cognition researcher who develops musical brain-computer interfaces, explores how the relationship between artistic and scientific practice might illuminate alternatives to reductionism. Pamela Z (chapter 15) offers insight from her experience as an experimental musician into the open-ended possibilities of what might be considered music and the wide range of audience reaction to her work.

Conversations about the dangers of reductionism aren't just coming from humanities and the arts; scholars from the cognitive sciences have been exploring new

methods to address some of these limitations. Hasson, Nastase, and Goldstein observe that traditional approaches to controlled experiments in neuroscience rely “on a core commitment to the assumption that the neural computations supporting . . . cognitive functions can be decontextualized . . . into a handful of latent features that . . . are . . . human interpretable and can be manipulated in isolation, and that the piecemeal recomposition of these features will yield a satisfying understanding of brain and behavior”—an assumption that has not proved true (2020, p. 416). They argue for overparameterized, direct-fit models as a way forward. Similarly, observing that emotion categories do not seem to have distinct, nonoverlapping physiological fingerprints, Siegel et al. (2018) propose population thinking and the systematic study of variability as an antidote to a reliance on essentialism in research design. Faber and McIntosh (chapter 12) point to the power of complex systems as another possibility. They observe that approaches from complex systems allow for nonlinearities and complex interactions that experimental methods reliant on studying features in isolation cannot hope to explain. Deutsch’s chapter 14 looks back at a long-standing controversy between rational and empirical approaches to music theory—the former favoring reduction to mathematical rules, the latter the complications of perceptual experience—and discusses how the advent of computer technology beginning in the 1950s dramatically changed the possibilities for the empirical study of music perception and cognition.

One challenge for reductive designs in music cognition is ecological validity. Raising similar concerns to our hypothetical jazz example, studies that reduce music to individual manipulable parameters gain experimental control but risk findings that are untenable or inapplicable to music—the phenomenon the experiment was trying to understand. When individual features such as pitch or timbre are studied outside their ordinary context, what suggests that they will operate the same way when reassimilated into a rich, complex, real-world musical experience? Williams and Sachs, neuroscientists who work on music, report in chapter 11 on new tools for analyzing responses to full-fledged musical excerpts rather than discrete elements drawn from them. They assess how these tools can and cannot address the challenges associated with reductionism.

Together, the chapters in this section chart a path forward for integrating humanistic and scientific approaches to study music empirically in ways that are more robust and likely to yield richer insights.

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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://lcn.loc.gov/2022014716>

LC ebook record available at <https://lcn.loc.gov/2022014717>