Spring 2021

Hearing the Tonality in Microtonality

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In the late 1970s and 1980s, composer-pianist Easley Blackwood wrote a series of microtonal compositions exploring the tonal and modal behavior of a dozen non–twelve-tone equal temperaments, ranging from 13 to 24 tones per octave. This dissertation investigates a central paradox of Blackwood’s microtonal music: that despite being full of intervals most Western listeners have never heard before, it still seems to “make sense” in nontrivial ways. Much of this has to do with the music’s idiosyncratic approach to tonality, which I define as a regime of culturally conditioned expectations that guides one’s attentional processing of music’s gravitational qualities over time. More specifically, Blackwood configures each tuning’s unfamiliar elements in ways that correspond to certain schematic expectations Western listeners tend to have about how tonal music “works.” This is why it is still possible to hear the forest of tonality in this music, so to speak, despite the odd-sounding trees that comprise it.

Because of its paradoxical blend of expectational conformance and expectational noncompliance, Blackwood’s microtonal music makes for a useful tool to snap most Western-enculturated listeners out of their ingrained modes of musical processing and reveal certain things about tonality that are often taken for granted. Accordingly, just as Blackwood writes conventional-sounding music in unconventional tunings, this dissertation rethinks several familiar music-theoretic terms and concepts through the defamiliarizing lens of microtonality. I use Blackwood’s microtonal music as a prism to shine a light on traditional theories of tonality, scale degrees, consonance and dissonance, and harmonic function, arguing that many of these
theories rely on assumptions that are tacitly tied to twelve-tone equal temperament and common-practice major/minor music. By unhooking these terms and concepts from any one specific tuning or historical period, I build up a set of analytical tools that can allow one to engage more productively with the many modalities of tonality typically heard on a daily basis today.

This dissertation proceeds in six chapters. The four interior chapters each center on one of the terms and concepts mentioned above: scale degrees (Chapter 2), consonance and dissonance (Chapter 3), harmonic function (Chapter 4), and tonality (Chapter 5). In Chapter 2, I propose a system for labeling scale degrees that can provide more nuance and flexibility when reckoning with music in any diatonic mode (and in any tuning). In Chapter 3, I advance an account of consonance and dissonance as expectational phenomena (rather than purely psychoacoustic ones), and I consider the ways that non-pitched elements such as meter and notation can act as “consonating” and/or “dissonating” forces. In Chapter 4, I characterize harmonic function as arising from the interaction of generic scalar position and metrical position, and I devise a system for labeling harmonic functions that is better attuned to affective differences across the diatonic modes. In Chapter 5, I synthesize these building blocks into a conception of fuzzy heptatonic diatonic tonality that links together not only all of Blackwood’s microtonal compositions but also more familiar musics that use a twelve-tone octave, from Euroclassical to popular styles.

The outer chapters are less explicitly music-analytical in focus. Chapter 1 introduces readers to Blackwood’s compositional approach and notational system, considers the question of his intended audience, and discusses the ways that enculturation mediates the cognition of
microtonality (and of unfamiliar music more generally). Chapter 6 draws upon archival documents to paint a more detailed picture of who Blackwood was as a person and how his idiosyncratic worldview colors his approach to composition, scholarship, and interpersonal interaction.

While my nominal focus in these six chapters is Blackwood’s microtonal music, the repertorial purview of my project is far broader. One of my guiding claims throughout is that attending more closely to the paradoxes and contradictions of Blackwood’s microtonality can help one better understand the musics they are accustomed to hearing. For this reason, I frequently compare moments in Blackwood’s microtonal music to ones in more familiar styles to highlight unexpected analogies and point up common concerns. Sharing space with Blackwood in the pages that follow are Anita Baker, Ornette Coleman, Claude Debussy, and Richard Rodgers, among others—not to mention music from *Curb Your Enthusiasm*, *Fortnite*, *Sesame Street*, and *Star Wars*.

Ultimately, this project is a testament to the value of stepping outside of one’s musical comfort zone. For not only can this reveal certain things about that comfort zone that would not be apparent otherwise, but it can also help one think with greater nuance, precision, and (self-)awareness when “stepping back in” to reflect upon the music they know and love.
Hearing the Tonality in Microtonality

A Dissertation
Presented to the Faculty of the Graduate School
of
Yale University
in Candidacy for the Degree of
Doctor of Philosophy

by
Michael Bruschi

Dissertation Director: Ian Quinn

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<table>
<thead>
<tr>
<th>TABLE OF CONTENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table of Contents</td>
</tr>
<tr>
<td>Index of Figures</td>
</tr>
<tr>
<td>Index of Examples</td>
</tr>
<tr>
<td>Index of Tables</td>
</tr>
<tr>
<td>Index of Images</td>
</tr>
<tr>
<td>Acknowledgements</td>
</tr>
</tbody>
</table>

**Chapter 1: Hearing the Forest for the Trees**

<table>
<thead>
<tr>
<th>Background, Rationale, and Aims</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enculturation (I)</td>
<td>7</td>
</tr>
<tr>
<td>Enculturation (II)</td>
<td>12</td>
</tr>
<tr>
<td>Modularity and Expectation</td>
<td>21</td>
</tr>
<tr>
<td>Blackwood’s Project</td>
<td>27</td>
</tr>
<tr>
<td>What Are We to Make of This Music?</td>
<td>45</td>
</tr>
<tr>
<td>Where Are We Going?</td>
<td>51</td>
</tr>
</tbody>
</table>

**Chapter 2: Right in the Feels**

<table>
<thead>
<tr>
<th>Mise en place</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>The State of the Discourse</td>
<td>67</td>
</tr>
<tr>
<td>Brass Tacks</td>
<td>77</td>
</tr>
<tr>
<td>Illustrative Vignettes (I): Initiation and Tonicization</td>
<td>84</td>
</tr>
<tr>
<td>Illustrative Vignettes (II): Modulation</td>
<td>89</td>
</tr>
<tr>
<td>Illustrative Vignettes (III): Tonal/Modal Ambiguity</td>
<td>95</td>
</tr>
<tr>
<td>But What About All Those Extra Notes? (I): Categorical Stretchiness</td>
<td>101</td>
</tr>
<tr>
<td>But What About All Those Extra Notes? (II): Categorical In-Betweenness</td>
<td>108</td>
</tr>
<tr>
<td>Digestif</td>
<td>114</td>
</tr>
</tbody>
</table>

**Chapter 3: Is Exposure So Mere?**

<table>
<thead>
<tr>
<th>Let’s Start with a Quick Salad</th>
<th>122</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting Up Shop</td>
<td>125</td>
</tr>
<tr>
<td>Some Terminological Distinctions</td>
<td>131</td>
</tr>
<tr>
<td>Dwelling in the Cracks (I): 19-TET</td>
<td>138</td>
</tr>
<tr>
<td>Dwelling in the Cracks (II): 15-TET</td>
<td>149</td>
</tr>
<tr>
<td>Meter as a “Consonating” Force</td>
<td>157</td>
</tr>
<tr>
<td>The Visual Consonance/Dissonance of Notation</td>
<td>166</td>
</tr>
<tr>
<td>Tying It Together</td>
<td>176</td>
</tr>
</tbody>
</table>

**Chapter 4: Laughing at the Static**

<table>
<thead>
<tr>
<th>Annals of a Floating Signifier (I)</th>
<th>187</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annals of a Floating Signifier (II)</td>
<td>192</td>
</tr>
<tr>
<td>Content and Context</td>
<td>195</td>
</tr>
</tbody>
</table>
Moving Away from “Chord” 202
The Numbers Game 212
But First, 12-TET Music 220
Blackwood’s Microtonality (I): Starting Out Simple 227
Blackwood’s Microtonality (II): Split Fourths, Again 231
Blackwood’s Microtonality (III): Functional Collision 236
Blackwood’s Microtonality (IV): Two Senses of “Antitonic” 240

Chapter 5: The “Stuff” of Tonality 250
  Fruit Salad, Again 252
  On Salience (I): The “Rivalry” of Tonal Hierarchy and Intervallic Rivalry 259
  On Salience (II): Illustrative Vignettes 266
  Lessons Learned 279

Chapter 6: Zooming In, Zooming Out 309
  Blackwood the Person 312
  Closing Gambit 328

Bibliography 347
Discography 370
## INDEX OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Spelling 16-TET as four interlocking $&lt;0 4 8 12&gt;_{16}$ diminished-seventh chords</td>
<td>33</td>
</tr>
<tr>
<td>1.2</td>
<td>Spelling 18-TET as three interlocking $&lt;0 3 6 9 12 15&gt;_{18}$ whole-tone scales</td>
<td>33</td>
</tr>
<tr>
<td>1.3</td>
<td>Spelling 15-TET as three interlocking $&lt;0 3 6 9 12&gt;_{15}$ 5-TET octave divisions</td>
<td>35</td>
</tr>
<tr>
<td>1.4</td>
<td>Fifth space in Blackwood’s 15-TET</td>
<td>36</td>
</tr>
<tr>
<td>1.5</td>
<td>Mapping bass-voice motion in mm.16–18 of “15 Notes”</td>
<td>38</td>
</tr>
<tr>
<td>1.6</td>
<td>Blackwood’s note names and enharmonic equivalences for 19-TET</td>
<td>40</td>
</tr>
<tr>
<td>1.7</td>
<td>Fifth space in Blackwood’s 19-TET</td>
<td>41</td>
</tr>
<tr>
<td>1.8</td>
<td>Comparing 19-TET and 12-TET versions of the same progression</td>
<td>43</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Ionian bias in modal scale-degree labeling conventions</td>
<td>63</td>
</tr>
<tr>
<td>2.2</td>
<td>Blackwood’s note names and enharmonic equivalences for 17-TET</td>
<td>90</td>
</tr>
<tr>
<td>2.3</td>
<td>Blackwood’s note names and enharmonic equivalences for 15-TET</td>
<td>105</td>
</tr>
<tr>
<td>2.4</td>
<td>Blackwood’s note names and enharmonic equivalences for 20-TET</td>
<td>109</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Blackwood’s note names and enharmonic equivalences for 19-TET</td>
<td>142</td>
</tr>
<tr>
<td>3.2</td>
<td>Blackwood’s note names and enharmonic equivalences for 15-TET</td>
<td>150</td>
</tr>
<tr>
<td>3.3</td>
<td>Fifth space in Blackwood’s 15-TET</td>
<td>151</td>
</tr>
<tr>
<td>3.4</td>
<td>Blackwood’s note names and enharmonic equivalences for 14-TET</td>
<td>158</td>
</tr>
<tr>
<td>3.5</td>
<td>Blackwood’s note names and enharmonic equivalences for 13-TET</td>
<td>170</td>
</tr>
<tr>
<td>3.6</td>
<td>Blackwood’s note names and enharmonic equivalences for 17-TET</td>
<td>172</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Illustrating Daniel Harrison’s (1994) notion of “functional discharge”</td>
<td>203</td>
</tr>
<tr>
<td>4.2</td>
<td>“Salami slicing” and the functional potentiality of non-tertian sonorities</td>
<td>208</td>
</tr>
<tr>
<td>4.3</td>
<td>The functional distinction between “subdominant” and “predominant”</td>
<td>215</td>
</tr>
<tr>
<td>4.4</td>
<td>Introducing my modal color-coding system for harmonic-functional labels</td>
<td>226</td>
</tr>
<tr>
<td>4.5</td>
<td>Blackwood’s note names and enharmonic equivalences for 21-TET</td>
<td>228</td>
</tr>
<tr>
<td>4.6</td>
<td>Blackwood’s note names and enharmonic equivalences for 19-TET</td>
<td>232</td>
</tr>
<tr>
<td>4.7</td>
<td>Blackwood’s note names and enharmonic equivalences for 15-TET</td>
<td>237</td>
</tr>
<tr>
<td>4.8</td>
<td>Pelog and slendro approximations in Blackwood’s 23-TET</td>
<td>241</td>
</tr>
<tr>
<td>4.9</td>
<td>Blackwood’s note names and enharmonic equivalences for 14-TET</td>
<td>246</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Fred Lerdahl’s (2001) “basic space”</td>
<td>260</td>
</tr>
<tr>
<td>5.2</td>
<td>Carol Krumhansl’s tonal hierarchy for major keys (from Krumhansl and Keil 1982)</td>
<td>260</td>
</tr>
<tr>
<td>5.3</td>
<td>A strong correlation between probe-tone ratings and tone durations in Schubert</td>
<td>261</td>
</tr>
<tr>
<td>5.4</td>
<td>Blackwood’s note names and enharmonic equivalences for 13-TET</td>
<td>268</td>
</tr>
<tr>
<td>5.5</td>
<td>Blackwood’s note names and enharmonic equivalences for 24-TET</td>
<td>271</td>
</tr>
<tr>
<td>5.6</td>
<td>Blackwood’s note names and enharmonic equivalences for 21-TET</td>
<td>280</td>
</tr>
<tr>
<td>5.7</td>
<td>Blackwood’s note names and enharmonic equivalences for 14-TET</td>
<td>294</td>
</tr>
</tbody>
</table>
# INDEX OF EXAMPLES

1.1: mm.15–20 of Blackwood’s “15 Notes” 37  
1.2: mm.110–22 of Blackwood’s “19 Notes” 41–42

2.1: Excerpt from “Happy Birthday” 85  
2.2: Excerpt from “Amazing Grace” 86  
2.3: mm.54–57 of Blackwood’s “17 Notes” 92  
2.4: mm.1–8 of Anita Baker’s “Body and Soul” (1994) 96  
2.5: mm.17–32 of Blackwood’s *Suite for Guitar in 15-note Equal Tuning*, 1st movement 105  
2.6: 12-TET version of mm.25–30 of Blackwood’s *Suite For Guitar*, 1st movement 107  
2.7: mm.4–6 of Blackwood’s “20 Notes” 110  
2.8: Excerpt from Richard Rodgers’ “Do-Re-Mi” (1965) from *The Sound of Music* 115

3.1: mm.57–60 of Blackwood’s “Fanfare in 19-note Equal Tuning” 143  
3.2: mm.30–33 of Blackwood’s “Fanfare in 19-note Equal Tuning” 146  
3.3: mm.1–3 of Blackwood’s *Suite for Guitar in 15-note Equal Tuning*, 4th movement 152  
3.4: mm.1–3 of Blackwood’s “15 Notes” 154  
3.5: mm.36–50 of Blackwood’s “14 Notes” 159–60  
3.6: mm.42–46 of Blackwood’s “13 Notes” 170  
3.7: mm.33–38 of Blackwood’s “17 Notes” 173  
3.8: Excerpt from John Williams’ “Imperial March” (1980) from *The Empire Strikes Back* 174

4.1: mm.1–12 of Anita Baker’s “Body and Soul” (1994) 221  
4.2: mm.45–50 of Blackwood’s “21 Notes” 229  
4.3: mm.30–33 of Blackwood’s “Fanfare in 19-note Equal Tuning” 232  
4.4: mm.32–39 of Blackwood’s “19 Notes” 234  
4.5: mm.1–8 of Blackwood’s *Suite for Guitar in 15-note Equal Tuning*, 1st movement 237  
4.6: mm.22–27 of Blackwood’s “23 Notes” 242  
4.7: mm.108–11 of Blackwood’s “14 Notes” 246  
4.8: Excerpt from Rom Di Prisco’s “Battle Royale Menu Music” (2018) from *Fortnite* 247

5.1: mm.1–10 of Blackwood’s “13 Notes” 268  
5.2: mm.39–43 of Blackwood’s “24 Notes” 272  
5.3: mm.1–25 of Blackwood’s “21 Notes” 281  
5.4a: mm.1–4 of Blackwood’s “19 Notes” 288  
5.4b: mm.1–13 of Blackwood’s “17 Notes” 289  
5.4c: mm.1–3 of Blackwood’s “15 Notes” 290  
5.5: mm.143–53 of Blackwood’s “14 Notes” 294–95  
5.6: Excerpt from Peter Erskine’s “Boogie Shuttle Stop” (2002) 306

6.1: Blackwood, “Ode to Bill Clinton (and His Charming Wife),” Op. 44x 323  
6.2: First vocal strophe from Ornette Coleman’s “All My Life” (1971) 333
INDEX OF TABLES

2.1: Forty-nine basic permutations of scale-degree genus (numeral) and species (syllable) 81

INDEX OF IMAGES

1.1: 1974 brochure advertisement for the Motorola Scalatron 30
1.2: 1979 magazine advertisement for the Polyfusion Series 2000 modular synthesizer 30

2.1: The “duck-rabbit” illusion 112

3.1: The Müller-Lyer illusion 148

5.1: The Cognitive Bias Codex 299
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Beyond my advising committee, there are literal dozens more faculty, staff, and graduate students in the Yale music-departmental family whose influence is palpable in the pages that follow. Gundula Kreuzer was instrumental in helping me convert a loosely connected series of thoughts about Blackwood’s music into a working prospectus. Brian Kane was an invaluable member of my prospectus committee, and his penetrating questions at my oral defense helped me immensely to think through the broader aims, scope, and intellectual context of my project. Michael Veal’s guidance during my doctoral qualifying exam on free jazz helped me nuance many of the thoughts that currently appear in the second half of Chapter 6. And Gundula, Ian, and Anna Zayaruznaya convened weekly dissertation colloquia during spring semester Friday mornings that were indispensable in helping several of my early chapter drafts move closer to their present state.

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To all the friends who have listened to my rambling over the past seven-plus years about Blackwood’s microtonal music, you have the patience of saints. To the subset of those friends who have actually sat through my playing of the recording, the looks on your faces continually convinced me that this was the dissertation I needed to write. And to my parents, finally, many thanks for instilling in me a lifelong love of learning, of music, and of the piano—but also enough of a rebellious streak that I would naturally be drawn to those notes between the cracks. All errors remaining in this document are mine and mine alone.
Chapter 1 | Hearing the Forest for the Trees

“[W]e are too apt to identify music with the sound to be elicited from the piano.”
– Alexander J. Ellis¹

Background, Rationale, and Aims

The notes on the piano are not the only notes that exist—a fact that is often taken for granted given how ubiquitous the piano’s 12-tone equal temperament (henceforth “12-TET”) has become in Western musical culture over the past century.² In recent decades, however, technological advances have made it possible to compose in alternate tunings that have never before been used or heard. These so-called “microtonal” tunings tend to be regarded as unexplored, uncharted sonic territory—a blank canvas of sorts, onto which can be written an infinite number of musical possibilities. As a result, microtonal music is typically discussed in terms of what is pathbreaking or forward-looking about it. The growing subfield of microtonal scholarship, moreover, is generally dominated by mathematical, acoustical, and scale-theoretic considerations that sometimes downplay or erase the consequential effects that the ubiquity of

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² I say “over the past century” because of the seminal role of William Braid White’s Modern Piano Tuning and Allied Arts (1917) in standardizing, to a degree of mathematical and scientific precision never before attained, the method of tuning a piano. For more on White’s role in standardizing 12-TET as we know it today, see Jorgensen, Tuning (1991), p.538, and Duffin, How Equal Temperament Ruined Harmony (and Why You Should Care) (2008), p.112.
tonal music in 12-TET has on those who engage with microtonality, whether as composers or as listeners.\textsuperscript{3}

What might it mean to hear microtonal music as “tonal”? To what extent can the constructs and frameworks that orient listeners in their native tuning transfer over to other, unfamiliar tunings without conceptual loss? This dissertation addresses these interrelated questions through the lens of Easley Blackwood’s microtonal music.\textsuperscript{4} Blackwood (1933–) is a composer-pianist who taught music theory at the University of Chicago for over half a century. He composed all of his microtonal music between 1978 and 1981 as “illustrations of a research project funded by the National Endowment for the Humanities. The project was to explore the tonal and modal behavior of all the equal tunings of 13 through 24 notes (to the octave), devise a notation for each tuning, and write a composition in each tuning to illustrate good chord progressions and the practical application of the notation.”\textsuperscript{5} His rationale seems straightforward enough on the surface, but it is couched in language that warrants further


\textsuperscript{5} Liner notes to Blackwood’s Microtonal Compositions (1994), Cedille CDR 90000 018, n.p.
prodding. Writing as an experimental composer-performer, Blackwood is concerned with framing his compositions in terms of their ability to break new musical ground. He goes on to say: “My purpose was to express what is inherent in each tuning by the most attractive possible musical design, to discover the most appealing arrangements within each tuning.”

But what makes a chord progression “good,” a musical design “attractive,” and an arrangement “appealing” in the first place? Are these even properties of musical objects per se? A certain short-circuitry is at work here. There are two elephants in the room, both lurking behind these value judgments: [1] the agency of listeners, and [2] the regime of expectations associated with “tonality” as configured in 12-TET.

My dissertation thus explores how Blackwood’s microtonality might be understood by listeners enculturated in this regime. To flesh out the provocations that open the previous paragraph: what might it mean to parse music written in 13- through 24-TET through the referential filter of the 12-tone octave? To what extent are things like scale-degree qualia, consonance/dissonance, and functional tonality transferrable from 12-TET to these other equal tunings? I am therefore not so much interested in the new musical territory Blackwood’s compositions explore as I am interested in the ways they engage with “old” musical terrain. In short, I investigate how it is still possible to hear the “forest” of tonality in this music, so to speak, despite the odd-sounding trees and branches that comprise it.

In viewing Blackwood’s microtonality through the prism of 12-TET, my research pushes back against several theorists who suggest that microtonal tunings should be understood on their own terms. Gerald Balzano, for instance, laments that “[so] many attempts at microtonal

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6 Ibid.
music—music using some more finely divided pitch system—too easily slide into sounding like out-of-tune versions of our familiar 12-fold system.”

Julia Werntz, moreover, advocates for a compositional style she calls “‘atwelve-tone’ microtonalism,” in which composers are encouraged to “remov[e] the prescriptions of tonality” and “start from scratch” when exploring new tunings. And William Sethares argues rather forcefully that each unfamiliar tuning should “ha[ve] its own ‘music theory,’” even sketching out what “a ‘music theory’ for 10-TET” might look like in Chapter 14 of his book *Tuning, Timbre, Spectrum, Scale*. But while Sethares’ methods are imaginative and his aims admirable, the ecological validity of his approach is questionable. Sure, it might be possible for listeners to check their enculturative baggage at the door and eventually internalize the nuances/affordances of another tuning on independent terms. But this process does not happen overnight. Howard Becker reminds us that “[t]he connected ‘package’ of practices and relationships which make up an art world, such as the world of music making, creates a powerful inertia” that is not so easily displaced. By downplaying the inertial force of 12-TET tonal music in modern Western society, Sethares’ account does not fully capture the veritable “culture shock” of hearing music in an unfamiliar tuning for the first time (and even beyond that).

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9 Ibid., pp.184–85.


By paying more attention to the constraining and mediating roles that enculturation plays in music processing, my research also notably pushes back against Blackwood’s own avowed skepticism of “the popular theory that musical perception is strictly the result of conditioning or training.” It is interesting to note that certain other remarks by Blackwood seem to call this skepticism into question, whether implicitly (“To my ear, the most disagreeable discords that exist are badly out of tune triads, or put another way, discordant tunings of harmonies that exist in smooth, consonant versions in other tunings”13) or explicitly (“When investigating a tuning for which there is little or no repertoire or tradition, the most illuminating approach is to look for similarities between the new tuning and the familiar 12-note equal tuning”14). Either way, however—and this is the larger point—Blackwood’s focus remains primarily on how composers might marshal these tunings to produce so-called “appealing” music,16 not on how/why certain listeners might come to find such music “appealing” (or not) in the first place. I thus address this imbalance by zeroing in on what it might be like, and what it might entail, to hear tonality in microtonality.

Viewed in one way, this project is a study of Blackwood’s idiosyncratic approach to microtonality and its implications for traditional theories of tonality. Viewed in another, it is a project about the regulative power of comfort zones: about how these comfort zones came to be in the first place, and about the entrenched tendency to seek refuge inside of them.

14 Ibid., Folder 2, p.324.
15 Ibid., Folder 1, p.1.
whenever they are challenged or put under pressure. In the four interior chapters of this dissertation, I probe what Blackwood’s microtonal music can reveal about the cultural comfort zone furnished by 12-TET itself. Since this tuning forms the tacit basis for modern music theory, analysis, and pedagogy, it follows that several widely ingrained assumptions in these discourses are tied to the particulars of that tuning. Accordingly, these four inner chapters pump new life into some of the most commonly used musical terms and concepts—scale degrees (Chapter 2), consonance/dissonance (Chapter 3), harmonic function (Chapter 4), and tonality (Chapter 5)—by reconsidering them through the defamiliarizing lens of microtonality. Chapter 6, on the other hand, focuses more on Blackwood’s own cultural “comfort zone,” unpacking certain distinctive aspects of his character, worldview, and personal archive that have yet to receive scholarly attention and relating these to the way he went about his work as a music theorist, composer, and departmental colleague.

In many ways, as we will see, this is a project about the generative power of contradiction. It is my firm conviction that, by attending more closely to the paradoxes and contradictions of Blackwood’s microtonality, one can gain a more robust picture of how tonality typically operates in the musics they know and love. For this reason, in the ensuing chapters, I frequently juxtapose microtonal examples from Blackwood with more familiar examples from non-microtonal repertoires in order to highlight unexpected analogies and point up common concerns. Over two dozen pieces not written by Blackwood—spanning R&B, pop/rock, film music, video game music, jazz, rap, music from TV shows, and Western Euroclassical music—

17 The term “Euroclassical” is borrowed from Philip Tagg’s Everyday Tonality II: Towards a Tonal Theory of What Most People Hear (2014), passim.
are mentioned at some point in the pages that follow. Readers who might have expected a more focused study of microtonal equal temperaments on their own terms are encouraged to look elsewhere. For while Blackwood’s microtonal compositions may sound very much like music on the vanguard, they also fundamentally rely upon a highly specific and historically contingent set of terms, conditions, and constraints for their intelligibility—and one cannot responsibly discuss this music without first grappling with its enabling conditions. This chapter sets out to do just that.

**Enculturation (I)**

One of my central claims in this dissertation is that enculturation mediates the cognition of microtonality (and of unfamiliar music in general), insofar as listeners subconsciously [1] take stock of statistical regularities in the music they hear, [2] form expectations based on these regularities about how future music will go, and [3] bring these expectations to the table when listening to unfamiliar music. Yet, as I will argue, this process involves a good deal of bending acoustic reality to fit preconceived auditory desires—in short, it involves cognitive bias. The heuristics that listeners employ to make sense of music are by nature imperfect, and this leads to gaps in knowledge and cracks in expectation that microtonal music exposes rather well. Faced with such gaps and cracks, I contend, listeners must do something to fill them if they are to make sense of the music. This is to say, tonal cognition—whether in microtonality or not—is often overcompensatory in nature, originating in the impulse to impose a sense of order and control on a highly variable sonic environment. Hearing tonality is therefore a procedural merging of biological instinct and culturally conditioned choice.
Mark Reybrouck likens music listening to “a process of sense-making that reduces the virtual infinity of information of the perceptual flux to a manageable and limited set of perceptual categories.”

This process is structured by the principle of cognitive economy: the disposition to seek out a “maximum of information with the least cognitive effort.” When the music is in a finely-grained microtonal tuning, the stakes are only raised: listeners must find a way to attend to it in a framework that optimizes predictive accuracy while streamlining cognitive load, or else they will experience negative feelings of frustration, bewilderment, and/or downright irritation. How far will listeners go in order to avoid these feelings? Just how far can preestablished auditory categories stretch to accommodate novel occurrences?

Listening to music involves both cognitive categorization and the experience of emotion, and wherever these two coexist, cognitive misattribution tends to lurk nearby. David Huron defines misattribution as “[t]he psychological tendency to attribute or associate feelings or emotions with any distinctive or noticeable stimulus or environment.”

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case that misattribution is far more fundamental to music cognition than has previously been thought. To start, the qualitative feelings and emotions evoked by music are mediated by the expectational and predictive capacities of listeners, which themselves are contingent upon the particularities of their respective enculturations. But all of these mediating factors are shaped by a great deal of implicit learning that occurs below a conscious level of awareness, and as a result, it is extremely difficult to describe musical emotions/feelings precisely in words, or to associate them definitively with explicit causal sources. In the face of this difficulty, listeners often compensate by pinning these sensations on the nearest available “concrete” candidate—the music itself.\textsuperscript{21} As I will argue, a wide variety of musical qualia—from consonance/dissonance to scale degrees to harmonic functions—can be explained under cognitive rubrics of misattribution and (over)compensation, operating in the name of economical processing. Readers are invited to think of Blackwood’s microtonality as a sort of musical Rorschach test, a set of sonic “inkblots” that activates certain predispositions, tendencies, and reactions in enculturated listeners.

What is an enculturated listener? In short, one who has been exposed to the music of a particular culture. As Marcus Pearce writes, “Musical enculturation depends on two cognitive processes: (1) statistical learning, in which listeners acquire internal cognitive models of statistical regularities present in the music to which they are exposed; and (2) probabilistic prediction based on these learned models that enables listeners to organize and process their

\textsuperscript{21} Huron calls these musical proxies “convenient bystanders.” [Huron, \textit{Sweet Anticipation} (2006b), p.138.]
mental representations of music.” 22 These two processes, crucially, take place whether one is aware they are happening or not. This is to say, one does not need to be a music theorist, or even a musician, to develop and hold a breadth of implicit musical knowledge that results from enculturation. As a result, I venture the broadstroke claim that most nonmusicians know more about music than they think they do. Just because this knowledge is not explicitly verbalizable or technical does not mean that it does not exist.

The enculturation process begins early. Annabel Cohen suggests that many of its “sophisticated building blocks are in place in the first year of life,” 23 a claim that is borne out by empirical evidence. Erin Hannon, for instance, has found that “infants can perceive rhythm and meter by attending to the same statistical properties that underlie adults’ perception[s],” 24 and that “[w]ithin the first year after birth, infants are sensitive to relationships between meter and pitch.” 25 More complex representations of culture-specific tonalities, however, emerge later on in childhood. One way to track the time course of this development is by measuring brain responses to violations of musical syntax. A common response to measure is the early right anterior negativity (or ERAN), which is “one electrophysiological correlate of music-syntactic processing” that tends to be used in “experiments investigating the processing of

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chord functions with chord-sequence paradigms.” Stefan Koelsch has found that children as young as two and a half display a very slight ERAN in response to unexpected chords, “suggesting that the development of the neural mechanisms underlying the generation of the ERAN commence around, or not long before, this age.” By twice this age, the ERAN is more pronounced; by age nine, it “appears to be very similar to the ERAN of adults,” and by age eleven, it is “practically indistinguishable from the ERAN observed in adults.”

However, there are two caveats that require further comment and open out onto more foundational lines of inquiry. The first is that trained musicians tend to display a more pronounced ERAN than do nonmusicians, which shows that even though most listeners register syntactic violations, musicians display greater sensitivity (and thus stronger responses) to them. This, in turn, leads to a broader question: what kinds of enculturated listeners are there, and how do they differ? The second caveat is that ERAN activation is linked to developmentally neurotypical language-processing abilities, which raises age-old debates about the relationship between language and music. More specifically: is music processing distinct from linguistic processing—making it “modular” and “domain-specific” in the sense of Jerry Fodor—or does it arise from more domain-general capacities? I will address these caveats in order before

27 Ibid., p.151.
28 Ibid., p.152.
29 See Besson and Friederici, “Language and Music: A Comparative View” (1998) for an overview of these debates, which are also famously treated in Diana Deutsch’s article “Speaking in Tones” (2010).
returning to Blackwood’s microtonal project, considering some illustrative musical examples, and outlining the chapters to come.

**Enculturation (II)**

Enculturation involves implicit learning, so implicit measures must be used to test its effects in listeners. One experimental paradigm of this sort is called harmonic priming, wherein listeners are expected to process chords that are related to a preceding context more quickly than they are expected to process chords unrelated to that context. The challenge with this method is that it must test for something whose existence is subconscious and non-verbalizable for most listeners. Luckily, though, harmonic priming experiments tend to leverage misattributive tendencies to their advantage in order to indirectly measure internalized knowledge. Frederic Marmel and Barbara Tillmann, for example, ask participants to judge the intonation of a target tone, with the expectation that their response times will be quicker for contextually expected tones than for contextually unexpected ones.31 In such a manner, listeners think they are making a surface-level judgment about intonation, but they are actually evincing internalized knowledge about how statistical regularities influence musical expectation. This is the basic rationale behind the paradigm: that “previous chord[s] prime harmonically related ones so that their processing is speeded up.”32

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But what is it that makes one chord harmonically related to another? There has been some debate as to whether harmonic priming is primarily a sensory or a cognitive phenomenon—that is, whether chords sound related to one another because of spectral overlap between their component tones or because they tend to follow one another in a particular style. Adherents of the former position include Richard Parncutt, whose sensory model of chord relatedness is based on pitch commonality, and Mark Schmuckler, who argues that “a chord sharing overtones with a preceding chord will be more highly anticipated than a continuation containing no overlapping frequencies with its predecessor.” These models do not require any abstract knowledge of a particular musical idiom, making them appropriate foils to the positions of Emmanuel Bigand, Timothy Justus, and Jamshed Bharucha, among others. Bigand has investigated the respective roles of sensory and cognitive components in harmonic priming, finding that “[h]armonic priming involves a very robust cognitive component” that outweighs the sensory component and “does not need explicit training.” Similarly, Justus and Bharucha have argued that musical expectancies are ”generated at a cognitive level, by activation spreading through a representation of harmonic relationships (spreading activation hypothesis) rather than by perceptual priming of specific frequencies (overlapping spectra

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Bharucha has even modeled this process using artificial neural networks. His connectionist MUSACT model (short for “MUSical ACTivation”) contains three tiers of interlinked units that represent pitch classes, chords, and keys; reverberations at lower levels of the network activate higher levels and vice versa, meaning that the model merges bottom-up and top-down cognitive processes. The amount of activation for each unit is proportional to that unit’s hierarchical importance in a particular context; these weightings “arise from a learning process that occurs automatically when the neural network is exposed to Western music.”

On the whole, several harmonic priming studies provide converging empirical evidence that implicit musical knowledge can be learned by passive exposure to the statistical regularities of a particular style, regardless of one’s level of musical skill or training. An early study by Bharucha and Keiko Stoeckig, for example, finds that “even untrained subjects were able to reach the criterion of accuracy” for intonation judgments of target chords, leading them to conclude that there is “no significant correlation between priming and musical training.”

Bigand, similarly, finds that both musicians and nonmusicians alike process tonic chords faster

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38 Bigand and Poulin-Charronnat, “Tonal Cognition” (2011), p.67. One drawback of Bharucha’s model, however, is that it only represents major and minor triads at the chord level, and only major keys at the key level. See also Tillmann, Bigand, and Bharucha, “Implicit Learning of Tonality: A Self-Organizing Approach” (2000) for a detailed discussion of the MUSACT model.

than subdominant chords at the ends of phrases, demonstrating that “nonmusicians’ brains process Western musical structures in a sophisticated way and sometimes very similarly as do musicians’ brains.” And Tillmann has conducted experiments showing that both musically trained and untrained listeners are “sensitive to changes in musical function of target [chords] due to the prime context”—even including a “patient with severe amusia,” who nevertheless displays “spared implicit knowledge of music.”

As revealing as these findings are, however, they should not be taken to mean that every listener processes music in the same underlying way. Indeed, there is a large host of neuroscientific evidence to the contrary. A study by Takashi Ohnishi, for example, shows that musicians rely more on the left hemisphere of the brain when processing music passively, whereas nonmusicians display a right hemispheric dominance. Moreover, it has been demonstrated that “[m]usicians with AP [absolute pitch] reveal a stronger leftward planum temporale asymmetry than nonmusicians or musicians without AP.” There also exist differences in musical processing that are contingent upon the idiosyncrasies of particular instruments and their conventions of performance. For instance, an electrophysiological study by Koelsch, Erich Schröger, and Mari Tervaniemi presents listeners with major triads whose thirds are slightly lowered in frequency and finds that professional violinists (who are

accustomed to intoning their thirds high) display a distinct mismatch negativity (MMN),\(^44\) whereas nonmusicians do not.\(^45\) An appropriate follow-up to this study might compare professional violinists to, say, professional brass players, who generally intone their thirds relatively low (that is, closer to pure). If it could be demonstrated that violinists display a more pronounced MMN than do brass players to triads with lowered thirds, it would reveal that differences in processing exist not only between musicians and nonmusicians, but also among musicians of different instrument families.

In general, musicians and nonmusicians may possess surprisingly similar levels of implicit musical knowledge, but musicians tend to display brain responses that are stronger (and occasionally faster as well) because of their additional level of explicit expertise. In Bigand’s aforementioned investigation of sensory versus cognitive components of harmonic priming, for instance, “The only difference between [musicians and nonmusicians] concerned their performance accuracies in the consonant-dissonant judgments: correct responses were more numerous and faster in musicians.”\(^46\) This is perhaps an unsurprising finding, given that “[this] experimental task taps into a perceptual competence that is explicitly trained in music education classes.”\(^47\) Perhaps Stanley Schachter and Jerome Singer’s two-factor theory of

\(^{44}\) According to Bigand and Poulin-Charronnat, “The MMN is assumed to reflect the cortical pre-attentive detection of change in a repetitive pattern.” [Bigand and Poulin-Charronnat, “Are We ‘Experienced Listeners’?” (2006), p.124.] It is thus associated with the real-time processing of auditory oddballs.


\(^{47}\) Ibid.
emotion can explain such a result: both trained and untrained listeners experience a similar base physiological arousal when listening to music (indicative of implicit knowledge), but trained listeners are better able to attach precise cognitive labels to these experiences (explicit knowledge), because they have a more varied set of technical terms at their disposal to name (and consequently reify) what they hear. This is essentially the idea behind Bigand and Bénédicte Poulin-Charronnat’s hypothesis that “musically trained listeners [can] better discriminate subtle differences in musical expressiveness” than can their musically untrained counterparts (though the authors do not cite Schachter and Singer in their article).

It is likely that a longstanding conception of “knowledge” as being exclusively explicit and verbalizable has led to the discounting of the musical intelligence of the musically untrained. What is colloquially invoked as a difference between knowledge and its lack might instead be more productively (re)framed as a difference between implicit and explicit forms of the same underlying thing. Hannon and Laurel Trainor, along these lines, distinguish between “enculturation processes” that involve implicit knowledge gained through passive everyday exposure, and “formal musical experience/training” that makes this knowledge explicit and “invokes domain-specific processes that affect salience of musical input and the amount of cortical tissue devoted to its processing.” This may explain why musicians display a more pronounced ERAN to syntactic violations than do nonmusicians, even though both groups are


capable of cognitively registering such violations. The role of conscious attention is also significant in distinguishing the trained from the untrained. In an experiment addressing these matters, Psyche Loui and David Wessel find that all their participants, regardless of their level of training, rate harmonic progressions in such a way that demonstrates their sensitivity to manipulations of harmonic expectations. However, they also find that “[m]usically trained participants form harmonic expectations independent of attention, whereas attention is required for the modulation of harmonic expectation in non-musicians.”

Koelsch makes a useful distinction between aware and unaware expectancy to characterize the different levels of specificity at which trained and untrained listeners, respectively, form musical expectations and predictions. In his words,

The syntactic expectancy of listeners (particularly of those not formally trained) is usually an unaware expectancy rather than an aware expectancy, meaning that [these] individuals do not consciously (or effortfully) anticipate the sound of a critical chord (or tone). Moreover, the musical sound expectancy is often a probabilistic one, rather than a very specific one. Finally, non-musicians expect a sound, rather than a chord function. For these reasons I usually use the term musical sound expectancy to refer to music-syntactic expectancies of [untrained] listeners. By contrast, I prefer the term prediction for the more specific (and high-probability) expectations and forecasts that involve conscious awareness.

It is worth dwelling on one sentence in particular from the above: that nonmusicians tend to expect particular sounds rather than specific configurations of scale degrees or specific instantiations of harmonic functions. This seems highly sensical—after all, is it not wrongheaded

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52 Ibid., p.1088.

53 Koelsch, Brain and Music (2012), p.137 [emphasis in original].
to generalize that most listeners who hear a contextually prepared V\(^7\) would then explicitly expect something called a “tonic” (or a “I chord”) to follow, particularly given that most everyday listeners do not know the names of specific harmonic functions or chord labels? They may know that particular types of sounds tend to follow others in certain culturally circumscribed contexts—and some might even be able to correctly sing the expected tonic degree as a synecdochic stand-in for the anticipated event. But many do not know what these sounds are called, or how to describe them further. And this leads seamlessly into what is perhaps the principal danger involved in doing music theory and analysis: that generalized invocations of “a listener” (or worse yet, “the listener”) more often than not serve as solipsistic proxies for the author’s own hearing.

Is there a way out of this linguistic mess? After all, this very dissertation might be charged as falling into the same trap: it makes several claims about the implicit knowledge of listeners enculturated to the 12-tone octave, and how such 12-enculturated listeners might draw upon this knowledge (however subconsciously) to make sense of music in unfamiliar tunings. How can one make explicit claims about implicit processes, or consciously generalize about what the subconscious is like? Of course, it is important to bear in mind that there is no such thing as an “ideal” 12-enculturated listener, nor is any group of 12-enculturated listeners more prototypical than any other. One could even go so far as to say that no two 12-enculturated listeners process music in exactly the same way. Pearce reminds us that “[l]isteners exposed to different musical styles will differ in their psychological processing of music.”

What is more, differences in levels of training, topological/instrumental points of reference, attentional capacity, neuroanatomical structure and neurotypicality, demographic constraints, and linguistic relativity, among other factors, can cause individual listeners to vary widely in their mental representations of music and the specificity with which they can access, describe, and metaphorize them. Yet all of these differences are scaffolded and undergirded by the same foundational processes: statistical learning, expectation formation, and probabilistic prediction. This is the bedrock upon which music cognition is built, and crucially, it is there whether one chooses to notice it or not. As Koelsch writes, “[M]usical syntax is processed even when a listener is not paying attention to the music (and the brains of listeners register music-syntactic irregularities even when listeners are not aware of these irregularities).”55 Similarly, Megan Long states that “we are taught to hear tonally by regularities in the repertoires we know well (statistical learning), and we don’t have to understand that we are hearing tonally to hear that way.”56 In speaking explicitly about these implicit processes, I am not arguing that they are, or should be, verbalizable for any listener who has been exposed to Western tonal music or the twelve-tone octave. But by bringing these oft-overlooked processes to the forefront, I am arguing that we can stand to learn a great deal about how the myriad inflections of tonal cognition grow from the same basic substratum of fundamental mechanisms.

Modularity and Expectation

Having provisionally addressed the issue of enculturation, I now turn to the question of modularity: the extent to which musical perception and cognition are innate adaptations that operate independently of perception and cognition in other domains, such as language or action. The notion that there is a unique “music faculty” consisting of core music-specific capacities that have evolved through natural selection was once a widespread, even dominant, viewpoint. But more recent studies in modern cognitivism have challenged this view, arguing for the interconnectedness of most all psychological processes. According to one such perspective, “[H]ighly specialized knowledge of music in adulthood arises through simple perceptual learning mechanisms that build increasingly specific representations from domain-general capacities.” This approach, according to Hannon, “emphasizes the role of perceptual experience and statistical learning that is domain-general, operating in tandem with simple constraints that arise from properties of the sensory organs and the nervous system.”

Indeed, there is mounting neuroscientific evidence that multiple spheres—ranging from music and language/speech to emotion, action, and even mathematics—are linked by shared

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60 Ibid., p.149.
cognitive processes. This is a major conclusion of Koelsch’s most recent book: that “overlaps among cognitive operations (and neural mechanisms) underlying music and language processing indicate that ‘music’ and ‘language’ are two poles of a single continuous domain.”  

Several studies have empirically confirmed the existence of such processual overlap, pointing to particular brain regions and neural populations as common denominators mediating a variety of scenarios. For example, it appears that “Broca’s area is involved in the processing of hierarchically organized sequences in general, be they musical, linguistic, action-related, or mathematical.” Patients with Broca’s aphasia have been shown to demonstrate impairments in their processing of musical syntax when presented with chords that reside in keys outside a prime harmonic context. Broca’s area is also active during the processing of mathematical formulas, particularly ones that involve “long-distance dependencies on a phrase-structure level.”

But an important clarification is in order. Even though there is ample evidence to disprove the hypothesis that music processing is wholly distinct from processing in other

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61 Koelsch, Brain and Music (2012), p.244. Koelsch calls this the “music-language continuum” (244).


63 Koelsch, Brain and Music (2012), p.133. Koelsch calls this the “Syntactic Equivalence Hypothesis” (133).

64 Patel et al., “Musical Syntactic Processing in Agrammatic Broca’s Aphasia” (2008).

spheres, this does not preclude the possibility that certain kinds of musical processing operate independently of one another. This is to say, modularity can and does exist within the realm of music cognition, even as its existence is dubious between music cognition and other processual realms. Perhaps the most famous example is how listeners can continue to be surprised by music they already know well. This paradox has been explained by positing a distinction between *veridical expectation* on the one hand, which engages specific episodic memories of actual pieces, and *schematic expectation* on the other, which engages semantic memories of auditory generalizations. The two kinds of expectation are said to be independent of one another; the former relates to how specific pieces of music actually go, whereas the latter relates more abstractly to how pieces in a particular style or cultural idiom generally tend to go. A classic situation often marshaled to explain this distinction is the deceptive cadence, which after multiple hearings continues to provide schematic surprise even as it becomes veridically predictable, since dominants in Western tonal music overwhelmingly tend to proceed to I or i chords (rather than vi or VI). Bharucha describes the scenario as follows: “Even when a piece has been heard often enough to be familiar, it cannot completely override the generic, automatic expectations. Surprises in a new piece thus continue to have a

\[66\] Huron’s *Sweet Anticipation* (2006b), pp.221–27, provides a good overview of these types of expectation and the kinds of memory on which they rely. See also Bharucha, “Tonality and Expectation” (1994).

surprising quality [even after repeated exposures] because they are heard as surprises relative to these irrepressible expectations.”

Just how automatic and irrepressible are these schematic expectations? A study by Justus and Bharucha investigates “the modularity of harmonic expectations that are based on cultural schemata despite the availability of more predictive veridical information,” and finds that “processing [is] facilitated when a schematically probable target chord follow[s] the prime”—an effect that is “independent of all manipulations of veridical expectation.” This is to say, even when participants are explicitly primed to expect specific contextually anomalous chords, they are still faster and more accurate at processing contextually related ones anyway. One can try to stack the deck in favor of veridical expectancy, so to speak, but the culturally ingrained automaticity of harmonic priming is such that schematic expectancy usually wins out.

To be clear, this does not mean that veridical expectation plays no role whatsoever in musical processing; on the contrary, it is intimately linked with associational memory, affective arousal, and emotional valence. Huron also astutely notes that “all semantic memories begin as episodic information,” meaning that schematic expectations themselves grow forth from veridical soil. But the larger point remains: these two expectational pathways operate

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independently of one another, and as a result, there exists a degree of modularity among the processual “parts” that comprise the “whole” of music cognition.

Koelsch makes the same distinction between schematic and veridical processes, but he refers to them as implicit musical expectancy formation and on-line knowledge-free structuring, respectively. As he argues, “[Implicit] musical expectancies are different from the expectancies (or predictions) formed due to knowledge-free structuring, because the latter are formed on the basis of acoustic similarity, acoustic regularity, and Gestalt principles, without long-term memory representations of statistical probabilities being required.” The two processes are not only distinguished by the types of memory they engage (long-term versus auditory sensory memory, respectively), but also by the brain regions and brain responses associated with them. Implicit expectancies primarily engage frontal regions (such as the frontal cortex), whereas knowledge-free structuring primarily engages temporal regions (such as the temporal lobe and the primary auditory cortex). There is thus a “crucial difference between the neural mechanisms underlying music-syntactic processing (as reflected in the ERAN) on one side, and the processing of acoustic irregularities (as reflected in phMMN and afMMN) on the

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72 Koelsch, Brain and Music (2012), p.106 [emphasis in original].

73 Ibid., p.107 [emphasis in original].
other.”74 Now, to be clear, Koelsch is careful to note that there do exist overlaps in the processes that elicit ERAN and MMN; both “require extraction of auditory features and the formation of auditory Gestalten,” for instance.75 This is resonant with Huron’s caveat, quoted in the paragraph above, that schematic and veridical expectations share a common episodic origin. But crucially, the two branch off at the stage that Koelsch terms “model establishment,” supporting the notion that they grow into complementary processes that are independent of one another.76 I will return to these findings in Chapter 5 when I discuss how multiple senses of “tonal salience” can coexist.

For now, suffice it to say that expectation and prediction play central roles in tonal hearing, regardless of one’s awareness of their operation. The syntactic and behavioral regularities of Western tonal music might be conceived as wearing expectational/predictive “grooves” into the brains of enculturated listeners—lubricated, efficient pathways that guide their processing and sense-making of unfamiliar music. But of course, the most deeply ingrained phenomena in society tend to be the most taken for granted and the most difficult to challenge or view in a different light from what is customary. This is why Blackwood’s microtonal

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74 Ibid., p.133. The phMMN refers to physical deviance within a repetitive auditory environment, whereas the afMMN deals with abstract feature mismatches “that do not necessarily have to be physical in nature.” [Koelsch, “Music-Syntactic Processing and Auditory Memory: Similarities and Differences Between ERAN and MMN” (2009), p.179.] The distinction between these two types of MMN was first made in Saarinen et al., “Representation of Abstract Attributes of Auditory Stimuli in the Human Brain” (1992). Subsequent studies that report afMMNs include Korzyukov et al., “Processing Abstract Auditory Features in the Human Auditory Cortex” (2003) and Schröger et al., “Processing of Abstract Rule Violations in Audition” (2007).


76 Ibid.
music is such a useful tool to expose some of tonality’s most overlooked truths: because it exhibits what Thomas Turino calls “the play around the edges of convention that wakes us from habit and calls our attention to the moment.”77 Or, to borrow the words of Gary Kemp, it “snap[s us] out of our customary or habitual trance of encountering things” and helps us “open our eyes” (and ears) to what has always been there—even if we have trouble seeing/hearing it at first.78

Blackwood’s Project

It is time to take a closer look at exactly what Blackwood was up to in composing these microtonal pieces, and how he went about bringing them to life. Blackwood is still alive at the time of my writing this, but due to recent changes in his living circumstances, it became necessary to consolidate his papers. The Easley Blackwood Papers are currently housed in the Hanna Holborn Gray Special Collections Research Center at the University of Chicago Library, and they sum to over one hundred boxes of scores, recordings, reviews, correspondence, unpublished materials, and personal diaries. At first, a rather modest set of thirteen boxes arrived in 2013 and was inventoried the following year; these mostly contain materials from Blackwood’s childhood up until the 1970s, and as a result, they have little to do with his pivot to microtonality at the turn of the 1980s. But a much larger set of boxes, received in 2016 and


inventoried in 2018, contains a veritable treasure trove of materials relating to his microtonal period (and the decades that followed).

Before visiting the Blackwood archive in the summer of 2019, I had my eyes on two unpublished items in particular: a 1992 manuscript entitled *A Practical Musician’s Guide to Tonal Harmony* and three folders of research notes (spanning 1979–81) that document the major findings of his NEH-funded microtonal project. The importance of the latter item to my project is self-explanatory—and indeed, it was vastly illuminating, containing not only detailed descriptions of the structural affordances of each tuning but also meticulous measure-by-measure analyses of each microtonal etude. I assumed the former manuscript would be similarly helpful, a way of seeing how Blackwood’s microtonal experimentation in the previous decades came to influence his later views on harmony and tonality more broadly. Notoriously few complete copies of this manuscript exist, and its inclusion in the bibliography of William Mathieu’s *Harmonic Experience* originally piqued my interest in locating it.\(^7^9\) As it turns out, however, *A Practical Musician’s Guide to Tonal Harmony* contains no mention of Blackwood’s previous experience with microtonality, nor any references to tunings other than 12-TET—which is somewhat surprising, given its date of completion.\(^8^0\) Instead, the manuscript reads like an old-school harmony textbook in the French figured-bass tradition; its structure, method, and

\(^7^9\) Mathieu, *Harmonic Experience: Tonal Harmony from Its Natural Origins to Its Modern Expression* (1997), p.532. Mathieu was a former student of Blackwood’s, and the latter’s presence is often strongly felt throughout this book.

\(^8^0\) Indeed, just the year prior, Blackwood not only published an article about some of the microtonal tunings he had been studying but was also featured as an interview subject in an article by Douglas Keislar on microtonal composition. [See Blackwood, “Modes and Chord Progressions in Equal Tunings” (1991) and Keislar, “Six American Composers on Nonstandard Tunings” (1991).]
contents all stem from his studies with Nadia Boulanger in the mid-1950s. Given this influence, it is perhaps less surprising that the text contains no references to microtonality (even as Blackwood’s reputation at the time was increasingly tied to his work with alternate tunings). One aspect of the text, however, that is at least abstractly reflected in his microtonal music is his sensitivity to register and distribution when voicing harmonies, which can be leveraged as a means to finesse chordal dissonances or hide away certain discordant combinations of notes.\(^{81}\)

Blackwood originally planned for his three folders of research notes to become a full-length book, but that plan never came to fruition. Instead, portions of these notes are featured in the last three chapters of his only published book, \textit{The Structure of Recognizable Diatonic Tunings},\(^{82}\) as well as in a later article in \textit{Perspectives of New Music}.\(^{83}\) But these do not approach the painstaking systematicity with which he originally went about cataloguing his process and findings. In order to render these little-known tunings audible, Blackwood first had to write out the etudes “with the aid of a performing instrument called the Scalatron (made by Motorola), and [then] record them by playing a Polyfusion synthesizer.”\(^{84}\) Both of these are

\(^{81}\) Blackwood makes a similar comment about timbre in his research notes: “It is truly remarkable how judicious choice of timbres can conceal roughness of this nature. It is not only that the beats are hidden—they are simply not there, no matter how hard one tries to hear them.” [Blackwood, “Research Notes: NEH Grant R0-29376-78-0642” (1979–81), Folder 2, p. 348.] This is resonant with William Sethares’ later proclamation in \textit{Tuning, Timbre, Spectrum, Scale} (2005) that “[i]t is possible to make almost any interval reasonably consonant, or to make it wildly dissonant, by properly sculpting the spectrum of the sound” (3).


\(^{83}\) See Blackwood, “Modes and Chord Progressions in Equal Tunings” (1991). This article only discusses four of the twelve tunings that Blackwood studied: 19-, 18-, 16-, and 15-TET.

retunable keyboard instruments invented in the 1970s and containing two ranks of the familiar Halberstadt layout (that is, seven white and five black keys to the octave), as shown below:

Image 1.1: Brochure advertisement for the Motorola Scalatron (1974)

Image 1.2: Magazine advertisement for the Polyfusion Series 2000 modular synthesizer (1979)
As is clear from the above, Blackwood did not use, say, a keyboard with 13 tones to the octave to record his 13-TET etude, another keyboard with 14 tones to the octave to record his 14-TET etude, and so on. Rather, he programmed these instruments in such a way that the familiar intervallic shapes of the 12-TET keyboard no longer corresponded to the familiar sounds that they typically generate (and vice versa). Thus, for 13-TET, the sounding octave above middle C4 would not be C5 but actually C#5 on these keyboards; similarly, for 14-TET, the sounding octave above C4 would be D5 (and so forth). Only in 24-TET would the sounding octave above middle C actually be another C—but in this case it would be C6, with the intervening C5 acting as the tritonal midpoint of the tuning.

Therefore, unit intervals in each tuning correspond to semitones on the Scalatron/Polyfusion synth, making Blackwood’s pitch mapping system a case of what Jonathan De Souza calls “voluntary self-sabotage,” since it introduces a form of “altered auditory feedback” that affects the customary coupling of action and sound. Sketchbooks from the Blackwood archive reveal that this mapping process involved a good deal of trial and error, for while it is a relatively straightforward matter to know where to map each microtonal pitch in each tuning, the question of what to call these pitches is far more complicated. Indeed, notating music—whether microtonal or not—is a political, interpretive act that points up certain features of the music at the expense of others. By choosing to retain the familiar look of five-line staff notation and introducing no new letter names outside of the familiar A through G, Blackwood encourages what I call a Euroclassical interpretive epistemology for his microtonal music:

85 De Souza, *Music at Hand: Instruments, Bodies, and Cognition* (2017), p.82. See in particular Chapter 4 of this book (pp.82–108) for a more detailed treatment of these types of situations.
framework for parsing it that is fundamentally “12-analogous.” This dovetails with a remark Blackwood makes in an interview with Douglas Keislar: “The aspect that intrigues me most [about composing in nonstandard tunings] is finding conventional harmonic progressions, or at least coherent progressions found by extension to their analogues in the most familiar tunings.” By notating his music in a way that points up these analogies (while simultaneously downplaying many of the ways in which nonstandard tunings are expectationally discrepant), Blackwood seems keyed into the fact that “[c]ulturally unfamiliar modalities are perceived through the framework of the cultural system with which one is already familiar.”

Blackwood writes that his notational system has two major goals: [1] to “reveal the tonal and modal configurations inherent within each tuning” and [2] to “conform to the habits of a trained musician.” With respect to the first goal, Blackwood strategically chooses note names and enharmonic equivalences so that each tuning’s closest approximations to familiar triads,

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86 To be clear, the commercially available score for the Twelve Microtonal Etudes, published by Schirmer in 1982, is not the score that Blackwood played from while recording these pieces. For this, he made an intermediary score in which each microtonal pitch was converted to the conventional key name on the Scalatron / Polyfusion synth with which it was associated. This was painstaking work—all written out by hand, one part at a time—and the finished intermediary score looks nothing like the surprisingly tonal music that it ultimately stands for. But it was the most efficient way for Blackwood, a pianist accustomed to the Halberstadt layout, to render his music playable given the spatial limitations of the technology at his disposal. When I first encountered these intermediary sketches, I was tempted to refer to them as “wrong-note scores”—a reasonable characterization from the perspective of a listener. But considering Blackwood’s unique perspective as the translator-performer of this music (not to mention the sole audience for these intermediary sketches), I suppose it might be more accurate to refer to them as “right-key scores.”


sevenths, and scales can look like familiar triads, sevenths, and scales on the staff. In his words, “If it sounds like a diminished-seventh chord [or] a whole-tone scale, it should look like one.”

With that quote in mind, consider the two layouts below:

*Fig. 1.1*: Spelling 16-TET as four interlocking $<0 4 8 12>_{16}$ diminished-seventh chords; slurs denote relationships of enharmonic equivalence

*Fig. 1.2*: Spelling 18-TET as three interlocking $<0 3 6 9 12 15>_{18}$ whole-tone scales

Both layouts demonstrate how Blackwood’s notational decisions are meant to highlight what Jason Yust calls the “harmonic qualities” particular to each tuning—diminished quality in 16-TET and whole-tone quality in 18-TET. Of course, these qualities stand out precisely because they match the centwise distribution of their analogs in 12-TET; each diminished-seventh chord

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91. Yust, “Special Collections: Renewing Set Theory” (2016), passim. Yust’s “harmonic qualities” are represented by six independent and one-dimensional “phase spaces” that are equivalent to the “Fourier balances” discussed by Ian Quinn in his earlier multi-part article “General Equal-Tempered Harmony” (2006/7).
in 16-TET consists of a fourfold division of the octave into 300-cent components, and each whole-tone scale in 18-TET consists of a sixfold division of the octave into 200-cent components. The only difference is that there are more notes than usual within these component parts: each 300-cent span in 16-TET measures four unit intervals (rather than the typical three semitones), and each 200-cent span in 18-TET measures three unit intervals (rather than the typical two semitones). Yet even these “extra” notes are labeled according to familiar conventions of chromatic raising/lowering—a sharp still raises a pitch by a unit interval, and a flat still lowers a pitch by a unit interval. Enharmonic equivalences, however, often depart from 12-TET convention; observe that C# and Db, for instance, represent two different notes in the above tunings. Yet the equivalences that do exist occur in systematic and purposive locations: on all the notes of exactly one of the four diminished-seventh chords in 16-TET, and on all the notes of exactly one of the three whole-tone scales in 18-TET. This optimizes the transpositional flexibility of Blackwood’s notation—a quality that mirrors the egalitarian transpositional affordances that are characteristic of equal temperaments in general.

By prying apart the usual enharmonic equivalences of 12-TET, Blackwood is able to represent all the pitches of 16- and 18-TET without introducing any new accidental symbols. But this is not always the case. In seven of his twelve tunings (14-, 15-, 20-, 21-, 22-, 23-, and 24-TET), Blackwood employs a new kind of accidental symbol that I like to call a “circle-arrow.” In some of these tunings (particularly 22- and 23-TET), it is deployed on an ad hoc

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92 To find the size of the unit interval in any tuning, simply divide 1200 (the number of cents in an octave) by the cardinality of the tuning.

93 In 20-TET, Blackwood even employs a double circle-arrow—but this is the only tuning of the twelve in which such a symbol appears.
basis, mainly to aid in labeling certain notes that fall, as Charles Ives memorably puts it, “between the cracks” of traditional sharp/flat/natural designations. But in most cases, Blackwood deploys these symbols with a high degree of systematicity, as another way of “reveal[ing] the tonal and modal configurations inherent within each tuning.” Consider the notational layout of 15-TET, for instance:

![15 Notes](image)

**Fig. 1.3:** Spelling 15-TET as three interlocking $<0\ 3\ 6\ 9\ 12>_{15}$ fivefold equal divisions of the octave

Here, circle-arrows perform the same chromatic raising/lowering function that sharps and flats do in those tunings where circle-arrows are not present. An up arrow raises a pitch by a unit interval ($1200/15 = 80$ cents), whereas a down arrow lowers a pitch by the same amount. Sharp and flat symbols therefore do not furnish the same sort of incremental alteration in 15-TET as they do in 16- and 18-TET; F and F#, for instance, are separated by not one but three unit intervals in Fig. 1.3 above (same with B and Bb). The enharmonic relationships of 15-TET, furthermore, appear quite counterintuitive at first. As Blackwood describes, “[A]ny interval that appears to be a diatonic minor second is actually an enharmonic unison—a state of affairs that

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takes some getting used to.” What sort of clarity is gained from such a scheme, which on the surface does not seem to “conform to the habits of a trained musician”? 

The following diagram, which maps out the nature of fifth space in 15-TET, is revealing:

![Diagram](image)

**Fig. 1.4**: Reorganizing 15-TET into three distinct $<0\ 3\ 6\ 9\ 12>_15$ fivefold equal divisions of the octave

As is clear from the above, each fivefold division (which Blackwood refers to in his research notes as the “pi chord”) is equally spaced and generated by fifth. But since the fifth in 15-TET measures nine unit intervals, and nine and fifteen share a common factor of three, this means that there is not one circle of fifths but three non-overlapping “fifth stars” (my term), each of which is diacritically distinguished from the others. Such a reorganization of 15-TET’s pitches clarifies the role of the circle-arrows in the notational scheme: all the down arrows are located in the leftmost fifth star, whereas all the up arrows are located in the rightmost one. The remaining pitches of the tuning, which contain no circle-arrows, comprise what I call “plain-space.”

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95 Blackwood, “Modes and Chord Progressions in Equal Tunings” (1991), p.188.
97 Blackwood, “Research Notes: NEH Grant R0-29376-78-0642” (1979–81), Folder 1, pp.11–12 and 17–18.
What might a musical motion through one of these spaces sound like? Consider the excerpt below from Blackwood’s 15-TET etude, which is simply titled “15 Notes”:

Ex. 1.1: An ascending-fifths sequence in 15-TET (bass voice bracketed in red); excerpt begins at 1:09 of https://www.youtube.com/watch?v=MIYXm-CJqUo
The bass notes in mm.16–18 traverse the rightmost fifth star, beginning and ending on equivalent chromatic pitches. Fig. 1.5 tracks this motion as a clockwise path through up-space:

Fig. 1.5: Bass-voice motion in mm.16–18 of “15 Notes”

Notice that this ascending-fifths sequence, if it were to iterate further, cannot reach any new bass notes due to the enharmonic properties of 15-TET; it is spatially confined to a single fifth star. The 720-cent fifth itself does not sound egregiously offensive in its 20-cent sharpness relative to 12-TET; in fact, it falls at the upper bound of what Blackwood calls the “range of recognizability” for this interval. But when this 720-cent interval is iterated five times in sequence (as corresponding to the five connective arrows of Fig. 1.5), a resulting “extra” 100 cents accumulates relative to 12-TET expectations—a perceptual scenario that is neatly encapsulated by the semitonally spelled enharmonic relationship between the bounding bass notes of the progression. In short, pursuant to Blackwood’s claim that his microtonal

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98 That is, 80 cents per unit interval times nine unit intervals.

99 Blackwood, The Structure of Recognizable Diatonic Tunings (1985), p.199. According to Blackwood, the range of recognizability for the perfect fifth lies between 4/7 (686 cents) and 3/5 (720 cents) of the 1200-cent octave. It is interesting to note that circle-arrows appear in the notation of all those tunings whose fifths lie at either extreme of this range, whether low (14- and 21-TET) or high (15- and 20-TET).
compositions “make new organizations of familiar-sounding harmonies,” the present excerpt amounts to a new organization (owing to the fact that nine and fifteen are not relatively prime) of a familiar-sounding type of harmonic sequence. Indeed, the effect is so disorienting that it is difficult to tell the sequence begins and ends on the same harmonic root, even when listening with a score. I like to call this a “Pac-Man moment,” since it simulates the experience of proceeding for a while in a single direction until a portal instantaneously returns one right back to the area where they started.

A diligent reader may point out that the three tunings I have discussed thus far (16-, 18-, and 15-TET) are all notable for the way their notational schemes bring out particular equal divisions of the octave—fourfold, sixfold, and fivefold, respectively. But how do such symmetrical collections square with what Norman Carey memorably calls the “characteristic asymmetry of tonality”? Is not the “stuff” of Western tonality contained in collections, like major/minor triads and diatonic scales, that divide the octave nearly (but not exactly) evenly? I will revisit this issue of tonality’s physiognomy in subsequent chapters, but for now, it is worth considering a complementary musical example from one of the tunings that Blackwood characterizes as containing “recognizable diatonic scales.” Four of his twelve chosen tunings meet this standard: 17-, 19-, 22-, and 24-TET. To be recognizably diatonic, according to

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102 This position is espoused by Dmitri Tymoczko, who argues in his book A Geometry of Music (2011) that “the basic sonorities of Western tonal music are optimal [because] they divide the pitch-class circle nearly evenly,” a property that allows them to be “connected to their transpositions by efficient voice leading” (63–64, emphasis mine).
Blackwood, a tuning must have a fifth that lies within the “range of recognizability” as well as a relatively simple integer ratio between the step sizes of \( W \) and \( H \) in the scalar-intervallic ordering \(< W W H W W H W >\) (where \( 5W + 2H \) equals the cardinality of the tuning).\(^{104}\)

The excerpt in question comes from the end of “19 Notes,” Blackwood’s 19-TET etude. His notational layout for this tuning is reproduced below for reference:

![19 NOTES](image)

**Fig. 1.6:** Blackwood’s note names and enharmonic equivalences for 19-TET

This scheme is designed with the recognizable diatonicity of 19-TET in mind. More specifically, all nineteen notes can be written as the root of a \(< 0 \ 6 \ 11 >_{19} \) major triad (\(< 0 \ 5 \ 11 >_{19} \) for minor), or as the tonic degree of a diatonic (major) scale with intervallic pattern \(< 3 3 2 3 3 2 >_{19} \), thanks to the enharmonic relationships of the tuning. Note that the perfect fifth in 19-TET measures 11 unit intervals, and since 11 and 19 are relatively prime, one can accordingly construct a single circle of fifths by iterating this group generator. Fig. 1.7 represents this space as a circular clock face with 19 hours:

\(^{104}\) Ibid., p.199. This ratio, which Blackwood calls “\( R \),” is 2:1 in 12-TET and 24-TET, 3:1 in 17-TET, 3:2 in 19-TET, and 4:1 in 22-TET. One might provisionally glean from this that a “relatively simple” integer ratio is one in which both terms sum to no more than five (when in its most simplified form).
As with the previous passage from “15 Notes,” the forthcoming excerpt from “19 Notes” also involves ascending, clockwise motion through fifth space. But the nature of that fifth space—not to mention the size of the actual fifth—differs widely between the two tunings, leading to two contrasting sonic outcomes. Consider the two measures boxed in red below:
Ex. 1.2: The closing gambit of “19 Notes”; excerpt begins at 3:44 of https://www.youtube.com/watch?v=N8IK38l1Anc
Fig. 1.8 provides a succinct illustration of the situation. The two measures sequentially unfold a fundamental motion from tonic to predominant in C ionian whose subsidiary harmonic waystations are equally spaced on the circle of 19 fifths. Note how this voice leading sequence—where the third of each major triad becomes the fifth of the next—cannot produce a string of distinct and nonoverlapping triads in 12-TET, since the size of the interval cycle (3) divides the cardinality of the tuning (12). But in 19-TET, all nonzero interval cycles exhaustively generate the tuning’s pitches (since the tuning’s cardinality is prime), and so Blackwood iterates the sequence over the enharmonic seam until it lands on the rhetorically emphatic F major triad, which points back to the overarching C ionian frame. This particular harmonic sequence seems
to be one of Blackwood’s favorites, appearing in reduced form not only in his unpublished research notes but also in the last chapter of his subsequent published book. It appears that Blackwood’s model for this sequence is an omnibus-like passage in Liszt’s *Ce qu ’on entend sur la montagne* (Symphonic Poem No. 1) that begins 16 bars after Rehearsal X and extends up until the start of Rehearsal Y. Interestingly, however, Blackwood only cites Liszt’s model in his research notes, not in *The Structure of Recognizable Diatonic Tunings*.

The two musical examples just discussed, from “15 Notes” and “19 Notes,” make for an appropriate pair in ways other than their featuring of ascending (clockwise) motion through fifth space. For one thing, they are neatly complementary in the ways they flout 12-conditioned expectations about interval behavior: for whereas the perfect fifth can generate all the pitches of 12-TET (but not of 15-TET), the minor third *cannot* generate all the pitches of 12-TET (but *can* of 19-TET). Furthermore, both leverage the regularities of sequential motion to end up at surprising destinations in a rather slick and sneaky manner. As Blackwood writes, “Sequences which are identifiable variants of 12-note sequences, but which come out in an unexpected key, are about the most fascinating aspect of the various different equal tunings.” Sometimes, as these two excerpts demonstrate, the most unexpected destination can be the very point of departure itself—the same chord in “15 Notes,” and the same key in “19 Notes.”

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107 I will return to the topic of Blackwood’s idiosyncratic approach to citation in Chapter 6, unpacking it in light of the “solitary genius” image he tried to cultivate for himself.

The larger purpose of my introducing these musical teasers now is twofold: [1] to initiate readers into Blackwood’s notational universe, and [2] to demonstrate that notation has agency. Notation, put plainly, is something that disposes listeners to hear certain things in certain ways, prioritize certain things over others, and expect certain things over others. It is not to be taken for granted; it always-already comes with an agenda, whether one consciously notices it or not. To quote Fred Lerdahl, it is as if Blackwood’s notational choices specify a sort of “listening grammar” through which one can better understand his “compositional grammar.”

Therefore, the 12-analogous Euroclassical interpretive epistemology that I posit earlier in this chapter is not only the case for reasons related to auditory enculturation and cognitive economy. Crucially, it is also the case because Blackwood’s notational system visually encourages it through the priming of familiar “looks.”

What Are We to Make of This Music?

At this point, readers should have a basic idea of how Blackwood’s music looks, how it sounds, and how it works. But one important question has yet to be addressed: who is this music for? Answering this question is not so simple. One place we might begin is with Lerdahl’s claim that “[t]he best music arises from an alliance of a compositional grammar with the listening grammar.” Notice the placement of an indefinite article before “compositional grammar” but a definite one before “listening grammar.” Are there really several compositional grammars

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110 Ibid., p.119.
but only one listening grammar? What is the scope of this allegedly generalizable listening grammar, and to whom does it belong? Of course, any “listening grammar” is always-already historically constructed and culturally contingent, and no two are exactly the same—though music theory, analysis, and pedagogy sometimes reify this construct as an ideal type. Whether Lerdahl’s intention is to reify or not, his language is telling nonetheless, implying that there are certain nontrivial aspects of music listening and processing that are shared across individuals. I have begun to address these matters in previous sections of the chapter. Because tonal music in 12-TET is so ubiquitous in Western musical culture, those exposed to it will accrue roughly similar kinds of implicit knowledge about how tonal music “works” and draw on roughly similar schematic expectations that guide their conceptions of how tonal music “should sound.” This is why most listeners who hear Blackwood’s microtonal music for the first time will immediately judge it as something like “out of tune” or “off key,” even if they have never received any formal musical training in their life. The ability to form these judgments does not require conscious awareness, skill on a particular instrument, or a certain number of college credits. And for this reason, I believe that Blackwood’s music can be a useful and uniquely powerful tool to tap into the implicit musical knowledge held by untrained “everyday” listeners.

But while this may be true, Blackwood’s microtonality is also far from music made for the everyday listener. Yes, it plays on a broad swath of ingrained, implicit knowledge shared by statistical learners of tonality. But at the same time, it is fundamentally music whose full understanding requires notational literacy and explicit knowledge of Eurocentric music theory—in short, a very specific type of musical training that most do not have. These are two very different types of “listening grammars,” to say the least, and their stark contrast complicates
the question of Blackwood’s intended audience. Of course, one could conceivably argue that this music is more accessible than most microtonal music, and that its visceral capacity to arrest both musicians and nonmusicians alike makes it capable of reaching a larger audience than was typical of most Western art music at the time. This seems to have been by design: Blackwood often voiced concern about the alienating nature of what he called the “nihilistic” atonal, aleatoric, radical music of the 1950s and 1960s, and he viewed his microtonal compositions as a way to connect with a broader listening audience while still continuing to push the boundaries of what was musically possible. But does this make his music any less “elite” at its core? It is still, after all, Western art music, made possible by expensive technology, written by an academic composer with an extremely specialized understanding of Western Euroclassical tonality, and principally geared towards an in-group of trained listeners who largely share in this understanding. And so, while his music undoubtedly pushes boundaries in certain areas, it also re-erects them in others.

In particular, Blackwood’s neoclassical, conservative approach to microtonal composition and notation creates the appearance that a very specific kind of tonality—the Western Euroclassical functional tonality of the common-practice period—constitutes the most “natural,” viable form of musical organization. His microtonal project might thus be regarded as reinscribing culturally dominant ideologies of musical Eurocentrism wherein common-
practice functional tonality is discursively framed as absolute, ahistorical, and transcendent.\textsuperscript{112} (In this case, moreover, the transcendence is double: withstanding not only the test of time but also the test of tuning.) Of course, “tonality” is far from a monolithic category that is unmoored from the particularities of culture and history. To this point, Mark Rodgers has recently argued for a rethinking of tonality “as a form of culture” that is “redolent of historicity” rather than “fixity.”\textsuperscript{113} Brian Hyer, writing several years prior, similarly frames tonality as “an ideological as well as a theoretical construct,” noting that “from the very beginning, the term has been used primarily for historiographical purposes.”\textsuperscript{114} And Thomas Christensen, in his latest book, describes tonality as a “construct born of alterity and anxiety.”\textsuperscript{115} Indeed, Christensen’s study of François-Joseph Fétis serves as a particularly potent reminder that even notions of tonality cloaked in the surface language of cultural plurality/relativity are not immune from being mobilized for the purposes of place- and race-based nationalisms.

It is in this ideological nexus that I want to consider the implications of replicating Euroclassical functional behaviors across 13- through 24-TET. That Blackwood takes the customs and practices of a dominant cultural tradition and transfers them systematically to a series of historically “untapped” (or “underdeveloped”) tunings is an act that ostensibly

\textsuperscript{112} As Alex Ross writes in a recent \textit{New Yorker} article, “[T]he entire music-education system rests upon the assumption that the Western tonality, with its major-minor harmony and its equal-tempered scale, is the master language,” despite the fact that “[v]ast tracts of the world’s music fall outside that system.” [Ross, “Black Scholars Confront White Supremacy in Classical Music” (2020)].

\textsuperscript{113} Rodgers, “Renaissance Formalisms in the Cultural Archive of Tonality” (2019), pp.8 and 11.


recreates the dynamics of colonialism and recalls Kofi Agawu’s characterization of tonality as “a colonizing force.” Under this interpretation, Blackwood treats microtonal composition not simply as a matter of exploring untouched musical space, but of domesticating it: effectively demonstrating that even the wildest sonic beasts can be tamed, made tonal (and thus respectable), and made tractable to Eurocentric music-analytic methods (thereby earning them the title of “nonthreatening”). This domesticating impulse can be observed not just across Blackwood’s dozen tunings, but also within them. Because each tuning is equal-tempered, this maximizes its number of “usable” tonal destinations and ensures that any unit interval, in any tuning, can be a potential tonic. But while this rhetoric may seem to paint equal temperament as “a thoroughly democratic musical system in which all notes are created equal and every key is given equal opportunity,” Ross Duffin also reminds us that equal temperament is deeply implicated in capitalist and imperialist regimes of the late 19th and 20th centuries—“when the American vision of democracy was spread worldwide.” It might be more appropriate, then, to phrase the matter thusly: that by optimizing the transpositional and modulatory potential of all his tunings, Blackwood ensures that even their most distant and unknown corners can be reached by the force of tonality and brought under its sphere of influence. It is in this light that Sumanth Gopinath’s characterization of tonal harmony as a “regime” comes most sharply into

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118 Ibid., p.141.
focus—a characterization that adds a consequential political and ideological dimension to my understanding of tonality as a regime of culturally conditioned expectations.\footnote{Gopinath, “Diversity, Music Theory, and the Neoliberal Academy” (2009), pp.74–75.}

So what are we to make of this music, in the end? It certainly occupies a multiply paradoxical space—in terms of its intended audience, its musical nuts and bolts, its ideological implications, and more—and different listeners/readers are bound to understand it in different ways. But however one understands Blackwood’s microtonal project, I want to reiterate that many of its paradoxes arise because of the way it engages with tonality. What some may see as the music’s most accessible quality—its troping of familiar Western 12-TET tonal praxes—others may see as its most elitist. Or, to frame things differently (and in terms particularly relevant to the present political moment), some listeners may regard Blackwood’s microtonal compositions as an assertion that “all tunings matter,” whereas others may regard them as a systematic demonstration that only one tuning—12-TET—really does in the end. Of course, there will always be listeners/readers who simply regard Blackwood’s microtonality as highly interesting music, and who are less invested in these broader claims. The ensuing chapters will have much to say about the fascinating musical nuts and bolts of these pieces. But there are also listeners/readers who will hear these musical nuts and bolts through a raced and gendered lens: that by propping up the supremacy of a very specific Western Euroclassical conception of tonality, Blackwood is also propping up the implied supremacy of the white male. In Chapter 6, I will delve more deeply into Blackwood’s own personal history of racism and sexism, to demonstrate that he was more than silently complicit in advancing these cultural ideologies of exclusion.
On the whole, Blackwood’s microtonal music raises a host of intriguing questions that cannot all be answered adequately within the bounds of a single dissertation. (Indeed, some of them are not exactly “answerable” at all.) What I have done, in the chapters that follow, is simply to address those questions that I find the most compelling, with the hope that future scholars will build on this work, challenge it, or perhaps pursue different questions altogether to fill in some of its gaps. With that in mind, let us now survey the terrain to come.

Where Are We Going?

The principal task of this dissertation is to advance a more flexible conception of diatonic tonality that is not reducible to any one specific tuning and whose assumptions do not proceed from a tacit privileging of major and minor keys. Doing so will involve rethinking several foundational music-theoretic terms and concepts—scale degrees, consonance/dissonance, chords, harmonic function, meter, and more—through the unconventional prism of Blackwood’s microtonality. These terms are so ubiquitous in musical discourse that they have all but become floating signifiers. While I do not claim to have solved all their linguistic problems in the following pages, I nevertheless propose some sensible solutions as to how these terms might be used with more precision in the future. Each of the interior chapters, to this end, proffers one or more terminological interventions, identifying what I see as some common misattributions and misconceptions that persist in how these basic concepts are typically framed/discussed in literature and taught in classrooms. As I will soon outline, Chapters 2 and 3 primarily propose terminological disentanglements, whereas Chapters 4 and 5 primarily
propose terminological synthesizes. We will have to take things apart first, in other words, so that we can eventually put them back together later.

Music’s effects are undeniably abstract, and this can trigger an impulse to associate such effects with concrete causes—to trace them back to their “source,” as it were.\textsuperscript{120} While the true sources are usually the idiosyncrasies of our enculturation and the attendant particularities of our expectational/predictive capacities, these things are exceedingly difficult to describe explicitly (as I mention earlier), because they rely so heavily on subconscious processes of implicit learning. As a result, there is a widespread tendency to project these sensations onto musical proxies, and to talk about these proxies as if they were concrete entities/objects (such as “notes” and “chords”) rather than abstract relations among these objects (such as “intervals” and “progressions”). This is not to say that musical entities do not exist; the frequency of a sound, for instance, is one. But tonal hearing necessarily involves the cognition of musical relationships, and so any descriptions or judgments resulting from this mode of listening are always-already relational at their core. This tendency to talk about relations as if they were entities is so deeply ingrained and widespread that it occurs not just in academic music scholarship but also in casual descriptions of music by nonspecialist listeners.\textsuperscript{121} Indeed,

\textsuperscript{120} This is not unlike the impulse to associate “acousmatic” sounds with the bodies or sources that produce them. See in particular Schaeffer, \textit{Traité des objets musicaux} (1966), Chion, \textit{The Voice in Cinema} (1999), and Kane, \textit{Sound Unseen: Acousmatic Sound in Theory and Practice} (2014) for more on this point.

\textsuperscript{121} It goes without saying that this tendency also extends to nonmusical contexts. Because cognition intimately involves acts of categorization, humans are constantly thinking of the “entities” they encounter in terms of their relationships to constructed prototypes. Thus a sentence as seemingly straightforward as “I like this apple” can be (re)read as “I like [how] this apple [compares to the others that I have previously encountered/seen/tasted/etc.].”
statements like “this note sounds out of tune” or “that chord sounds weird” are relatively common even among musical laypersons, whereas formulations like “the musical/temporal context in which this note (or chord) occurs makes it sound expectationally anomalous” are not.

As a result, I treat the building blocks of tonal cognition in strictly relational terms: as qualia\textsuperscript{122} that capture information about how alleged musical “entities” fit into their respective musical/temporal contexts of occurrence, and how these contexts, in turn, square with culturally conditioned expectations. This guiding principle characterizes my framing of scale-degree qualia, consonance/dissonance qualia, and harmonic function qualia all as “[cognitive] misattributions that originate in limbic responses to expectation.”\textsuperscript{123} This is easily the most controversial and suggestive of the several definitions of “qualia” that Huron offers in Sweet Anticipation, but curiously, he never pursues this particular formulation in more detail, nor does he specify what sorts of musical sensations qualify as qualia. The subsequent chapters might therefore be regarded as taking Huron’s provocation seriously and demonstrating its widespread utility through the lens of a music that demands the workings of expectation and prediction in unique and distinctive ways.

This sets the stage for the more targeted interventions that I make within each building block itself. In Chapter 2, I argue that when scholars invoke the notion of scale degrees, they typically conflate two subcomponents of scale-degree experience—which I call “generic scalar

\textsuperscript{122} I will discuss the concept of qualia in more detail in Chapter 2, but for now, suffice it to say that this term, originally of philosophical origin, refers to what it is like to undergo certain subjective experiences, such as tasting an apple, seeing the color red, or hearing a particular interval/progression in a piece of music.

position” and “specific modal character”—and treat them as if they were one composite thing.

In response, I propose an original notation for labeling scale degrees that insists upon the representational separation of these two subcomponents and relies upon a conception of tonality whose essence is heptatonic diatonicism in general (rather than major and minor scales more specifically). I then demonstrate through a series of analytical vignettes that conceiving of scale degrees in this manner can shed new light on a variety of common musical scenarios, from local tonicizations to large-scale modulations to moments of tonal/modal ambiguity. My scale-degree notation is intentionally designed for a flexible domain of application, and my analytical vignettes are strategically selected to reflect this repertorial diversity.

The main claim of Chapter 3 is that the gamut of connotations historically indexed by the terms “consonance” and “dissonance” is uniquely linked by the concept of expectation. I advance an expectational account of musical consonance and dissonance that draws on the social-psychological concept of cognitive dissonance, and I argue that Blackwood’s microtonality makes the expectational underpinnings of consonance/dissonance judgments startlingly clear in ways that traditional 12-TET music cannot. The fact that so many of Blackwood’s intervals and intervallic collections seem to straddle the line between established auditory categories creates unique cognitive demands for 12-enculturated listeners, who must face the expectational dissonances wrought by these anomalous occurrences. Such occurrences are cognitively dissonant precisely because of the difficulties they present to processes of categorization, being so fundamentally equivocal that they seem to call up multiple plausible interpretations at once, while also resisting categorical contextualization altogether—as if they were two different things at the same time, yet somehow neither fully
one nor the other. Any interpretive choice thus leaves behind a reasonable alternative and exacerbates the sense that there is no truly “correct” answer that can magically make all the dissonance permanently disappear. Throughout the chapter, I discuss kinds of (cognitive) consonance and dissonance that involve elements of musical experience other than pitch, such as meter and notation. I also discuss how judgments of musical consonance and dissonance, which largely originate in subconscious, lower-level musical exposures, can trickle up to inform more complex appraisals of centricity, stability, and even preference and value.

The primary terminological intervention of Chapter 4 is to do away with the conventional connotation of a “chord” as a static, vertical entity. In its place, I propose the alternative term “intervallic collection” (or “IC”), which has more desirable connotations of contextually embedded relationality. The goal of this substitution is to achieve greater ecological validity: to be able to talk about harmonic function in a way that aligns more closely with the relational dynamics of tonal cognition. One major through-line of this chapter is that harmonic function qualia primarily emerge from the interaction of generic scalar position (or scale-degree content) and metrical position (or temporal context). A corollary of this is that “harmonic function” is not something that inheres in musical entities the second they sound—an assumption that tacitly falls out of the way function is taught in classrooms—but rather is something that is only fully consolidated/confirmed once an IC stops sounding (i.e., once it is followed by another IC). Building off the deliberate modal democratism of my scale-degree notation from Chapter 2, I establish a color-coding system for harmonic-functional labels that communicates information about contextual modal flavor. This system can also be applied to
Roman numerals, allowing analysts to more precisely capture the qualitative subtleties of ICs that escape the major/minor binary.

Chapter 5 takes these building blocks and synthesizes them into a conception of fuzzy heptatonic diatonic tonality that links together all the musical examples discussed in this dissertation, microtonal or otherwise. The first half of the chapter revisits the distinction between entities and relations in a discussion of tonal salience. I argue that theories of tonal hierarchy and intervallic rivalry—often framed as incompatible and mutually exclusive takes on the same phenomenon—can actually be regarded as complementary and coexisting. This is because tonal salience is not a unitary phenomenon; there exist different kinds of tonal salience that operate independently of one another, drawing on distinct pathways of expectation and forms of memory. In the second half of the chapter, I synthesize ten broad takeaway lessons that Blackwood’s idiosyncratic approach to (micro)tonality can teach us about tonality in general. I focus on how his microtonal music can nuance what is already known or typically assumed about tonality, and how it challenges several ingrained assumptions about tonality’s alleged “ingredients,” its scope and various inflections, its supposed methods of parsing, and its limits. Many of these lessons summarize interventions and findings that cut across multiple previous chapters of the dissertation, such as the crucial roles played by enculturation and cognitive bias, the pervasiveness of misattribution, and the centrality of rhythm and meter in creating, influencing, and temporally regulating tonal sensations.

Chapter 6 is a deep dive into Blackwood’s archive of personal papers, focusing in particular on those materials that ostensibly have nothing to do with his microtonal music. And yet, as I argue, they have everything to do with his microtonal music. By piecing together
documentary evidence of Blackwood’s alarming racism, sexism, and homophobia, I make the case that his music and his approach to scholarship must be understood in the context of these unfortunate views.\textsuperscript{124} Drawing on correspondence, personal diaries, non-musical writings, and compositions “for the drawer,” I paint Blackwood as an especially vested stakeholder in (and gatekeeper of) what Philip Ewell calls “music theory’s white racial frame.”\textsuperscript{125} In doing so, I break the scholarly cycle of discussing Blackwood’s music without any consideration of his personhood and worldview, and I problematize the “isolated genius” trope that is often attached to his name and reputation. One major purpose of this chapter is to consider how the dissertation’s principal music-theoretic findings/lessons might be applied to music lying outside of the discipline’s “white racial frame.” I close the chapter with a close analysis of Ornette Coleman’s “All My Life” (1971) to demonstrate that the analytical tools developed in previous chapters can be applied in ways that expressly resist music theory’s longstanding Eurocentrism and hegemonic whiteness.

I envision this dissertation as speaking to multiple audiences at once, both musical and extramusical. On the one hand, its retreading of “familiar” musical ground through an unfamiliar repertorial lens leads to fresh perspectives on commonly discussed topics that will be of interest to future generations of music theorists, analysts, historians, pedagogues,\footnote{In other words, I make it a point not to separate Blackwood’s music from the more unsavory aspects of his personality. For more on the dangers of separating art from artist, see Hess, “How the Myth of the Artistic Genius Excuses the Abuse of Women” (2017).}

composers, and microtonal enthusiasts. And on the other hand, its positioning of these interventions within the broader landscape of dominant historical ideologies and cultural currents makes the project’s findings relevant to a wider interdisciplinary audience of humanists and social scientists. I believe there is something in this document for the social psychologist, the cognitive neuroscientist, the media theorist, the philosopher of mind, the critical race theorist, the historian of culture, and the postcolonial theorist, among other potential stakeholders. At bottom, I consider this dissertation to be a study of contradiction on many simultaneous levels of operation: the individual, the musical, the sociocultural, and the aesthetic-ideological. And this is to say nothing of the fundamental disciplinary contradiction at the heart of the project: that to discuss music as a liberal art is to intimately reckon with all the ways that humans, as musicking subjects, are anything but “free”—from biases, from prejudices, and from participation in systems of oppression.
Chapter 2  |  Right in the Feels

To name a historical period often requires having sufficient temporal distance to put its idiosyncrasies into perspective. Whatever the temporal boundaries of the common-practice period might be, its endpoint had certainly passed when Walter Piston coined the term “common practice” in 1941. Even more time has passed between Piston’s coinage and the present day. Yet certain characteristic features of this period—traces of the regime’s apex, one might say—remain entrenched in contemporary music-theoretic, music-analytic, and music-pedagogical discourses as normative “defaults.” The interior chapters of this dissertation critically interrogate one in particular: the longstanding conception that “tonality” consists only of music in major and minor keys that derive from a 12-tone octave. In this chapter specifically, I argue that this limited conception of tonality still serves as the tacit basis for how numeric scale-degree labels are used and discussed. I first explore some of the problems and contradictions that arise when these labels are applied to music that is colloquially “modal.” I then propose a flexible system for labeling scale degrees that does not privilege any particular diatonic modes (or any particular tuning) over any others. Readers expecting Blackwood’s microtonality to be at the center of this discussion throughout should be warned that his music will not come into play until the illustrative analytical vignettes towards the end of the chapter.


2 Of course, not all common-practice music confines itself exclusively to major and minor keys, particularly in the 19th century. For more on this, see Biamonte, “The Modes in Romantic Music” (1998) and Lam, “Relative Diatonic Modality in Extended Common-Practice Music” (2019).
where it is placed alongside other musical examples in more familiar tunings. This is deliberate: for while Blackwood’s microtonal compositions are indeed useful tools to illustrate this chapter’s major claims, the purview of such claims extends far beyond his set of experimental pieces.

*Mise en place*

Contemporary Western listeners frequently encounter diatonic tonal music that escapes the major/minor binary. By “diatonic,” here, I mean music whose scalar structure derives from the iteration of seven consecutive perfect fifths that are then collapsed within the range of an octave; this results in a heptatonic (i.e., seven-note) scale with five major seconds and two minor seconds. While such a process produces familiar major (ionian) and natural minor (aeolian) scales, it also produces the remaining diatonic modes: dorian, phrygian, lydian, mixolydian, and locrian. These latter modes have become increasingly prevalent in the popular music of the last century or so, as artists have sought to draw on scales outside the major/minor binary for expressive compositional resources. Recent studies have shown that the slight structural differences between these modes—which essentially boil down to where the two minor seconds are located relative to the scale’s tonic—are qualitatively consequential even for casual listeners. Daphne Tan and David Temperley, for instance, conclude in a recent empirical account that “Western listeners without music training are able to internalize diatonic modal frameworks.”\(^3\) This builds on an earlier study by the same two authors that finds untrained listeners to be so sensitive to “the subtle distinctions between modes” that the authors reject

the possibility that their participants interpreted the modal melodies they heard through a major/minor “common-practice” lens.⁴

While such findings are notable, they are not necessarily reflected in the scale-degree terminology that the authors use. Consider, for instance, the following quote from Tan and Temperley: “In Aeolian mode, the flattened sixth degree is a half-step above 5♭ […] in Dorian, the raised sixth degree is a whole-step above 5♮.”⁵ What is the purpose of the words “flattened” and “raised” here? To me, they seem superfluous; the sentence would make perfect sense without them. And furthermore, since these two degrees are naturally occurring in their respective modes, it seems odd to refer to them with the language of chromatic lowering and raising. I highly doubt that Tan and Temperley actually regard the aeolian sixth as an altered form of the ionian sixth, or the dorian sixth as an altered form of the aeolian sixth. (Indeed, this would contradict their conclusion of modal independence.) Yet their language speaks to a broader tendency in music-theoretic discourse to refer to modal scale degrees as chromatic deviations from an implicit major-scale—or sometimes minor-scale—norm.⁶ Of the two, ionian bias is far more widespread. It is not unusual, for instance, to see the third, sixth, and seventh degrees in an aeolian scale represented as “b♭3,” “b♭6,” and “b♭7,” respectively—and the fourth degree in a lydian scale represented as “#4”—even though these are all

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⁶ These two kinds of implicit bias often operate simultaneously. It is not uncommon for textbooks to introduce the dorian, phrygian, lydian, and mixolydian modes as major or minor scales with a single distinguishing chromatic alteration. See, for example, Ottman and Rogers, Music for Sight Singing, 8th Edition (2011), p.358.
naturally occurring degrees in their respective modes.\textsuperscript{7} Aeolian bias, while less common, still occurs at times during colloquial discussions of modes with minor thirds above tonic. Accounts that highlight the “lowered”\textsuperscript{8} or “flat”\textsuperscript{9} second of the phrygian mode, for instance—but do not make this same comment about its third, sixth, or seventh—are ones that proceed from an implicit aeolian frame of reference.

To be clear, such informal language is eminently understandable when considering that music in major and minor keys still statistically outnumbers music in the other diatonic modes—even in the 21st century. But what is gained in heuristic accuracy, I argue, is lost in qualitative precision. Applying sharp and flat signs to non-ionian degrees in blanket fashion\textsuperscript{10} can obscure some of the experiential subtleties that differentiate instances of the same-named degree across multiple modes. Consider the following diagram, for example, which appears in both of the aforementioned articles by Tan and Temperley:

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In this diagram, “b7” is common to mixolydian, dorian, aeolian, and phrygian. But does experiencing this degree feel the same in each of these four modal contexts? In this chapter, I want to explore the possibility that this quartet of “b7s” may actually represent four different scale degrees. While such differences are no doubt slight, I believe that they warrant further analytical attention—particularly in an era when modality is garnering an increasingly nontrivial market share in Western musical culture. In other words, the time is ripe for a conception of scale degrees that is more sensitive to the wider range of contextual modalities in which they can occur.
In order to make this case, I draw on the concept of qualia. This term has a complicated history—one that begins not on contemporary musical terrain, but instead with 20th-century philosophy of mind. Clarence Lewis was the first to define “qualia” as a plural noun, calling them “recognizable qualitative characters of the given, which may be repeated in different experiences, and are thus a sort of universals.” In other words, qualia are those ineffable aspects of subjective experience that are repeatable across contexts. Familiar examples include the pain of a paper cut, the blueness of a clear sky, and the taste of a peach. But, as always, definitions like these which aspire to capture such a foundational concept themselves necessitate foundational follow-up questions. What exactly is “the given,” for instance? Can qualia really be ineffable if we can communicate our experience of them to others (however imperfectly and circuitously)? And how can we be sure that others perceive qualia in the same way that we do? From its philosophical inception nearly a century ago, the term has been

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11 Invocations of the singular “quale” can be found in earlier works, such as Peirce, “Lowell Lecture, ix” [1866] (1982) and Tolman, “Nerve Processes and Cognition” (1918). For a comprehensive overview of the term’s early history, see Keeley, “The Early History of the Quale and Its Relation to the Senses” (2009).


13 Regarding this last, it is difficult not to think of the following memorable quote from Donald Tovey: “Tonality is a thing which you can no more describe except by metaphors and comparisons than you can describe the taste of a peach.” [Tovey, A Musician Talks, Volume 1: The Integrity of Music (1941), p.47.]
highly controversial, and when it eventually gained currency in recent musical discourses on phenomenology, perception, and cognition, that controversy far from disappeared.

Several 21st-century scholars have turned to the concept of qualia when discussing what it is like to hear and experience scale degrees. Scale-degree qualia provide a foundational point of entry into processes of tonal hearing, being the primary sensations through which listeners apprehend their musical position, orient themselves towards particular kinds of musical events over others, and maintain their bearings when things change. But exactly how these sensations arise, what they are “made of,” how many distinct types of them exist, and who is privy to experiencing them remain subject to debate. In the next section, I survey some of the ways that scholars have talked about scale-degree qualia, and I argue that despite their differences of opinion, all of their accounts are underpinned by [1] an implicit bias towards major/minor keys from a 12-tone octave (particularly major ones) as the proper “bearers” of tonality, and [2] a problematic method of attaching “sharp,” “flat,” and (implied) “natural” labels to caretet numerals that leads to misrepresentations and obfuscatory redundancies when dealing with non-ionian modes. To combat this, I advance an original

14 Indeed, the notion of qualia is intimately bound up with the hard problem of consciousness, which was first formulated under this name in Chalmers, “Facing Up to the Problem of Consciousness” (1995). For more on the relation between qualia and the hard problem, see Crane, “The Origins of Qualia” (2000), Robbins, “Form, Qualia, and Time: The Hard Problem Reformed” (2013), and Loorits, “Structural Qualia: A Solution to the Hard Problem of Consciousness” (2014). For a theory of consciousness that hinges on a critique of qualia, see Dennett, Consciousness Explained (1991).

15 Prominent contributions to this discourse include Huron, “Are Scale-Degree Qualia a Consequence of Statistical Learning?” (2006a) and Sweet Anticipation (2006b); Dowling, “Qualia as Intervening Variables in the Understanding of Music Cognition” (2010); Rings, Tonality and Transformation (2011); Hansberry, “What Are Scale-Degree Qualia?” (2017); and Arthur, “A Perceptual Study of Scale-Degree Qualia in Context” (2018).
conception of scale degrees as *chromatic species of diatonic genera* that can be represented as ordered triples \((x, y, z)\). Under this notation, \(x\) is a careted numeral indicating generic scalar position, \(y\) is a solfège syllable in re-based dorian (a modal extension of la-based minor) indicating specific modal character, and \(z\) is an uncaret numeral indicating unit-intervallic position in an \(n\)-tone octave (i.e., pitch class). The generic/specific and diatonic/chromatic distinctions invoked above will be familiar to readers of diatonic set theory.\(^{16}\) Essentially, generic intervals span a fixed letter-name distance in diatonic space, whereas specific intervals span a fixed pitch-class distance in chromatic space. For instance, all intervals that ascend from a spelled form of B to a spelled form of C can be regarded as seconds, but this generic interval can take on a variety of specific forms, including but not limited to \(B\#–C\) (diminished second), \(B–C\) (minor second), \(Bb–C\) (major second), and \(Bb–C\#\) (augmented second)—all of which have different chromatic lengths.

This system has several advantages. First, it pushes back against the dominant historical conception that tonal music can only consist of major and minor keys, instead locating the essence of Western tonality in heptatonic diatonicism more broadly, which can take on a variety of rotational shapes, forms, and colors—what I call “modalities of tonality.” Second, it solves a persistent labeling issue—namely, whether to call (for instance) the seventh degree in mixolydian “\(b\text{♯}\)” or just plain “\(\text{♯}\)”—by relocating the onus of indicating natural versus auxiliary degrees onto the re-based dorian (i.e., sol-based mixolydian) solfège syllables, thereby

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obviating the need for conventional “sharp” and “flat” labels. And lastly, though generic scalar position (x) and specific modal character (y) are richly interactive in practice, their strategic representational separation in ordered-triple notation affords one the flexibility to model certain subtleties of scale-degree hearing that would otherwise continue to be obscured by their tacit representational fusion. As I illustrate through a series of analytical case studies spanning folk hymns, show tunes, 1990s R&B, and Blackwood’s microtonality, ordered-triple scale-degree notation furnishes a clearer way to representationally distinguish between tonicization and modulation, while also providing an innovative take on the cognitive mechanics underlying situations of tonal/modal ambiguity. A recurring theme throughout is that the genus/species framing allows for greater nuance and precision in capturing the subtle ways that harmonic and metrical context can influence one’s sense of musical position. This puts pressure on two widespread (and interrelated) discursive tendencies: [1] to paint scale-degree qualia as if they pertained to isolated musical entities rather than contextually/temporally embedded relations, and [2] to talk about them as if they were the exclusive province of melody, rather than the product of interaction among several domains—both musical and otherwise.

The State of the Discourse

Where do scale-degree qualia come from? For David Huron, they result from implicit processes of statistical learning.¹⁷ Huron has tested this hypothesis by asking a group of musicians to

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¹⁷ See Huron, “Are Scale-Degree Qualia a Consequence of Statistical Learning?” (2006a) and Sweet Anticipation (2006b).
imagine hearing certain scale degrees and to describe the feelings they evoke. He finds “a notable association between the subjective *qualia* reported by musicians and the basic statistical properties of scale tones for Western music.”¹⁸ More specifically, degrees described as “stable” (such as ¹) have high probabilities of ending a phrase or work, degrees described as “unexpected” (such as b²) have low probabilities of occurrence, and degrees described as “leaning” (such as #₅) tend to be the most constrained in terms of how they are typically followed by other degrees.¹⁹ This overarching contention—that statistical learning and probabilistic prediction play crucial roles in musical processing and the subconscious formation of style- and culture-specific auditory generalizations—has been borne out by a long line of cognitive-expectational literature stretching from Leonard Meyer to the more recent computational models of Marcus Pearce.²⁰ But certain aspects of Huron’s experimental design have tended to raise more questions than they answer. These can be summed up threefold: his directive that participants “please think of pitches rather than chords,” the homogenous profile of his participant pool, and the restriction of his survey “to the major scale only.”²¹

With regards to the first, is this something that is in principle even possible—to conceive of pitches in isolation, without any traces of context, convention, or relationality? Take, for instance, some of the sample responses associated with the supertonic: “transitory,

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¹⁹ Ibid., pp.1677–79.


moderate expectancy of more to come, part of a flow.22 These responses seem to highlight one feature of the supertonic in particular: its location between two degrees of the tonic triad. It is not a stretch to imagine that participants may have conceived of this degree in terms of its helping role in tonic-prolongational progressions such as I–vii₆–I₆ or I–V₄/₃–I₆, both of which feature a stepwise 1̂–2̂–3̂ bass. This demonstrates just how difficult it is to jettison the vestiges of relational thinking that mark tonal cognition and to zero in on pitches by themselves (whatever that might entail). Not only do these participants appear to be thinking about chords, despite Huron’s injunction otherwise—they also appear to be thinking about particular chord progressions and the roles that certain scale degrees tend to play within them. Such cognitive slippage points up the limits of talking about scale-degree qualia as if they were descriptors of entities, since they always-already encode information about relations and conventions of usage. In a sense, this vindicates Huron’s hypothesis that scale-degree qualia result from implicit learning of statistical regularities. But at the same time, it plainly shows how these regularities take place over temporal contexts that are larger than the isolated present.

Another limiting factor of this study is its sample size: there are only ten main participants, and all are experienced musicians. The lack of nonmusicians means that Huron is unable to test whether scale-degree qualia are capable of being heard and experienced by the musically untrained (and if so, the extent to which their sensations are similar to those of the musically trained). This is a central preoccupation of Claire Arthur’s recent empirical study of scale-degree qualia, which builds on Huron’s while also addressing some of its aforementioned

22 Ibid., p.1677.
methodological drawbacks. Arthur’s pool of participants is much larger (41 musicians, 22 nonmusicians) and more widely varied in terms of its spread of musical backgrounds and levels of experience/training. Moreover, by prompting her participants to respond to actual musical stimuli, rather than asking them to merely imagine certain scale degrees and reflect upon their properties, Arthur’s experimental design is better able to capture the kinds of implicit knowledge that people hold about scale degrees.

Arthur plays each of her participants a series of short and varying key-defining chord progressions, all of which are followed by an isolated probe tone. She then asks participants to rate these probe tones on a set of oppositional descriptors (tense/relaxed, happy/sad, complete/incomplete, etc.) by adjusting a group of sliders towards one or the other pole. Her findings ultimately indicate that “even when listeners have limited musical experience, [they] came up with similar types of descriptive terms (that could be categorized in similar ways)”; however, “those with music training certainly appear more consistent” in their scale-degree judgments than do nonmusician listeners. These differences notwithstanding, Arthur’s study remains noteworthy for its ability to demonstrate that untrained listeners are in fact capable of forming consistent judgments about scale-degree qualia at a level above chance.


24 Ibid., p.311.
Another major aim of this study is to investigate “how the role of harmonic context might shape certain aspects of scale-degree qualia.” Arthur does this by adopting the probe-tone methodology of an earlier experiment by Carol Krumhansl and Edward Kessler, but with one crucial difference: all of Krumhansl and Kessler’s key-defining progressions end on the tonic, whereas each of Arthur’s progressions ends on a different diatonic triad. This allows her to test whether local harmonic context influences qualia ratings, and in short, it does. Her results reveal “a significant interaction for scale degree and progression (all $p < .01$),” which leads her to conclude that “a large part of a scale degree’s ability to influence qualia may be tied to a harmony (or perhaps harmonic function) with which it is most closely attached.” Like Huron before her, Arthur advances an account of scale-degree qualia as statistically learned. But her experimental design allows her to argue for this position in a manner that is more sensitive to the contextual embeddedness of scale degrees and more attentive to the diverse populations of listeners who can hear and describe them. However, Arthur’s study does also

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25 Ibid., p.298. Indeed, Arthur acknowledges up front that “in real musical contexts—at least in Western [ones]—a melody is most commonly embedded in a harmonic context” (295). While her study does not explicitly focus on the influence of rhythmic/metrical context on scale-degree judgments, this is the topic of Chapter 5 of her Ph.D. dissertation, “When the Leading Tone Doesn’t Lead: Musical Qualia in Context” (2016), pp.96–130.


28 Ibid., p.312.

29 As Arthur writes, scale-degree qualia “are not ‘absolute’ but in fact only exist in relation to something else” (296, emphasis in original).
replicate Huron’s study’s restriction to a major-mode purview—and this recurrent ionian bias is something that my ordered-triple notation will expressly resist.

Perhaps the most foundational debate surrounding qualia concerns whether they are experienced properties of things or subjective (mis)attributions to things. The former position is more characteristic of the way qualia have historically been invoked in philosophy of mind, whereas the latter is more typical of the term’s 21st-century application to cognitive psychology and neuroscience. Huron exemplifies this more recent position, claiming that “‘scale degree’ is how minds interpret physically sounding tones, not how tones are in the world.” 30 And yet the view that scale-degree qualia are immanent properties of notes remains hard to shake, particularly in the moment of listening. As Steven Rings points out, “Some listeners may in fact experience tonal qualia so vividly that they seem to infuse the sounding medium itself.”31 This is cognitive misattribution in action. It all begins with the fact that humans have evolved to instinctively seek out concrete causes when they experience abstract effects.32 But this effort to pin down explicit sources is not always so easy, particularly in the case of scale-degree qualia, considering all the implicit knowledge/learning that feeds into listeners’ subconscious conceptions of what scale degrees are. As I argue in Chapter 1, these are things that are extremely difficult to describe in words, and in the face of such difficulty, listeners can be prone to respond by pinning their expectational sensations onto elements of the music itself, which act as convenient “concrete” proxies that appear to be the true root cause of their emotions


and feelings. And so, if someone says that a particular note (say, ionian-mode 7) sounds restless, incomplete, or like it is pointing upwards, two interrelated misattributions are taking place. First, the judgment is more about that listener’s expectations than it is about the note itself. And second, those expectations pertain not just to that one note in isolation, but to the larger contexts in which that note is embedded, as compared to the larger contexts in which it typically (i.e., statistically or probabilistically) tends to occur.

Not all recent commentators share this view of scale degrees, however—particularly those who are more committed to upholding the native philosophical sense of qualia. Benjamin Hansberry, for one, puts forth an account of qualia that is rooted in the term’s “home discipline [of] philosophy of mind,” contrasting this understanding with the more “psychological” accounts of commentators like Huron who typify “the way qualia are discussed in music theory.” Though in the end Hansberry argues for a “phenomenological extension of Huron’s psychological account of scale-degree qualia,” he also articulates two main points of

33 It has been noted in the burgeoning literature on image schemas and cognitive categorization that these sensations of musical tendency, motion, attraction, and the like—are so often associated with scale-degree “behavior”—are metaphorical projections that originate in recurrent bodily experiences, such as moving towards a destination, maintaining one’s balance, and being subject to the force of gravity, among others. See in particular Johnson, The Body in the Mind (1987); Lakoff, Women, Fire, and Dangerous Things (1987); Saslaw, “Forces, Containers, and Paths” (1996); Zbikowski, Conceptualizing Music (2002); Johnson and Larson, “Something in the Way She Moves” (2003); Brower, “Paradoxes of Pitch Space” (2008); Cox, “Embodying Music: Principles of the Mimetic Hypothesis” (2011); and Larson, Musical Forces: Motion, Metaphor, and Meaning in Music (2012).

34 This is precisely the logic behind Huron’s characterization of qualia as “misattributions that originate in limbic responses to expectation.” [Huron, Sweet Anticipation (2006b), p.167.]


36 Ibid., p.183.
disagreement. The first is that, by treating scale-degree qualia as unconscious phenomena that result from automatic judgments based on implicit statistical learning, Huron’s account cannot reckon fully with the complex phenomenological character of scale degrees. The situation is more flexible and intricate than a theory of automatic and non-conceptual attribution lets on, Hansberry argues, because “we can sometimes control [scale-degree] attribution, [and so] we cannot account for this aspect of conscious experiences as cleanly as a psychological explanation might prefer.”\(^{37}\) The second point of disagreement pertains to Huron’s view that qualia can be understood as misattributions. Hansberry states rather forcefully that “qualia are not the kinds of things we can misattribute. They are as they appear, and we simply cannot be mistaken about what it is like to have an experience.”\(^{38}\) But, I argue, we are often mistaken about what causes these experiences to be like they are and to feel like they do—and these misattributions are part and parcel of what it means to experience musical qualia in real time. I am thus more interested in embracing and extending the recently emergent cognitive-psychological sense of qualia than I am in trying to steer the term back into its original philosophical clamshell. As W. Jay Dowling notes, it is not necessarily a problem that contemporary music-centric accounts of qualia often carry this term far from its “traditional use in the history of philosophy,” since the concept of qualia can also be quite “useful in

\(^{37}\) Ibid., p.198.

\(^{38}\) Ibid., p.188.
psychology, especially if we seek a psychology that tries to understand the mechanisms by which we perceive and understand the world. “39

Regardless of one’s stance on the origin, scope, or essence of scale-degree qualia, a few basic commonalities link practically all accounts of scale degrees, and these center on conventions of labeling. In most scholarship and pedagogy on Western tonality, it is customary to see the careteted numerals \( \hat{1} \) through \( \hat{7} \) deployed in conjunction with sharp/flat symbols that indicate chromatic raising/lowering. My proposed scale-degree labeling system does not eschew these careteted numerals, which I believe communicate useful information about a pitch’s generic position in a referential diatonic collection. Where I diverge from previous scholarship, however, is that I do not make any *a priori* assumptions about the specific shape of this referential diatonic collection. The key to my intervention, again, is the distinction between “generic” and “specific”—and this essentially boils down to a difference of opinion over exactly what those seven careteted numerals, in their unaltered form, represent. To me, they denote generalized slots in a heptatonic diatonic scale with a tonal center; it does not matter where this center is located or what the ensuing arrangement of major and minor seconds is. To many other commentators, however, they tend to denote specific intervallic relationships to the tonic of a tacitly ionian scale. As I have already begun to unravel, this can lead to problems when sharp and flat symbols enter into the mix, since these do not always reliably mark distinctions between natural and auxiliary degrees. Cases like the dorian sixth only compound such problems further: this degree shares the same specific intervallic size as the ionian sixth,

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but it is often referred to as “raised” or even “sharp” because of ingrained aeolian bias. This gives rise to pertinent questions about how to properly label such a degree: should it be a “sharp” 6, as such language implies? Should it be a “natural” 6; that is, a 6 preceded by a natural sign? Or should it be just a plain old 6, with no diacritic modifications whatsoever? This situation illustrates rather pointedly the need for a scale-degree labeling system that avoids such orthographic traps altogether. After all, if musical qualia are truly about capturing the “raw feels” of musical experience, then it is critical that scale degrees be labeled in ways that do not mask the nuanced modalities of this experience. Replacing sharps and flats with equivalent symbols, such as pluses and minuses, does little to rid scale-degree thinking of its historical bias towards major and minor keys at the expense of other heptatonic diatonic rotations—which are no less capable of producing sensations of tonal centeredness. What is necessary, instead, is a way of representing scale degrees that not only treats the various modal “flavors” of tonality in equitable fashion, but also does away completely with the entrenched practice of attaching diacritic symbols of modification to caret numerals. Ordered-triple notation is designed to accomplish both of these tasks at the same time.


42 This stock phrase, also of early 20th-century origin, has recently been applied to musical qualia in Gleason, “Compositional Qualia in the Princeton School” (2019), p.287, and to scale-degree qualia more specifically in Rings, Tonality and Transformation (2011), p.43 and Hansberry, “What Are Scale-Degree Qualia?” (2017), p.182. According to Hansberry, Edward Chace Tolman may have been the first to use “raw feel” in a published work. [See Tolman, “Nerve Processes and Cognition” (1918), p.436.]

Brass Tacks

To model scale degrees as chromatic species of diatonic genera, I propose representing them as three-place ordered sets \((x, y, z)\). The principal purpose of this notation is to disentangle two distinctive aspects of scale-degree experience—what I call “generic scalar position” \((x)\) and “specific modal character” \((y)\)—that are typically conflated together or fused into a representational singleton. As stated previously, what is “generic” about \(x\) is that it makes no assumptions about a referential scalar collection other than [1] that one exists, [2] that it is diatonic, and [3] that it is centered on one of those seven notes. The \(x\)-component is always a careted numeral and just that; it is never modified with sharps, flats, cautionary natural signs, or other symbolic prefixes. The \(y\)-component, on the other hand, supplies more precise information about how a particular note fits into a governing modal context. This is what is “specific” about \(y\): its primary concern is the actual intervallic pattern of a reference scale, and whether a particular note is naturally occurring in that scale or auxiliary to it. As mentioned earlier, \(y\) is always a solfège syllable reckoned in movable do with re-based dorian (meaning mi-based phrygian, fa-based lydian, etc.). The taxonomical relationship between \(x\) and \(y\) can be expressed as follows: naturally occurring ionian \(\hat{2} (y=\text{re})\), dorian \(\hat{2} (y=\text{mi})\), and phrygian \(\hat{2} (y=\text{fa})\) all represent distinct modal species of the superordinate genus “\(x=\hat{2}\).” And on another level, the major-mode pitches that would conventionally be labeled as “\(b\hat{2} (y=\text{ra})\), “\(\hat{2} (y=\text{re})\), and “\(#\hat{2} (y=\text{ri})\) all represent distinct chromatic species of the superordinate genus “ionian \(x=\hat{2}\).” This latter example shows exactly how ordered-triple notation offloads the burden of indicating chromatic raising/lowering onto the solfège-syllabic \(y\)-component—and in a manner that bypasses the need for accidental symbols altogether. As for the remaining component in the
triple, $z$, this is always an uncaret numeral that indicates a note’s pitch class, as outlined prior. It is most commonly represented by an integer modulo 12 (with C=0, following traditional pitch-class convention). However, in more finely grained microtonal tunings (as we will soon see), $z$ can take on a range of values larger than the typical 0 to 11, increasing in accordance with the number of pitch classes per octave.

My formalism builds on the work of several scholars who have modeled tonal pitches as ordered sets on the grounds that they are multidimensional phenomena. An important predecessor in this regard is Rings’s Generalized Interval System (GIS) for heard scale degrees, which employs an ordered-pair notation (sd, pc) such that “the left hand element in the pair denotes a [caret, sensed] scale-degree quale,” whereas “the right-hand element correspond[s] to the acoustic signal” and “denotes what psychologists call a chroma: the perceived ‘color’ shared by all pitches related by octave.”

Rings’s model, along with what he calls the “formally identical models of the diatonic system presented by Eytan Agmon (1986, 1989) and Alexander Brinkman (1986),” all share the premise that two pieces of information are needed to represent a tonal pitch.

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Later in his book, Rings explores the possibility that his left-hand “sd” component is itself multidimensional, and this results in an ordered triple \((\text{acc}_n, \text{sd}_n, \text{pc})\) for “diatonically oriented heard scale degree[s]” that is very similar to my proposed system—roughly equivalent to my \((y, x, z)\).\(^{47}\) Indeed, Rings’s “\(\text{acc}_n\)” formalizes a way to represent whether a heard scale degree is a naturally occurring member of a diatonic scale or an auxiliary inflection of one of its referential pitch classes. Rings even allows for the possibility that this diatonic collection can be modal\(^{48}\)—but he ultimately chooses to focus on major/minor music in his work. Where my approach differs from Rings’s, in addition to my explicit pursuit of modal democratism, is that my \(y\) is not identical to his “\(\text{acc}_n\).” Rings uses accidental symbols to label this component, whereas I prefer solfège syllables. Now, to be clear, Rings’s accidental symbols “represent chromatic inflections of heard scale degrees, not notated sharps, flats, or naturals”\(^{49}\)—and this is certainly a welcome improvement to traditional labeling practices. But because his formalization of key is separate from his formalization of scale degree, his ordered triples themselves do not give any indication of governing diatonic collection or specific chromatic length. For example, the triple \((\natural\, , \flat, 2)\) would represent the apperception “naturally occurring \(\flat\) inheres in acoustic signal D” under Rings’s notation, but this representation does not specify the modal identity of the referential diatonic collection or whether such a collection is centered on Eb or E. My proposed notation reads analogously but bakes in more specificity: \((\flat, \text{ti}, 2)\), for instance, represents the misattribution “generic scalar position \(\flat\) and leading-tone quality


\(^{48}\) Ibid., p.71n37.

\(^{49}\) Ibid., p.72.
inhere in acoustic signal D.” From this triple alone, one can infer not only that the referential diatonic collection is ionian but also that it is centered on Eb. Only in the ionian mode, however, would naturally occurring \( x=\frac{7}{6} \) call for the upward-vectored \( y \)-component of \( ti \); in an aeolian (i.e., natural-minor) context, by contrast, its \( y \)-component would be the more directionally neutral sol, and in a mixolydian context, it would be the downward-vectored fa (and so on in the remaining modes). I am far from the first scholar to tout the utility of re-based dorian\(^{50}\) or to propose a more expansive conception of tonality that encompasses what is usually othered as “modality.”\(^ {51}\) But I may well be the first to combine these two convictions under the aegis of a single scale-degree labeling system.

While certainly indebted to the work of these aforementioned scholars, my proposed system actually has far older historical and conceptual roots. One could trace back its conceptual underpinnings to “Guidonian”\(^ {52}\) solmization (as Rings does with his own system\(^ {53}\)),

\(^{50}\) For some recent perspectives, see Lam, “Relative Diatonic Modality in Extended Common-Practice Music” (2019) and “Modal Spelled Pitch Class, La-Minor Solfège, and Schubert’s Third Relations” (2020), and de Clercq, “Lobbying for a La-Based Approach to the Minor Tonic in Popular Music Harmony” (2020). Both authors refer to this solfège system as “la-based minor.”


\(^{52}\) I use scare quotes here, because Eurocentric musicological bias has led to the longstanding assumption that such a system was the invention of Guido d’Arezzo, when in fact he may have learned it from earlier Arabic music theory. For more on this, see La Borde, Essai sur la musique ancienne et moderne (1780); Farmer, Historical Facts for the Arabian Musical Influence (1930); Saoud, “The Arab Contribution to Music of the Western World” (2004); and Chami, “Deconstructing a Mediæval Legend: Guido d’Arezzo, the ‘Arabian Influence,’ and the Role of the ‘Historical Imagination’” (2014). I thank Bronwen Garand-Sheridan for bringing this to my attention in 2017.

in which pitches are represented by *littera\/vox* (roughly z/y) pairings such as “G sol re ut,” indicating the different hexachordal contexts in which the note G can occur: as sol in the C-centric *naturale* mode, re in the F-centric *molle*, and/or ut in the G-centric *durum*. Of course, there are more than just three possibilities for vox in heptatonic diatonic music; accordingly, the following table lays out the basic space for x/y permutations that can occur within an (x, y, z) ordered triple:

<table>
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<th>do</th>
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<th>mi</th>
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<th>sol</th>
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<td>Aeolian</td>
<td>Locrian</td>
<td>Ionian</td>
<td>Phrygian</td>
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<td>7</td>
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Table 2.1: 49 basic permutations of scale-degree genus (x = numeral) and species (y = syllable)

The table is organized such that each modal collection cuts diagonally across the space, downwards and to the right (modulo do). I have chosen to list the solfège syllables in ascending scalar order (i.e., do re mi fa sol la ti), rather than as an ascending line of fifths (i.e., fa do sol re la mi ti), in order to make these modal collections more literally connected and visually clear. Note that the z-component of the ordered triple is nowhere to be found in Table
2.1. This is intentional; the idea is that any one of these $x/y$ pairs can theoretically “accrue” to any acoustic signal (qua pitch class) $z$. Notice, also, that the table does not cover any possibilities of chromatic inflection (this is what makes the space “basic”). Indeed, it only contains the seven degrees that are natural to each of the seven diatonic modes, and thus, none of the forty-nine rectangles houses an auxiliary degree (where “auxiliary” is understood as “lying outside the boundaries of a particular modal collection”). To reach these auxiliary degrees, as I have already teased above, solfège syllables must be altered in accordance with traditional conventions for chromatic raising/lowering. For example, the leading-tone seventh is technically an auxiliary degree in the aeolian mode, and so it would have to be represented by $(\hat{7}, si, z)$ whenever it occurs in that context. Likewise, a perfect fourth above the tonic is naturally occurring in every mode except for lydian, where it is actually a diminished fourth—an auxiliary degree that would garner the label $(\hat{4}, te, z)$. And a perfect fifth above tonic would only be considered auxiliary in a locrian context, where it would necessitate the ordered triple $(\hat{5}, fi, z)$. So on and so forth; by now, the general idea should be clear.

All in all, this notation provides a handy way to clearly distinguish among the varied tonal/modal contexts in which any given generic scalar position $x$ can occur. But some of these contextual distinctions—such as the difference between $\hat{2}$ in ionian ($y=re$) and $\hat{2}$ in lydian ($y=sol$)—are admittedly rather minute. Indeed, I can imagine some readers being skeptical that they even exist at all. For this reason, it is important to clarify exactly what my ordered triples are (and are not) doing. Temperley posits a useful distinction between “descriptive” music theory, whose purpose is “to describe the way people hear pieces already,” and “suggestive”
music theory, whose purpose is “to find and present new ways of hearing pieces.” I intend my ordered triples to align more with the latter pole than the former. That is to say, I regard them as qualitative “hats” that listeners can try on for size in order to experience familiar tonal phenomena in new/unfamiliar frameworks (that nevertheless have the potential to be revelatory in certain ways). They are not claims about how listeners already hear such phenomena. Now, this does not rule out the possibility that some readers might find descriptive value in certain of my analytical claims—or find that such claims tap into latent knowledge they hold about tonal hearing. Indeed, Temperley allows for the possibility that “a theory might be descriptive in some aspects, but suggestive in others [….] A theory might also have a different status for different people, or for the same person at different times.” But the larger point here is that the purpose of my ordered triples is to suggest how certain musical situations might be heard, not to dictate how they are (or should be) heard. David Lewin’s apt remark comes to mind: “One should not ask of a theory that every formally true statement it can make about musical events be a perception-statement. One can only demand that a preponderance of its true statements be potentially meaningful in sufficiently developed and extended perceptual contexts.”

55 Ibid., p.75.
Illustrative Vignettes (I): Initiation and Tonicization

Ordered-triple scale-degree notation is repertorily flexible in its intended domain of application, and it can bring greater analytical clarity to a variety of common musical scenarios. As we will see in the forthcoming examples, two of its primary advantages are that [1] it provides a more intuitive way to represent the differences between tonicization and modulation, and [2] it models tonal/modal ambiguity in a manner that succinctly captures both the experiential differences that separate competing hearings and the (typically under-discussed) experiential commonalities that link them together. Both of these advantages would not exist without a genus/species framing of scale-degree qualia. Disentangling generic scalar position \( x \) from specific modal character \( y \), I maintain, makes explicit something that often bubbles below the surface of discourses surrounding scale degrees, but that has yet to be acknowledged notationally: that while these two components do obviously correlate in practice, they also often diverge from one another in ways that are quite revealing. This is most apparent during moments of tonal transformation that involve attentional negotiations among multiple referential diatonic collections. More specifically—and here I finally tip my hand—for all common tones \( z \) shared across such collections, local tonicizations usually involve changes in \( y \) (but not in \( x \)), large-scale modulations usually involve changes in both \( x \) and \( y \), and instances of tonal/modal ambiguity usually involve changes in \( x \) (but not in \( y \)). I illustrate these insights through a diverse triptych of analytical case studies: a moment of tonicization from “Amazing Grace,” a moment of modulation from Blackwood’s “17 Notes,” and a moment of tonal/modal ambiguity that opens Anita Baker’s “Body and Soul” (1994).
Before delving into this triptych, however, I proffer the following amuse-bouche. It is intentionally straightforward and uncontroversial; its purpose is to ease the reader into my labeling system and to set the stage for the more complicated scale-degree scenarios that follow in its wake:

Ex. 2.1: Applying ordered-triple notation to a familiar ionian melody

There is likely nothing that will come across as jarring or surprising about the way I label these first four measures of “Happy Birthday”—particularly for those who are accustomed to movable-do solfège (and pitch class integer notation). The excerpt contains no instances of tonicization, modulation, or ambiguity, and its crystal-clear F ionian orientation allows for the customary pairing of $x=\hat{1}$ and $y=do$. But though things may look rather tame now, we will soon see how different musical situations call for certain representational tweaks that may come across as disorienting or unusual at first. By employing movable do with re-based dorian, for instance, not every tonal/modal center (i.e., every naturally occurring $x=\hat{1}$) will be represented as do (this will only be the case in ionian).

Consider the following excerpt, for instance—also the first four measures of a familiar F-centric melody in 3/4, but this time, one whose tonal orientation shifts subtly midway through:
Ex. 2.2: During tonicizations, \( y \) changes to match the qualia of the local key whereas \( x \) remains rooted in the global key (for all common tones \( z \) shared between both), creating the appearance of a “parallel” modal shift.

My analysis postulates the existence of a secondary dominant in m.2. Of course, not all accompaniments to this hymn play a literal \( \text{V}^7/\text{IV} \) at this juncture; many opt to stay on the tonic for the first two bars. But even a notional “I” in m.2 has traces of latent dominant function on the local level (i.e., as a V/IV), given how it seems to “resolve” into the hypermetrically stronger m.3. This demonstrates two things: [1] the important role that meter plays in influencing scale-degree qualia, and [2] the fact that the melodic A in m.2 is somehow experientially different from the melodic A in m.1—much like how the F on the downbeat of m.3 is experientially different from the F on the downbeat of m.1.

Because these qualitative differences boil down to local matters of specific contextual character, the aforementioned pairs of pitches differ only in the \( y \)-components of their respective ordered triples. This accomplishes a few things. First, it registers the subtle sense of upwards striving that accompanies the word “Grace” by modeling this degree as a mixolydian, rather than an ionian, third—a \( \text{ti} \) rather than a \( \text{mi} \). Second, it allows for a neat solfège-syllabic parallelism between “how sweet” and “the sound” (both “\( \text{la sol} \)” ), which matches their more

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57 One could certainly read this moment hermeneutically for its obvious religious subtext—but then again, one would also have to explain the fact that this latent upwards striving is thwarted by the counterbalancing force of downwards melodic gravity.
obvious parallels in contour, rhythm, and meter. But most importantly, it gives analysts a novel way to suggestively model those elusive nuances of scale-degree hearing that separate moments of transitory tonicization from ones of outright modulation: the former typically involve interpreting the same \( z \) with a different \( y \) (but the same overarching \( x \)), whereas the latter typically involve interpreting the same \( z \) with both a different \( y \) and a different \( x \). By disentangling generic scalar position from specific modal character, ordered-triple notation can more cleverly portray those situations in which the local harmonic context shifts, but not enough to disturb one’s global sense of governing centricity.\(^5\)

This analytical clarity, however, comes at a price. During the tonicization of Bb ionian, my scale-degree labels are drawn not from this collection but from (the \( y \)-equivalent) F\(_{\text{mixolydian}}\) collection instead. This creates the appearance that tonicizations are equivalent to modal shifts—a state of affairs that is likely to be quite disorienting for many readers. In fact, it completely reverses the conventional understanding of local major-key tonicizations in a global context.

\(^5\) Observant readers may point out that the melody of “Amazing Grace” is completely pentatonic and accordingly wonder why I do not reflect this reduced scalar cardinality with a truncated range of possible \( x \)-values (i.e., from \( \hat{1} \) to \( \hat{5} \) rather than \( \hat{1} \) to \( \hat{7} \)) in Ex. 2.2. In short, I stick with a heptatonic diatonic conception of \( x \) because my hearing of the melody hinges on an argument about its (diatonically based) accompaniment, which always uses more than five notes. If I were to model this hymn melody in purely pentatonic terms, however, a few representational tweaks would result: each C would be labeled as \( (\hat{4}\text{p}, \text{sol}, 0) \) rather than \( (\hat{5}, \text{sol}, 0) \), and each D would be labeled as \( (\hat{5}\text{p}, \text{la}, 2) \) rather than \( (\hat{6}, \text{la}, 2) \). (The superscripts are meant to distinguish these degrees from the \( x/y \)-equivalent dorian fourth and dorian fifth, respectively.) These labels probably seem counterintuitive and disorienting to the diatonically accustomed reader. But they are intended to be more consistent with the implicit knowledge of those whose musical enculturation is primarily pentatonic. Restricting \( x \) from \( \hat{1} \) to \( \hat{5} \) simply reflects the mental equalization of scale steps that are of different sizes—something that, let us not forget, is part and parcel of diatonic hearing as well. On this last point, see Shepard, “One Cognitive Psychologist’s Quest for the Structural Grounds of Music Cognition” (2009), pp.138–40 and Dowling, “Qualia as Intervening Variables in the Understanding of Music Cognition” (2010), pp.9–12.
major-key context: typically, these involve changes in centricity but no changes in mode, whereas here, my scale-degree labels suggest a change in mode but no change in centricity. Such labels, however, are merely artifactual byproducts that fall out of my conception of tonicization as affecting \( y \) (local qualia) but not \( x \) (global tonal positioning); they are not, again, claims that listeners (ought to) hear tonicizations as modal shifts wholesale. Of course, if readers wish to imaginatively conceive of tonicization as an abstract sort of generalized modal shift, they certainly can; perhaps there is even something to be gained from “making the familiar strange” in such a manner.\(^{59}\) But this apparent conflation of tonicization with modal shift, simply put, is the conceptual cost one must bear when thinking of tonicization’s unique relation to \( x \) and \( y \) in the way I propose. Odd things will inevitably happen when theorists try to transport concepts like tonicization—which are so intimately tied to our familiar major/minor tonal system—onto modally democratic terrain. My hope, though, is that the analytical clarity gained from being able to simultaneously represent the competing pull of local and global tonal forces during moments of tonicization within a single scale-degree representation can outweigh this cost (and result in a net analytical profit).

Readers are invited to think of the relationship between \( F \) ionian and \( F \) mixolydian in Ex. 2.2 in terms of a “parallel” shift between two referential scalar collections that share the same center (and the same cardinality) but differ in their constituent pitches. This generalizes the notion of parallel keys beyond the binaristic confines of major/minor thinking and onto a

\(^{59}\) Here I am quoting Novalis’s conception of Romanticism as “mak[ing] the familiar strange and the strange familiar,” as Alexander Rehding translates it in “Three Music-Theory Lessons” (2016), p.251. [For the original passage, see Novalis, Schriften (1837–46), iii, p.236.] This phrase has since acquired wide currency as a rallying cry for disciplines ranging from semiotics to cultural anthropology.
broader landscape that is inclusive of the other diatonic modes. Such shifts engage the horizontal relationships in Table 2.1—those among occupants of the same row, which are linked by a common $x$ but vary in their respective $y$-components. We will shortly encounter the notational inverse of these situations in ones of tonal/modal ambiguity, which feature “relative” shifts among referential diatonic collections that contain identical constituent pitches but differ in their centers. This will provide an analogous generalization of the relative-key concept beyond the major/minor binary, and as one might have guessed by now, such shifts will engage the vertical relationships in Table 2.1—those among occupants of the same column, which are linked by a common $y$ but vary in their respective $x$-components.

Illustrative Vignettes (II): Modulation

Before making good on this promise, however, I must first fulfill another one previously made: to demonstrate exactly how ordered-triple notation distinguishes between local tonicizations and large-scale modulations. I now turn to an example of the latter from Blackwood’s “17 Notes.” This is no ordinary modulation. To start, it features not just a change in centricity (from G to E) but also a change in mode (from dorian to aeolian)—and this latter shift, which would typically be downplayed by traditional scale-degree labeling conventions, figures prominently in my interpretation of the passage. Of course, the excerpt is also in 17-TET, and this increase in octave cardinality means that $z$ must now take on an expanded range of values, from 0 to 16 rather than the customary 0 to 11. Thanks to Blackwood’s unusually neoclassical approach to microtonal composition and notation, however, the other two ordered-triple components can
actually be applied quite fruitfully to the passage without any need for modification (such as expanding the range of $x$ or inventing new names for $y$).

Part of the reason for this is that 17-TET is particularly well equipped to simulate the characteristic sound of heptatonic diatonicism. Indeed, as mentioned in Chapter 1, it is one of only four out of Blackwood's dozen tunings (along with 19-, 22-, and 24-TET) that contains what he calls “recognizable diatonic scales.”\textsuperscript{60} Fig. 2.2 below shows how 17-TET meets both of Blackwood's conditions for recognizable diatonicity:

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{17_notes.png}
\caption{Blackwood's note names and enharmonic equivalences for 17-TET}
\end{figure}

First, the fifth in 17-TET measures ten unit intervals, or $(1200/17) \times 10 = 705.88$ cents. Since this size falls right near the middle of Blackwood's “range of recognizability” for the perfect fifth,\textsuperscript{61} the first condition is met. Moreover, 17-TET allows for a simple 3:1 ratio between the step sizes of $W$ and $H$ in the scalar-intervallic ordering $\langle WWHWWWH \rangle$ (again, where $5W + 2H$ equals the octave cardinality)—thus meeting the second condition and leading to diatonic scales that sound strikingly similar to their counterparts in 12-TET. It is worth pointing out that despite

\textsuperscript{60} Blackwood, \textit{The Structure of Recognizable Diatonic Tunings} (1985), p.254.

\textsuperscript{61} Ibid., p.199.
Blackwood’s phrasing of this second condition in a manner that privileges the ionian ordering $<\text{WWHWWWH}>$, any $z$ in 17-TET can act as the tonic not only of a $<3313331>_{17}$ ionian scale, but also of a $<3133313>_{17}$ dorian scale, a $<1333133>_{17}$ phrygian scale, and so on. As I explain in Chapter 1, Blackwood’s notational system is designed to visually prioritize familiar shapes such as these and visually optimize the transpositional/modulatory affordances they enjoy as a result of equal temperament.

I am not the first scholar to apply an original scale-degree labeling system to Blackwood’s microtonal music. Daniel Cox and William Ayers have recently extended Rings’s ordered-set notation to make some fascinating observations about the workings of “19 Notes.” But both of their approaches replicate the familiar practice of merging sharp and flat symbols with careted numerals, and as a result, they perpetuate the tradition of referring to scale degrees in a way that conceptually fuses $x$-information with $y$-information. Ostensibly, my ordered-triple notation would seem to be most helpful whenever it can capture those musical situations where these two components diverge: where one changes while the other remains constant. This was the case with “Amazing Grace,” and it will be the case again with “Body and Soul.” But I want to submit the following modulatory passage from “17 Notes” as evidence that disentangling $x$ from $y$ can still reveal rewarding analytical insight even in those cases where both components change together. And further, the passage demonstrates that ordered-triple notation can still be useful outside of 12-TET, since the system is built on an intentionally broad definition of “diatonic” that is unsutured from the 700-cent perfect fifth.

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Ex. 2.3: Wait, how can moving from the flat side to the sharp side be "darker"? Labels pertain to the top voice only.
The double bar in Ex. 2.3 acts as an unexpected phrasal boundary that ushers in a striking hypermetric realignment: the last measure of the excerpt is retrospectively reinterpreted as “strong” rather than “weak.” Also reinterpreted is the governing centricity and mode; two potential pivot junctures are marked in the penultimate measure with vertically aligned ordered triples. The exact location where this pivot occurs, however, is less important than the larger point: that modulation—provided that it is not to a “parallel” or “relative” tonal area (in the expansive sense outlined above)—entails interpreting each common tone $z$ with both a different $x$ and a different $y$. This occasions a reexamination of John Muniz’s view, building off of Rings, that modulations can be conceived as “scale-degree reassignments.”

One might qualify this view accordingly: that for every common tone $z$, parallel modulations (e.g., F ionian to F dorian) entail reassignments of $y$ but not of $x$, relative modulations (e.g., B aeolian to G lydian) entail reassignments of $x$ but not of $y$, and all other modulations (including conventional moves to the dominant, the flat submediant, etc.) entail reassignments of both $x$ and $y$.

Ex. 2.3 modulates from G dorian to E aeolian, and I want to make the case that this change in mode is a much more consequential aspect of the passage than it may seem to be at first. Indeed, those listening through a strictly major/minor lens might regard the only

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63 I use scare quotes here because these labels, too, are misattributions. What is really “strong” (or “weak”) is not the measure itself, but rather the expectation that certain kinds of things—like phrasal beginnings—tend (or tend not) to occur at these particular junctures.


consequential tonal shift in this passage to be one of mere centricity: from a G-centric “minor” key to an E-centric one. This would likely lead to a sense of surprise that a move from the flat side of the tonal spectrum to the sharp side could sound like a “darkening”—a shift in color/energy that matches Blackwood’s parenthetical marking but contradicts mounds of key-characteristic and sound-symbolic wisdom.\textsuperscript{66} Sure, there are a slew of factors that configure to make the last measure of Ex. 2.3 sound “darker” than the previous ones, from timbre to dynamics to register. But not to be forgotten, I contend, is the concomitant shift to a “darker” mode—from the comparatively brighter dorian to the less bright aeolian. The only difference between these two modes is their sixth degree, which is two 17-TET unit intervals lower in aeolian than it is in dorian, thereby making the latter relatively “brighter” than the former.\textsuperscript{67} Furthermore, as shown by the y-components in Ex. 2.3, these telltale sixth degrees point tendentially in opposite directions: the dorian $\hat{6}$ is an upward-vectored (and thus colloquially “bright”) ti, whereas the aeolian $\hat{6}$ is a downward-vectored fa. This tendency reversal cannot be overlooked in accounts of why the double bar precipitates a “darker” soundscape—and


\textsuperscript{67} This notion of relative brightness/darkness among the diatonic modes has been discussed in Sugiura, Electronic Musical Instruments Having Automatic Ensemble Function Based on Scale Mode [U.S. Patent 4,450,742] (1984), Miller, Modal Jazz Composition and Harmony, Volume 1 (1996), and Mathieu, Harmonic Experience: Tonal Harmony from Its Natural Origins to Its Modern Expression (1997), among several others. More recently, it has been formalized in Sailor, “Modality and Alternative Functional Harmony in Diatonic and Non-Diatonic Scales” (2018) and Sherrill, “Partial Orders of Modal Brightness” (2019).
ordered-triple notation makes this explicit in ways that conventional scale-degree notation does not.

**Illustrative Vignettes (III): Tonal/Modal Ambiguity**

Another useful feature of ordered-triple nomenclature is its ability to capture the dynamics of tonal/modal ambiguity with greater precision and nuance. More specifically, it provides a way to simultaneously register not only those aspects of scale-degree experience that separate potential interpretations during such moments of ambiguity, but also those aspects that remain constant regardless of which interpretation one chooses. The opening of Anita Baker’s “Body and Soul” is an instructive case study in this regard. As seen in Ex. 2.4 below, the introductory eight-bar vamp to this recording consists of what Philip Tagg would call a harmonic “shuttle” between a C#-rooted chord and an F#-rooted chord. Two-chord shuttles typically carry great potential for ambiguity—particularly when the chords are related by fourth/fifth, since this combines a local sense of directionality with a global sense of figure/ground ambivalence. As a result, the tonic of “Body and Soul” is initially unclear; three plausible hearings are listed below:


69 These particular hearings are chosen because the most statistically probable motions by fourth/fifth in tonal music are those between V and I, I and IV, and ii and V. Other hearings of the shuttle are in principle possible—the next most likely would probably be vi <—> II in E lydian—but this hearing is not given structural/metrical support, and in any case, lydian pop/rock tunes are exceedingly rare. On this last point, see Moore, *Rock: The Primary Text: Developing a Musicology of Rock* (2001), Biamonte, “Triadic Modal and Pentatonic Patterns in Rock Music” (2010), and Tymoczko, “Passing Tones, Rock Music, etc.” (2010).
Ex. 2.4. Tonal ambiguity engages "relative" modal relationships wherein y is preserved but x varies according to centricity.
I have already hinted that this situation amounts to the notational inverse of local tonicization, in that tonicizations generally involve representing each common tone $z$ with the same $x$ but a different $y$, whereas moments of tonal/modal ambiguity involve representing the same $z$ with the same $y$ but a different $x$. In other words, whether one chooses to hear the above passage in C# dorian, F# mixolydian, or B ionian, the corresponding succession of solfège syllables, in every case, is identical.

One could argue that this finding is not actually special at all, being merely a fallout of my reliance on movable do with re-based dorian. Such an objector would, technically, be correct. After all, this form of solfège guarantees that all naturally occurring minor seconds are represented by $mi$-$fa$ and $ti$-$do$ (regardless of mode)—and since Ex. 2.4 does not contain any modulations or tonicizations, the $z$-location of these minor seconds remains fixed throughout, being an acoustic fact that is independent of auditory interpretation(s). However, while some may regard the resultant $y$-component consistency across potential hearings as anticlimactic and incidental, I want to argue that it can also be quite revelatory. Traditional accounts of tonal/modal ambiguity tend to focus on interpretational differences: that each potential hearing contains no caretet-numeral overlap with the other(s). But what ordered-triple notation can do is to register these differences while also highlighting the interpretational commonalities.

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70 The one exception to this rule, which I treat in the chapter's closing gambit, is when a “relative” tonal area is being tonicized—in which case both $x$ and $y$ remain the same for all common tones $z$.

71 Examples of such accounts include Carpenter, “Grundgestalt as Tonal Function” (1983); Chapter 7 of Rings, Tonality and Transformation (2011); Attas, “Sarah Setting the Terms: Defining Phrase in Popular Music” (2011); and Richards, “Tonal Ambiguity in Popular Music’s Axis Progressions” (2017).
that are shared across hearings, and crucially, *that contribute to the ambiguity in the first place.*

I therefore hold that tonal/modal ambiguity is more than a mere binary matter of acoustic sameness (z) meets auditory/interpretive difference (x). More accurately, these situations also involve a third element of auditory/interpretive sameness—encapsulated in the y-component—that cannot be discounted, since this thread links together the multiplicity of interpretive possibilities and reflects the sense in which they are conceivably interchangeable.

A brief word about harmonic function is warranted at this juncture. To start, my functional labels follow the example of scholars such as Kevin Swinden in distinguishing between tonic-prolongational subdominants (cf. the C# dorian hearing) and dominant-preparing predominants (cf. the B ionian hearing). But even without this distinction, an intriguing fact about Ex. 2.4 would still stand: that at any one given moment, the operative harmonic function in one potential hearing is wholly distinct from those in the two others. Notice how all of these non-overlapping harmonic-functional possibilities are abstractions of the same succession of y-components (and, obviously, z-components) but different successions of x-components. This suggests that harmonic function may have more to do with generic scalar position than it does with specific modal character, since function appears to demonstrate covariance only with x and not with y. The view that harmonic functions result from confederations of scale degrees has gained wide currency over the past few decades, particularly in the wake of Daniel Harrison’s influential work on the subject. But moments of

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ambiguity such as the one above neatly point up the possibility that function may actually depend more on certain aspects of scale-degree experience than it does on others. I will return to this line of reasoning (and this particular musical example) in Chapter 4 on harmonic function. For now, however, the foregoing teaser will have to suffice.

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Brian Hyer writes that the term “tonality” primarily “refers to the orientation of melodies and harmonies toward a referential (or tonic) pitch class.”74 If this is the case, then what should stop us from considering, say, the theme song from The Simpsons (1990), Miles Davis’s “So What” (1959), or Wendy Carlos’s “Just Imaginings” (1986) as properly “tonal”? Why should these first two be marked with an ontological asterisk simply because they use certain heptatonic scales of 12-TET and not others? And why should this last incur the same treatment simply because it uses more pitch classes per octave than the customary twelve? Do not all three meet Hyer’s abovestated definition anyway?

I doubt that many of us, if asked to define “tonality” today, would include an explicit provision that it be limited exclusively to 12-TET music in major and minor keys. Yet the scale-degree language that we overwhelmingly continue to use in our analyses and pedagogies of tonal music remains implicitly tied to the major/minor system and to the modern piano keyboard. The present chapter begins to combat these biases by proposing an alternative way to think about scale degrees (and tonality) that can circumvent these recurrent linguistic/labeling issues and lead to more rewarding analytical engagements with music in any of the heptatonic diatonic modes. By resisting the tacit conflation of generic scalar position (x) and

specific modal character (y), my genus/species account of scale-degree qualia unhooks the
custom of “scale degree” from its historical dependence on the dominant particulars of
common-practice tonality and provides more nuance and flexibility in reckoning with the
various inflective colors, flavors, and repertorial instantiations of tonality. To this end, I have
been choosing my illustrative vignettes strategically: to underscore my contention that tonality
is not just something that transcends the historical major/minor binary, but also something that
transcends tuning itself. Now, to be sure, ordered-triple notation is not a panacea that can
resolve all of tonality’s problems and contradictions in one fell swoop. It certainly has its
drawbacks, and these will receive further attention later in the chapter. But the notation can
address many of these problems and contradictions with a level of precision and insight not
typically afforded by traditional labeling practices. Tonal hearing inevitably involves attentional
shifts—whether these be momentary (as in local tonicization), large-scale (as in global
modulation), or theoretically simultaneous (as among competing potential hearings during
moments of ambiguity). What ordered-triple notation can do especially well is to suggestively

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I am certainly not the first scholar to formalize these three particular kinds of transformations
among diatonic collections. Ian Bates, for instance, proposes three categories of “fixed-domain
diatonic relationship[s]”—“fixed-tonic relationships,” “fixed scale-type relationships,” and
“fixed key-signature relationships”—that are conceptually related to the way I model
tonicizations, mode-preserving modulations, and tonal/modal ambiguities, respectively. [Bates,
“Vaughan Williams’ Five Variants of ‘Dives and Lazarus’: A Study of the Composer’s Approach
to Diatonic Organization” (2012), pp.35–36.] An important predecessor to Bates’s work is Julian
Hook’s distinction among “field transposition” (e.g., G ionian to G lydian—aloguous to my
conception of “parallel”), “spc-structure transposition” (e.g., G ionian to D ionian), and “dpc-
structure transposition” (e.g., G ionian to A dorian—alogous to my understanding of
“relative”). [Hook, “Spelled Heptachords” (2011), p.91 (particularly Fig. 1).] Hook’s work in this
area also influenced Nathan Lam’s concepts of “relative diatonic modality” and “modal spelled
pitch class,” the former of which is similar in many respects to the way I model tonal/modal
ambiguities. [Lam, “Relative Diatonic Modality in Extended Common-Practice Music” (2019)
and “Modal Spelled Pitch Class, La-Minor Solfège, and Schubert’s Third Relations” (2020).]
model, during moments such as these, exactly which components of scale-degree experience might be shifting (and which are not).

That this notation is at its most revealing during times of positional flux is no accident. For tonality is not simply a matter of the apparent stability of a certain tonal area during a certain musical span. Rather, it is just as much about those moments that challenge, unseat, or otherwise unsettle that sense of stability—since these serve to frame and consolidate such apperceptions of stability in the first place. Harrison remarks that it is typically “much easier [to] examine something when it is at rest than when it is in motion.”76 My hope is that ordered-triple notation can ultimately make it easier for analysts to capture (and thereby examine) those experiential liminalities that invariably result when tonality itself is in motion.

But What About All Those Extra Notes? (I): Categorical Stretchiness

Readers may feel that, in unrolling ordered-triple scale-degree notation with an eye to its stylistic flexibility, I have downplayed the many visceral ways in which microtonality—even Blackwood’s uniquely conservative brand—necessarily challenges established auditory categories. Simply put, some may find it an oversimplistic cop-out to imply that only the z component appreciably changes when labeling tonal pitches in Blackwood’s music, whereas x and y can continue to be applied without modification. This is worth dwelling on further, for it is a basic fact of microtonality that there exist so-called “extra” notes that fall “between the cracks” of expectation and do not neatly fit preexisting categorical boundaries.

And yet, as I argue in the previous chapter, there is a strong tendency to domesticate these anomalous occurrences by filtering them “through the framework of the cultural system with which one is already familiar.” In other words, there is a limit to the number of scale-degree categories that listeners can hold in their mind at once, and this number is contingent upon their enculturation. By repeatedly being exposed to music that draws from a fixed number of tones, listeners become conditioned to expect that future music will also proceed along those lines. When listening to something unfamiliar, then, listeners are often inclined to throw a variety of cognitive tools at the music in order to mentally simplify and “tame” it—and categorization is at the forefront of this process. This streamlines processual activity by [1] reducing the number of “things” one needs to listen for in order to make sense of what they hear, and [2] directing cognitive activity towards the more efficient goal of parsing the unfamiliar in terms of the familiar.

Several scholars are in agreement on this front. Lawrence Zbikowski, for instance, speaks of a functional counterbalance between an “efficiency principle, according to which people prefer to minimize the number of categories they need to consider in making a categorization,” and an “informativeness principle, according to which people tend to maximize the informativeness of their categorizations.” Hasan Tekman and Nuran Hortaçsu

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discuss the adaptive benefits of striking such a balance: “Dividing the world around us into categories of items that we can treat in similar ways facilitates our lives by providing cognitive economy and directing future learning.” And Brian Bridges frames categorization as “a cognitive [process] whose form maps a relatively complex set of relationships whilst minimizing cognitive load due to the derivation of its parsing/organization process from familiar environmental models and activities.” All of these scholars outline the same basic process of optimization: to draw upon prior knowledge to make sense of future events by thinking in terms of the fewest number of categories that can provide the most useful kinds of information. To hear any kind of music in a tonal framework, put simply, is to perform this balancing act. But to hear the tonality in microtonality, given all the additional challenges such music engenders, is to walk an even more demanding cognitive tightrope.

Microtonal music reminds its listeners that pitch is a continuous phenomenon: a basic fact that the 12-TET piano keyboard’s cultural ubiquity tends to obscure. Yet microtonality reveals the continuous nature of pitch in a way that conflicts with the imperatives of discrete and efficient categorization. Much of what it means to hear microtonality in a tonal framework, then, lies in the effort to contextualize expectationally discrepant events by fitting them into more familiar frameworks. This entails stretching existing auditory categories—not creating entirely new ones—to accommodate novel occurrences. Mark Reybrouck has argued that “[i]f there are more elements in the music than there are representations in the listener’s mind, the


listener must accommodate by creating new representations.”81 On my account, Reybrouck’s statement can only be true if these “new” representations are based on, or are extensions of, old/familiar ones. Ayers, in his aforementioned paper on “19 Notes,” restates the problem thus: “When Blackwood uses more than 12 notes in a single passage, a listener must either associate two separate pitch classes with a singular chromatic function or count one of the pitch classes as functionally ambiguous, lying in a state outside of traditional scale-degree functions.”82 I suspect that the former is more likely to be the case than the latter: that it is more economical to stretch an existing category than to leave some novel event lingering outside category boundaries altogether. What’s more, according to Deepti Navaratna, this (former) process engages the intraparietal sulcus, the part of the brain that acts as “the substrate for creation of new mental representations that are directly linked to prior knowledge or previous experience of sensory events.”83

Admittedly, the previously discussed modulatory excerpt from “17 Notes” does not require an inordinate amount of cognitive “stretching” to understand through the framework of heptatonic diatonicism. But there are obviously several other moments in Blackwood’s microtonal music that demonstrate quite pointedly just how elastic auditory categories can be in practice. One short passage is especially illustrative in this regard, occurring in the first

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movement of Blackwood’s four-movement Suite for Guitar in 15-note Equal Tuning, recorded in 1994 by Jeffrey Kust. For reference, the pitches of 15-TET are given below:

![15 NOTES](image)

**Fig. 2.3**: Blackwood’s note names and enharmonic equivalences for 15-TET

I want to focus on the relationship between D natural and D-down (z=3 and z=2, respectively), which sound rather like the same pitch class in the following excerpt, despite their being 80 cents apart:

![Ex. 2.5](image)

**Ex. 2.5**: A “stretchy unison” in mm.26–27 of the Suite for Guitar, 1st movement; excerpt begins at 0:18 of [https://www.youtube.com/watch?v=h89I8-wWrWs&list=OLAK5uy_mUM6_6q6J4VL8gSrPlesFNU9FCGfmRL9g&index=14](https://www.youtube.com/watch?v=h89I8-wWrWs&list=OLAK5uy_mUM6_6q6J4VL8gSrPlesFNU9FCGfmRL9g&index=14)
The two circles in Ex. 2.5 above are the same color to indicate the momentary impression of pitch-class equality between D natural and D-down in mm.26–27, an impression that obtains even despite the fact that these two pitches are not enharmonically equivalent in Blackwood's 15-TET. That two pitch classes separated by 80 cents in such close quarters might be cognized as “the same” seems an unlikely proposition on the surface. How does such auditory “stretching” occur—and why might one’s ears be especially flexible at this particular juncture?

The moment in question occurs in the middle of a sequence that stretches from m.25 to the end of m.30. This sequence might be classified by its recurring root motion (which in this case is the same as its bass motion): down a fourth, up a minor third. But quickly one realizes that this designation warrants a bit of categorical elasticity, for the two motions “up a minor third” are of different sizes. In the first case (mm.26–27), the ascent from B-down to D-down spans three unit intervals (240 cents), whereas in the second case (mm.28–29), the ascent from A-down to C natural spans four unit intervals (320 cents). The melodic motion across these barlines also differs: three unit intervals separate D and F in the former case (mirroring the ascent in the bass), whereas five unit intervals, or 400 cents, separate C and E-down in the latter (leading to the first major triad in the sequence). The irony of the situation is that, across mm.26–27, the same-sized ascent in bass and melody (3 unit intervals) results in the notational inequality of the pitches circled in red, whereas across mm.28–29, the differently sized ascents in bass (4 unit intervals) and melody (5 unit intervals) result in the notational equality of the pitches enclosed by purple diamonds (both z=0).

My overarching contention is that, despite being literally unequal, the two pitches circled in red in Ex. 2.5 come across as notionally z-equivalent in real time. (The same
impression of equality, of course, also goes for the two literally z-identical pitches boxed in purple.) These pairs of pitches occur in analogous positions of the sequence, and they undergo the same voice-leading transformation: chordal minor third (mm.26, 28) becomes chordal root (mm.27, 29). For listeners accustomed to this type of sequence in 12-TET, such a transformation typically acts upon a single pitch class—a common-tone “hinge” between sequential waystations, as it were:

![Ex. 2.6](image)

Ex. 2.6: 12-TET version of mm.25–30 of the Suite for Guitar, 1st movement (harmonic reduction)

But this is only true of the boxed C-naturals in mm.28–29 of Ex. 2.5. There are no common tones between the governing triadic harmonies of m.26 and m.27; the chordal third (D) in the former is a different note than the chordal root (D-down) in the latter. Yet such a common-tone hinge [1] is expected in general, and [2] actually occurs across mm.28–29. Might this confederation of schematic and veridical evidence be strong enough to cause one to retrospectively postulate a pitch-class equivalence where none exists? If so, it would make for an impressive feat of mental gymnastics. In the next chapter, I discuss how the auditory category of “perfect fifth” admits around 75 cents of variance across Blackwood’s etudes. Now, an even larger bandwidth—80 cents—separates a notional unison within the same brief span of
music! Perfect intervals evidently have much more contextual flexibility than previously thought.\textsuperscript{84}

**But What About All Those Extra Notes? (II): Categorical In-Betweenness**

So how does this categorical elasticity figure into scale-degree judgments during some of the more expectationally interstitial moments in Blackwood's microtonality? The previous example from the *Suite for Guitar* involves sequential motion, of course, but what of those moments when the governing key is unambiguously clear, yet an interval within it seems to straddle the line between two established auditory categories? What becomes of ordered-triple notation then?

The following example from “20 Notes” illustrates this situation rather well. It contains a pointed instance of what I call “notal” ambiguity: an ambiguous interval whose categorical in-betweenness challenges the operation of what Bridges calls the “particularly efficient chunking

\footnote{See for instance Vos, “The Perception of Pure and Mistuned Musical Fifths and Major Thirds: Thresholds for Discrimination, Beats, and Identification” (1982), Hall and Hess, “Perception of Musical Interval Tuning” (1984), and Chapter 10 of Blackwood, *The Structure of Recognizable Diatonic Tunings* (1985)—all of which suggest that major/minor intervals (i.e., thirds, sixths, seconds, and/or sevenths) display more centwise flexibility in practice than do perfect intervals (i.e., unisons, octaves, fifths, and/or fourths). In other words, Western listeners, when presented with (say) a perfect fifth that is twenty cents sharper than pure and a major third that deviates from pure by that same amount, are more likely to judge the former as mistuned than the latter.}
mechanisms” that attend “the cognitive experience of microtonal practice.” More specifically, in Ex. 2.7 below, the circled D-down (z=3) in the “noble baritone solo” seems to lie exactly in the middle of two familiar scale-degree qualia, dorian 6 and dorian 7:

20 NOTES

![Fig. 2.4: Blackwood’s note names and enharmonic equivalences for 20-TET](image)

85 Bridges, “Towards a Perceptually-Grounded Theory of Microtonality: Issues in Sonority, Scale Construction, Auditory Perception, and Cognition” (2012), p.284. See also McAdams, “Psychological Constraints on Form-Bearing Dimensions in Music” (1989), for a discussion of microtonality that routes its inquiry through George Miller’s famous “7 +/-2” capacity limit for short-term memory. [See Miller, “The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information” (1956).] Bridges, however, parts company with McAdams on the issue of this putative “magical number,” arguing that “musical pitch is a significant exception to the Miller limit” (291) because it is contextual and multidimensional—not the decontextualized and unidimensional phenomenon that Miller allegedly treats it as in his study.
Ex. 2.7: A microtonal “blue note” (or rather, “blue interval”) that confounds established auditory categories; excerpt begins at 0:11 of https://www.youtube.com/watch?v=K7EdfaaUQel
It is worth pointing out that thirteen of the twenty notes in the tuning appear in this excerpt; these correspond to the pitch classes numbered 1, 2, 3, 4, 6, 7, 9, 11, 12, 14, 15, 16, and 19 in Fig. 2.4. A cursory look at this list reveals that the \{1, 2, 3, 4\} subset has the greatest potential for “notal” ambiguity, since it is the longest span of consecutive unit intervals used in Ex. 2.7. Indeed, this 180-cent span\(^{86}\) contains four pitches in a space even smaller than most Western listeners are accustomed to hearing three. This presents a unique categorization dilemma for those enculturated to the 12-tone octave, who are thrust into a scenario where they must somehow account for an “extra” note.

I contend that the circled D-down in m.5 above is this “extra” note. Given the E-down centricity of the passage, C-up (\(z=1\)) reasonably approximates a minor sixth above tonic, C-double-up (\(z=2\)) approximates a major sixth, and D natural (\(z=4\)) a minor seventh. But D-down (\(z=3\)) forms an interval with the E-down tonic that resists straightforward characterization. This “blue interval” seemingly occupies the exact midpoint between dorian \(6^\#\) and dorian \(7^\#\), as if merging two generic scalar positions and two specific modal characters into an uncanny alloy. So how might the fundamental equivocality of this interval—what Rings might call its “apperceptive multiplicity”\(^{87}\)—be captured in ordered-triple notation? In other words, does the circled D-down in Ex. 2.7 sound more like a (\(6^\#, ti, 3\)) in this particular context, a (\(7^\#, do, 3\)), or some neological portmanteau of the two?

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\(^{86}\) That is, 1200 [cents to the octave] / 20 [unit intervals to the octave] = 60 [cents per unit interval], and 60 x 3 [the unit-intervallic distance between \(z=1\) and \(z=4\)] = 180 cents.

In short, either scale-degree interpretation of the D-down is theoretically possible, but both cannot be heard simultaneously. The auditory situation is therefore analogous to the famous duck-rabbit illusion reproduced below:

![Image 2.1](image2.jpg)

Image 2.1: Unattributed 1892 drawing first discussed by Joseph Jastrow in 1899 and then popularized by Ludwig Wittgenstein in 1953.88

Put another way, one can theoretically flip back and forth between hearing the D-down as a (6, ti, 3) or as a (7, do, 3) across successive hearings, simply by performing the requisite mental gymnastics. But one cannot hear it as something like a “(6, ti, 3).” The D-down thus brings about a momentary fork in the road of scale-degree interpretation, presenting listeners with two potential paths—neither of which is perfectly equipped to deal with such an expectational anomaly.

This is not to imply that both paths will always sound equally plausible for any given listener. In my own listening experience, for example, I tend towards hearing the D-down more

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as a (7, do, 3) than as a (6, ti, 3). This is primarily due to the presence, in m.5, of C–double-up (z=2) in accompanimental parts 9 and 15, which ascends unit-intervally to D-down in both cases. On my hearing, this motion establishes a more clear ti-do relationship/distinction between C–double-up and D-down, which helps me tip the scales slightly in favor of the (7, do, 3) interpretation of the circled D-down in the solo part. But even in making this interpretational choice—and this is the larger point—I am still aware of its fundamental inadequacy to fully capture the novelty of the situation. There will always be traces of upward-straining ti-ness that persist in this D-down whenever I choose to hear it as a do, and likewise, there will always be traces of 6-ness that persist whenever I choose to hear it as a 7 (and vice versa). This is to say, either interpretive choice necessarily leaves behind a viable alternative and points up the fact that no single “cure-all” interpretation can fully eliminate the cognitive uneasiness that results from encountering categorical in-betweenness. In the next chapter, I make the case that such uneasiness can be understood in terms of the social-psychological phenomenon of cognitive dissonance, which leads to a rethinking of musical consonance and dissonance under the banner of culturally conditioned expectation. As we will see, this reframing accomplishes three principal goals: [1] it productively illustrates how “consonance” and “dissonance” are culturally relative qualia and not just reflections of immutable psychoacoustic laws, [2] it uncouples these terms from a historical overemphasis on the pitch domain, and [3] it opens out onto a broader discussion of what drives our musical preferences, tastes, and value judgments.
Digestif

Before turning to consonance and dissonance in earnest, I would like to close this chapter with one final analytical vignette that is more lighthearted—and less microtonal—in temperament. It is difficult to think of a song more explicitly concerned with the matter of scale-degree labeling than “Do-Re-Mi” (1965) from *The Sound of Music*. But though the song is ostensibly employed to teach the Von Trapp children the seven solfège syllables for an ionian scale, its melody features a few notes that fall outside of that collection. These additional notes start to appear during the second half of Maria’s scalar exposition, once the harmonic rhythm doubles in pace. It is here that the referential diatonic collection shifts for the first time away from Bb ionian, as a result of a series of successive tonicizations that prepares the arrival of the final do. More specifically, the introductions of sol, la, and ti all occur over secondary dominants (that resolve to global IV, V, and vi, respectively). How might these local shifts in harmonic context affect the y-components of this trio of newly introduced syllables? In other words—and here I beg the reader’s indulgence—if Maria Von Trapp somehow knew ordered triple notation, would she still sing sol, la, and ti as such?
Ex. 2.8: Rethinking the solfège syllables of a well-known didactic melody during a momentary stretch of x/y independence:

Excerpt begins at 0:57 of https://www.youtube.com/watch?v=drnBMAEA3AM
In short, not quite. Even though “Do-Re-Mi” never modulates away from its global Bb ionian orientation, the sequential tonicizing tilts in Ex. 2.8 are enough to momentarily unhook the customary relationship of x and y in ionian. As a result, while x never fundamentally shifts—Bb remains 1 throughout the song—the z-location of y=do changes rather frequently, to reflect how tonicizations typically involve shifts in the referential diatonic collection (and thus shifts in where its naturally occurring minor seconds are located). In the opening measure of the excerpt above, for instance, I postulate that the lyric “So[l]” is better understood as a re in light of its participation in a tonicization of Eb ionian.\textsuperscript{89} In a similar vein, I label the lyric “La” in the third measure as another re because of its analogous role in a tonicization of F ionian. Ordered-triple notation therefore deftly clarifies how the relationship between Maria’s “So[l]” and “La” is simultaneously one of stepwise ascent (in the x sense) and one of contextual equivalence (in the y sense). Perhaps, in a parallel universe (but over the same music), she could have introduced the notes of Bb ionian numerically rather than syllabically, as generic scalar positions rather than specific modal characters. This would necessitate some serious lyrical revisions, of course—possibly a golf-related pun on the homophonic relationship between 4

\textsuperscript{89} Of course, one could also conceivably hear the first two measures of Ex. 2.8 in a framework that is wholly native to Bb ionian (i.e., as a I–IV), which would result in a y-matching label of sol on the lyric “So[l].” This interpretation is plausible because none of the preceding music in Maria’s scalar exposition has left a Bb ionian frame of reference—even on the local level. (Accompaniments that do not include a literal Ab during the first bar of Ex. 2.8, moreover, make this hearing even more plausible.) But what such an interpretation misses is the harmonic, melodic, and sequential parallelism of the first three two-bar units in Ex. 2.8, which call out for similar analytical treatment as local tonicizations. The scale-degree hearing I propose for “So[l], a needle pulling thread” is therefore one that consciously privileges the coming sequential inertia over the preceding tonal/modal consistency. That Ex. 2.8 begins on a strong hyper-downbeat only further solidifies the sense that it is the start of something new (despite its rhetoric of sentential continuation).
and “fore”—but it would ultimately make for a more accurate introduction to the diatonic scale. Alternatively, she could keep the solfège syllables as they are but tweak their musical accompaniment so that each one is introduced in a framework unmistakably native to Bb ionian. Either way, something has to give, for the actual introductions of “So[l]” and “La” do not make for the best exemplars of how ionian-mode sol and la characteristically feel.

The case regarding “Ti” is nominally similar, but a closer look at my annotations in mm. 5–6 reveals some notable limitations of ordered-triple notation that warrant candid discussion. I have proffered two possible interpretations for these bars; each interpretation has its own benefits but also some nontrivial drawbacks. Above the staff, I propose a scale-degree hearing that has the advantage of y-component parallelism with the previous pair of two-bar units; under this interpretation, Maria’s “Ti” is reckoned as yet another re-flavored cog in the sequential machine. But the principal drawback of this hearing is that its scale-degree labels presuppose a tonicization of G ionian (rather than the expected G aeolian)—which leads to the melodic Bb on the downbeat of m.6 being labeled with an altered solfège syllable of me (rather than the expected mi). Why should one hear this Bb as auxiliary, given that the

90 Readers will notice that the ordered triples in m.5 of this hearing are nominally native to B phrygian—a scale that is y-identical to G ionian, the putative goal of the tonicization. My main issue with this interpretation, to be clear, is not that B phrygian should not be considered a “parallel” mode to the other Bb-centric modes in the passage; this is an inevitable consequence of my more expansive conception of “parallel,” and in any case, there is precedent in Russian music theory for granting parallel status to two modes whose centers are a minor second apart. [See Dolzhansky, “O ladovoi osnove sochinenii Shostakovicha” (1962), which has been cited more recently in Carpenter, “Russian Theorists on Modality in Shostakovich’s Music” (1995) and Bazayev, “The Expansion of the Concept of Mode in Twentieth-Century Russian Music Theory” (2014).] Rather, I primarily take issue with the assumption that Bb ever lies outside of a referential orienting collection in this passage and that, as a corollary, it should ever warrant an altered solfège syllable when it occurs melodically.
diatonic triad being tonicized at this point (G minor, or vi of Bb ionian) contains Bb as its third? The hearing I propose below the staff, on the other hand, treats mm.5–6 as a tonicization of G aeolian. But while this hearing is ostensibly more faithful to the modal quality of the sequence’s triadic landing points, it also creates the (dubious, in my opinion) impression that the melodic Bbs on the downbeats of measures 6 and 8 are experientially identical (since both receive a y-component of do—at least initially in the case of m.6). Ordered-triple notation therefore posits a qualitative equivalence on paper where one may not actually exist. The reason for this apparent equivalence is that the bottom-staff hearing of mm.5–6 marks the one exceptional case in which a local tonicization does not disturb the customary x/y pairing of an overarching mode: when the local area being tonicized exists in a “relative” relationship to the global referential diatonic collection.91 If ordered-triple notation can be likened to a drug, then the way it deals with tonicizations of relative tonal areas is certainly one of its most pronounced and notable side effects. Or, to use a metaphor instead of a simile, it is a notable “bug” in my system—and a pointed reminder that no analytical tool can work perfectly all the time.92

91 Because G aeolian (local goal) and Bb ionian (global anchor) share the same naturally occurring minor seconds, they are y-identical. And because this is a tonicization, x is preserved as well. At first, admittedly, it is difficult to tell from my scale-degree labels that a local harmonic shift is even taking place in the fifth measure of Ex. 2.8—but the raised solfège syllables fi and si provide the telltale traces of that form of aeolian typically called “melodic minor.”

92 Ordered-triple notation might also be accused of “diatonic bias” in that it does not treat heptatonic (but non-diatonic) scales like harmonic minor or lydian dominant as genuine referential structures in their own right. Instead, the notation would regard the former as an altered form of aeolian and the latter as an altered form of either lydian or mixolydian. (And this is to say nothing of the system’s limited applicability to various non-Western scales and modes.)
Now, to return to my hypothetical question from earlier: regardless of how one hears Ex. 2.8, none of the three new syllables Maria introduces in this excerpt actually corresponds with their typical ionian character. Yes, under the bottom-staff interpretation of mm.5–6, her introduction of “Ti” can actually be heard as occurring on a ti. But this is not the ti that is native to the Bb ionian scale she is teaching. The point of this closing gambit, to be abundantly clear, is not to argue that Maria Von Trapp was a poor pedagogue, or to chide her and her family for not knowing ordered-triple scale-degree notation. Over half a century later, “Do-Re-Mi” remains an indispensable classic—and an invaluable resource for teaching diatonic scalar structure. All I ask is that we consider the subtle ways in which its didactic purview actually extends far beyond a single major scale. The drawbacks of my system notwithstanding, let my counterfactual rethinking of this cultural relic serve as a final case in point that, when armed with a labeling system that reflects a genus/species conception of scale-degree qualia, one will find themselves better equipped to capture not only the “sound” of Western tonal music, but also its “feels.”
Chapter 3  |  Is Exposure So Mere?

By this point, I have played Blackwood’s microtonal music for almost two hundred people, spanning all sorts of musical backgrounds. I can confidently say that I have never before seen a recording arouse such consistently strong and pronounced reactions in listeners, regardless of their respective levels of musical expertise, experience, and training. Sometimes, I would single out specific people—like my parents (who have no musical training whatsoever) or my students (many of whom are trained, practicing musicians)—to solicit their gut reactions and opinions on the music. But perhaps even more revealing have been those instances where I played Blackwood’s microtonality for people who had no idea it was coming.

One perk of my having chosen to study music for a living is that people sometimes entrust me with the auxiliary cable at social gatherings. Most of the time, when I play music that I like (whether it be Steely Dan, Mark Turner, or Joni Mitchell), most others do not bat an eye; the music simply recedes to the background, serving as sonic accompaniment for our conversations. Rarely does anyone actually stop and ask me what I am playing. But whenever I play Blackwood’s microtonal music for an unsuspecting audience, it does not take long for the entire room to fall silent. Indeed, it is difficult to multitask when so many implicit preconceptions about how music sounds are being blown to bits right before one’s ears. Innocuous social experiments such as these communicate to me more pointedly than any direct conversation that, simply put, something bizarre is up with this music. As Theodor Adorno writes, “Involuntariness is the best proof that a tendency is socially authentic.”¹

Blackwood’s music provokes intensely visceral reactions across the board—whether of fascination, dumbfoundedness, or frustration—and there does not seem to be any middle ground. When I press listeners to describe it, the most common descriptors I receive are “weird” or “out of tune.” A few actually cannot stand to hear it and plead with me to turn the music off immediately. But many more are instantly hooked and request to hear more, listening with mouths agape and brows furrowed, trying to figure out what is happening. For these sorts of listeners, Blackwood’s microtonality represents the ultimate contradiction: music that sounds out of tune, yet music that cannot be simply tuned out.

A healthy plurality of people I have surveyed describe the experience of hearing Blackwood’s music in contradictory terms. Many have communicated to me the paradoxical sense that it sounds unlike anything they have ever encountered in their lives, yet at the same time, oddly similar to music they have heard before. Descriptions like these remind me of Jonathan Kramer’s characterization of Blackwood’s microtonality as “music simultaneously of strange novelty and of almost comfortable familiarity.”² One recurring descriptive motif in this vein, most common among trained musicians and fellow music theorists, is that Blackwood’s music is “highly dissonant,” yet also somehow “more consonant” than they initially thought it would be. Comments such as these especially intrigued me at first. For how could music that contains basically no purely tuned intervals besides octaves—and extremely few other intervals that match the size of ones in 12-TET—be heard as “consonant”? This contradiction eventually became the impetus for the present chapter.

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In the following pages, I examine the familiar categories of consonance and dissonance through a primarily microtonal lens. This continues the dissertation’s overarching theme of exploring what can be revealed about the most conventional musical concepts by considering them from an unconventional perspective. I begin by briefly surveying some of the ways that scholars have previously talked about consonance and dissonance. I then advance an expectational account of these terms, in which musical events are considered consonant to the extent that they are expected (and vice versa for dissonance). Throughout, I frame consonance/dissonance qualia as cognitive misattributions wherein listeners pin broader sensations of expectational fit/non-fit onto what David Huron calls the “convenient bystanders” of intervals, chords, and progressions.\(^3\) Advancing this account will occasion an unpacking of the kinds of expectation that impinge upon such interpretive judgments as well as the panoply of musical parameters that can inform and influence them. My analytical vignettes focus on the roles that enculturation, meter, and notation play in mediating this complex process. With these last two mediators in particular, I explore some of the oft-overlooked ways in which non-pitched elements can act as “consonating” and/or “dissonating” forces.

**Let’s Start with a Quick Salad**

Historically, the terms “consonance” and “dissonance” have referred to quite a number of different things. James Tenney’s book-length survey of these terms posits at least five distinct “consonance/dissonance concepts” (or “CDCs”) in Western musical culture.\(^4\) According to his


account, “consonance” has been used to refer to [1] a “relatedness between pitches sounding successively,” [2] the “sonorous character of simultaneous dyads,” [3] the “perceptual clarity of a polyphonic texture,” [4] “individual tones in a chord,” and [5] an acoustico-perceptual smoothness (whose flip side equates “dissonance” with “roughness”). This last concept, catalyzed by the work of Hermann von Helmholtz, is the most recent to take hold in musical discourse. It aligns with what Tenney calls the “colloquial” notion of dissonance as beats (and consonance as their relative absence). William Sethares, for instance, adopts something like CDC-5 in his book Tuning, Timbre, Spectrum, Scale—except he calls it “sensory” consonance and dissonance.

Of course, there are several other conceptions of consonance and dissonance that fall outside of Tenney’s historical typology. Aline Honingh, for example, relies on geometric and group-theoretic criteria in her account, arguing that “consonance is optimized in a convex

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5 Ibid., p.4. Crucially, Tenney argues that these various CDCs are chronologically accumulative; they do not simply replace one another over time.

6 See especially Helmholtz, Die Lehre von den Tonempfindungen als psychologische Grundlage für die Theorie der Musik (1863).

7 Tenney, A History of ‘Consonance’ and ‘Dissonance’ (1988), p.94. Tenney goes on, in the book’s conclusion, to suggest calling this subtype “timbral consonance and dissonance” (100, emphasis mine).

8 Sethares, Tuning, Timbre, Spectrum, Scale (2005), p.3. Sethares claims rather boldly that “[i]t is possible to make almost any interval reasonably consonant, or to make it wildly dissonant, by properly sculpting the spectrum of the sound” (3). For him, no parameter has a greater influence on judgments of consonance, dissonance, and intonation than timbre. In fact, their relationship is so closely intertwined that it can often be difficult to distinguish between something that is strictly “out of tune” and something that is in tune but “out of spectrum” (250), as Sethares puts it.
musical pitch structure.” Jan Wild asserts that “the phenomenon [of consonance/dissonance] is of a genuinely interdisciplinary nature,” citing works of neurophysiology, psychology, musicology, and psychoacoustics alike. And Norman Cazden claims that consonance and dissonance are culturally contingent concepts, arising from the regularities “peculiar to specific system[s] of music-making.” Cazden triangulates the historical binary between Pythagorean and Aristoxenian notions of musical consonance, proffering a middleground view of consonance as more than a simple mathematical ratio or an isolated judgment of the ear. His nuance on this matter is particularly welcome—for as is becoming clear, comparing these differing perspectives on consonance/dissonance is more than the proverbial “apples-to-oranges” affair. A veritable fruit salad has accumulated. Consonance and dissonance have been applied to single tones, horizontal successions, and vertical combinations; they have been

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9 Honingh, “The Origin and Well-Formedness of Tonal Pitch Structures” (2006), p.23. “Convexity” is a term borrowed from mathematical topology, where it describes a set in Euclidean space that “contains all the line segments connecting any pair of its points” (80). Honingh goes on to conjecture that “[c]onvexity may be a consequence of striving for maximizing connectivity; i.e. to get as many consonant intervals as possible within the notes defining the scale or chord” (86).


located in notation, in sound, and in the mind; they have been associated with both specific cent sizes and generic interval classes. Does there exist a common ingredient? I propose that expectation is this ingredient, akin to the collected juice in which the fruit salad macerates. My account treats consonance and dissonance as flexible qualia that describe the interaction between sounding music and culturally conditioned expectation. As I argue in Chapter 1, musical expectation is largely subconscious and difficult to verbalize with precision, and so listeners sometimes compensate by offloading their sensations of expectational fit/non-fit onto musical proxies of various sizes and dispositions—e.g., “this note is a dissonance,” “this chord is a consonance,” “this interval is consonant,” “this progression (or section [or even piece]) is dissonant.” This is in part why there have been so many “consonance-dissonance concepts” over the course of Western music history. But what binds them all together, I maintain, is an implicit conception of dissonance as unexpectedness relative to statistically learned cultural/stylistic norms—and it is this sense that I wish to pursue further.

**Setting Up Shop**

Blackwood’s microtonal music demonstrates that the same structural processes and rhetorical moves that orient listeners in familiar (twelve-note) tunings can be recognized as such in more finely grained tunings—but only if enough other musical parameters (such as rhythm/meter, 

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12 Two examples of this latter perspective—that is, of consonance as a function of generic interval class rather than specific cent size—are Balzano, “The Group-Theoretic Description of 12-fold and Microtonal Pitch Systems” (1980) and Yasser, A Theory of Evolving Tonality (1932). Both of these authors argue (in their own ways) that each tuning houses its own unique set of consonances that are derived from mathematical criteria independent of the approximation of familiar just or equal-tempered intervals.
style/topoi, timbre, dynamics, etc.) join forces in predictable ways. “Predictability,” here, is a cognitive alloy: a function of several distinct forms of expectation and types of memory working in tandem. Huron notes three of these in particular: veridical expectation (“episodic” memories of specific events), schematic expectation (“semantic” memories of auditory abstractions), and dynamic expectation (“short-term” memories arising from real-time exposures). I have already discussed the distinction between “veridical” and “schematic” in Chapter 1, noting how these types of expectation engage auditory sensory memory and long-term memory, respectively. The new term here is “dynamic” expectation, which describes piece-specific predictions that are set up, confirmed, or denied processually, in the act of real-time listening; this type of expectation engages one’s short-term and working memory capacities.

My guiding assumption is that listeners enculturated to 12-note tunings (what I have been calling “12-enculturated listeners”) rely primarily on schematic and dynamic expectations to contextualize the unusual features of Blackwood’s microtonality and render them more intelligible. This reliance, furthermore, is overcompensatory: faced with the near absence of specific intervals, chords, and progressions familiar from 12-TET or just tuning (which would trigger episodic / auditory sensory memories), listeners react by relying all the more strongly on semantic/long-term and short-term/working memories to make sense of the music. Rather than trying to process each unfamiliar interval/chord/progression on its own, which would be cognitively taxing, listeners instead “relinquish the particularities and idiosyncrasies of the sensory experience in favor of forms of conceptualization by which [they] can process the

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incoming information in a more economical way." As I discuss in previous chapters, this is the principle of cognitive economy: the notion that we are disposed to seek out a “maximum of information with the least cognitive effort.”

Human brains have evolved to compress information efficiently, latching onto certain features of the environment at the expense of others. But to what end? Huron notes that our brains typically condition us to behave in ways that pursue pleasure and avoid punishment or pain. When it comes to listening to music, for example, the brain rewards a “successful (i.e. coherent) parsing of the auditory scene.” One key to this process is the identification of a tonal center, or tonic: a referential pitch class $z$ that has an anchoring/hierarchizing effect on melodic and harmonic perception across a certain span of musical time. As I have already mentioned in Chapter 1, the stakes are only raised when the music is in an unfamiliar tuning: for one must either attend to the music in a framework that maximizes predictive accuracy whilst minimizing cognitive load, or else risk the negative feelings of confusion, annoyance, and frustration—nature’s “punishment.”

It appears that the human capacity for tonic-finding has a long evolutionary history. Piotr Podlipniak addresses this history, synthesizing previous research by Huron and Reybrouck, among others, to argue that “the ability of pitch centre recognition (PCR) became an adaptive

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15 Ibid., p.256.

16 Huron, “The Plural Pleasures of Music” (2005), p.7. For more on auditory scene analysis, see Bregman, *Auditory Scene Analysis: The Perceptual Organization of Sound* (1990). Of course, it goes without saying that there are certain situations, for humans and animals alike, where successfully/coherently parsing an auditory scene can be a literal manner of life or death.
innovation in the course of hominine evolution which enabled a more effective social consolidation." \(^{17}\) In other words, the capacity to hear tonal centers is rooted in human ritual culture and sociality. \(^{18}\) As Podlipniak claims, "[A] musical performance that is organized around pitch centricity can serve as a tool for reducing tension between group members and enhancing mutual trust," in addition to promoting feelings of community, group identity, and social cohesion. \(^{19}\) Tonic-finding is thus part nurture and part human nature: though its evolutionary specifics are strongly conditioned by culture, it also serves a fundamentally biological purpose—as a means to enhance adaptive fitness—that cannot be discounted or forgotten. Indeed, Huron takes great pains to emphasize that all evolved behaviors (along with the emotions that attend/accompany them) have arisen via natural selection "as adaptations that enhance survival." \(^{20}\) The act of hearing tonality in microtonality, therefore, is more than just a vestigial product of a bygone era, or an optional choice only available to a small group of musicians trained in Western Euroclassical idioms. Rather, it is also a manifestation of a more general biological phenomenon: the instinctual response to make sense of unfamiliar surroundings by leveraging mental heuristics to impose a sense of order and control on a highly variable environment.

Such are the stakes of (micro)tonal attention—like the aural equivalent of being dropped in the middle of the woods (or a maze) and needing to follow environmental cues in


\(^{18}\) Ibid., p.537.

\(^{19}\) Ibid.

order to find one’s way out. Tonal hearing (whether in microtonality or not) thus has a lot to do with the interconnected processes of expectation and prediction, which work in tandem to help listeners stake out their musical bearings in the face of equivocality. I have already spoken at great length about the role that implicit learning plays in influencing this process and fleshing out its specifics. As Carol Krumhansl writes, “Listeners appear to be sensitive to the frequency with which various elements and their combinations are employed in music. It seems probable that abstract tonal and harmonic relations are learned through internalizing distributional properties characteristic of [a particular] style.” 21 This process is largely unconscious, as several authors have noted, and begins mere months after birth. Annabel Cohen calls it “tonality induction”: the “natural outcome of acoustic redundancies in music, and the predisposition of the brain to represent these redundancies.” 22

To put things bluntly, the baggage of enculturation is heavy and cannot be pushed aside. I have been arguing that 12-enculturated listeners, faced with a tuning/soundworld that is culturally unfamiliar, compensate by seeking out familiar shapes, processes, and behaviors as referential guideposts, pinning these labels (however subconsciously) on the best available candidates that present themselves. This in itself is a rather uncontroversial assertion. Meagan Curtis and Jamshed Bharucha, for instance, have tested this hypothesis empirically, finding that “one’s internalized cultural knowledge may drive musical expectancies when listening to music.

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of an unfamiliar modal system.” Daniel Cox has even given this sensation of unfamiliarity a name: “intercultural structural discordance.” What is more controversial, however, is the notion that the labels listeners pin on musical proxies are not always accurate (or at least, not always what they think they are). The mutable history of “consonance” and “dissonance” provides a fertile case study in cognitive misattribution, and this circles back to the major goal of the chapter. My choice to look more closely at the role expectation plays in judgments of consonance and dissonance is not to be understood as an indictment of listeners, a way of chiding them for thinking they have been talking about one thing, when in reality they have actually been talking about another all along. Rather, it is an attempt to think more critically about how minds have evolved to work, and how this in turn conditions the ways that musical expectation and prediction operate.

To be clear, my intention is not to replace or supersede all existing definitions of consonance and dissonance with a catch-all expectational account. I understand the danger of claiming that consonance and dissonance are solely about expectation. Over half a century ago, John van de Geer, Willem Levelt, and Reinier Plomp demonstrated that judgments of “consonance” are actually judgments about many different phenomena at the same time, conflated under a convenient blanket descriptor. And in a more recent book, Huron suggests that “at least ten factors influence the perceived pleasantness of a sonority,” ranging from

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enculturation to the mechanics of the basilar membrane. Yet I still believe it can be useful to
tell the story of consonance and dissonance primarily through the lens of expectation—
especially in the case of Blackwood’s microtonal music, which engages (even demands) the
workings of musical expectation in unique and memorable ways. As will hopefully become
clear in what follows, consonance/dissonance judgments mainly derive from subconscious,
lower-level musical exposures and expectancies, but they can trickle up to infuse more complex
assessments of centricity, stability, and even value.

Some Terminological Distinctions

My account does not disavow the existence of sensory consonance and dissonance. Simply
put, certain combinations of sounds come across as rougher than others, and this is an
established psychoacoustic fact that I do not intend to downplay or discount. But alongside
this sensory conception of consonance and dissonance, there also exists a robust cognitive
component to consonance/dissonance judgments wherein expectation and prediction play
central roles—and this latter component is the main focus of the present chapter. Like Chapter
2, which argues that much can be revealed about scale-degree qualia by separating out two
oft-conflated subcomponents of scale-degree experience, this chapter performs a similar type
of disentangling work. But again, as is the case with the x- and y-components of my scale-
degree ordered triples, the sensory and cognitive components of consonance/dissonance
judgments are richly interactive in practice—a fact that cannot be denied even as I argue for
their terminological disentanglement. In 12-TET, for example, the intervals that are most

dissonant in the sensory sense of the term (i.e., the ones that produce the most “beats” and whose ratios involve the largest numbers) are also the ones that are rarest in tonal music and thus the least expected. This is not to say that tritones or minor seconds are dissonant primarily/precisely because they are unexpected, but rather, that sensory dissonance often begets cognitive dissonance, and these two subcomponents exist in complicated historical and cultural feedback loops where one is not so easily separated from the other.

And yet, microtonal music such as Blackwood’s, where so many passages come across as oddly coherent and familiar despite the near-complete lack of intervals that are “consonant” in the sensory/psychoacoustic sense of the term, demonstrates the utility of isolating the cognitive/expectational side of consonance/dissonance judgments. Until this point, very few music scholars have framed the phenomena of consonance and dissonance in expectational terms, demonstrating the persistence of the historical trend to talk about these properties as if they were inherent in musical sounds themselves (rather than being the result of interpretive judgments of these sounds). Ian Quinn is one of the exceptions; in a 2013 talk, he makes a distinction between “acoustic” consonance/dissonance and “schematic” consonance/dissonance, the former corresponding with the sensory/psychoacoustic sense of the term and the latter with the expectational/predictive sense that is contingent upon a listener’s enculturation.27 Another exception is Jamshed Bharucha; in his 1994 article discussing the difference between schematic and veridical expectation, he argues that “[e]xpectation, Quinn, “In Time and Out of Tune: Some Perspectives on Consonance and Dissonance” (2013), invited lecture given at St. Jerome’s University, Waterloo, Ontario. A recording of the talk is available at https://www.youtube.com/watch?v=A5XodbqeZK0; in it, Quinn also proposes a third type of consonance/dissonance that relates to the properties of critical bands (he calls this “cochlear” consonance and dissonance).
consonance, and stability [...] refer to slightly different experiential aspects of the same underlying process." But statements such as these that explicitly link sensations of consonance/dissonance to expectation are few and far between, and they largely have yet to take hold in music-theoretic discourse.

There is, however, precedent for such a framing in the social-psychological literature of the 1950s onwards. I am thinking in particular of Leon Festinger’s influential notion of “cognitive dissonance.” In his words, “The simplest definition of dissonance can be given in terms of a person’s expectations. In the course of our lives we have all accumulated a large number of expectations about what things go together and what things do not. When such an expectation is not fulfilled, dissonance occurs.” Festinger argues that when facing such dissonance, it becomes imperative to reduce it by all means necessary. This restoration of mental consistency can be accomplished by a variety of means, from changing one’s behavior

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30 Festinger, “Cognitive Dissonance” (1962), p.94. This quote is from a public-facing distillation of his 1957 book that appears in a 1962 issue of Scientific American. The article, it is worth noting, makes for a rather uncomfortable read, as some of its examples and illustrations are blatantly sexist, reducing women to the value they can provide for men, and painting them as objects of “temptation” (see in particular p.98). It also consistently uses male pronouns to refer to hypothetical persons when explaining the theory.
to altering one’s belief system to even “distorting [one’s] perception and information about the
world around [them].” I argue that this last technique of “dissonance reduction,” so to speak,
is particularly important in parsing Blackwood’s microtonality. More specifically, listening to this
music produces a profound sort of cognitive dissonance in 12-enculturated listeners—since so
much of it flouts 12-conditioned expectations about how music typically sounds—and reducing
this dissonance often amounts to “consonating” deviant musical events by fitting (sometimes
even forcing) them into familiar categorical frameworks of best fit, thereby making them easier
to process and understand. Festinger’s conception transfers particularly well to the case of
processing unfamiliar music (and music in unfamiliar tunings) not only because it centers the
role of expectation, but also because it is equipped to deal with the fundamental relationality
of tonal cognition. As he writes, “The word ‘cognitive’ simply emphasizes that the theory deals
with relations among items of information.”

As far as I am aware, no music scholar has applied the notion of cognitive dissonance to
discussions of musical consonance/dissonance or to scenarios involving the processing of
music in unfamiliar tunings. Leonid Perlovsky has written about music’s capacity to help
students “tolerate cognitive dissonances” and “overcome CD-related stress” while taking tests
and exams—situations that usually involve making difficult decisions among competing
choices. But rarely, if ever, is music framed as the source of cognitive dissonance. Blackwood’s

31 Ibid., p.93.
32 Ibid., emphasis mine.
microtonality demonstrates rather cleverly that music is not always the calming, soothing influence it is often taken to be. Sometimes, music can be a thorn in our side, a threat to our established worldview of how things ought to go—and when its conflicts strike us at an existential level, we are often forced into making snap decisions to resolve them and re-establish some semblance of order and control.

Pointing up the expectational, cognitive component of musical consonance/dissonance judgments has some provocative implications for the way that consonance and dissonance are typically discussed and understood. This leads to the second terminological distinction I wish to make in this section: one among the terms “consonance,” “dissonance,” and “discordance.” This third term is particular to Blackwood, who distinguishes between discordances and dissonances on the following grounds: the former are characterized by “rough sound[s],” whereas the latter “contain combination[s] of tendency notes” that are “unstable regardless of the level of discordance.”34 For Blackwood, therefore, “discordance” aligns with the sensory/psychoacoustic conception of dissonance discussed earlier, whereas “dissonance” is more of a contextual/behavioral phenomenon that need not be directly proportional to discordance (though it sometimes can be). “Consonance,” on the other hand, features both the absence of discordance and the absence of dissonance; it is marked by smooth sounds and stable notes.

Under an expectational lens, however, the meanings of these terms shift in ways that might strike a reader as controversial. To start, because discordance is fundamentally sensory, there is no such thing as “cognitive discordance”—though psychoacoustic discords can be said to evoke varying degrees of cognitive dissonance. This, admittedly, is not likely to cause a reader much alarm. More likely to ruffle some feathers, however, is the notion that there exists a valid expectational sense in which traditional musical “dissonances” are actually more cognitively consonant than traditional musical “consonances,” since the former tend to behave/resolve in a predictable manner, whereas the latter are behaviorally unconstrained. This last bit has become such a pedagogical commonplace—that dissonances must resolve downwards by step, whereas consonances are free to move/leap/proceed as they please—that it obscures an important truth of musical processing: that when a (chordal or functional) dissonance occurs, we tend to know what it will do next. Of course, traditional “consonances” are more statistically probable than traditional “dissonances” in the zeroth-order sense of frequency of occurrence, and I do not intend to deny or supplant this truism here. But in the first-order sense of continuational probability in a given musical context, traditional “dissonances” tend to behave and progress in ways that engender a greater degree of expectational certainty than do traditional “consonances”—and it is precisely this that motivates my suggestive inversion of these categories when regarding them as expectational phenomena. Again, this is not to argue that what we usually think of as “dissonances” are actually “consonances” wholesale (and vice versa), but rather, to point up the fact that adopting a cognitive/expectational framework can reveal surprising contradictions in how these
terms are typically framed and discussed. These contradictions, I believe, are worth unraveling, taking seriously, and pursuing further.

Before proceeding to some musical specifics, some preparatory words of summary and synthesis are in order. I have been arguing that we should take a closer look at the expectational underpinnings of consonance/dissonance judgments, and that microtonal music that purports to be tonal is fertile terrain to see these misattributions in action. The ecological stakes of attention are only raised when processing unfamiliar tunings; this demands the union of schematic and dynamic expectation, working together in the name of cognitive economy, to make sense of the unfamiliar. If listening to microtonal music can be likened to standing on razor's edge, then the process of parsing it treats this razor as Occam's. In other words, a listener's mental toolbox of referential orienting collections, auditory categories, and strategies for coping with musical novelty is only as robust as their enculturation allows it to be. There will always be intervals, chords, and progressions in microtonal music that fall "between the cracks," so to speak, and hearing them encourages (over)compensatory responses in listeners, who must do something to mitigate their unfamiliarity and reduce the attendant cognitive dissonance. Most of the time, schematic expectation picks up the burden,

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As I mention in Chapter 1, Charles Ives was the first person to use this phrase to describe microtonal music. When I use it in this dissertation, I employ it not only in Ives's original/colloquial sense of "between the literal 'cracks' that separate notes on the piano," but also (more pertinently) in the sense of "between the figurative 'cracks' of culturally conditioned expectation." It is worth noting that the phrase "between the cracks" has been applied to other musical contexts outside of microtonality. Benjamin Doleac, for instance, uses it to describe the not-quite-straight, not-quite-swung feel of sixteenth notes in funk. [Doleac, "Strictly Second Line: Funk, Jazz, and the New Orleans Beat" (2013), passim.] It is interesting that this same phrase can be applicable both in contexts of unequal subdivision (funk sixteenths) and in contexts of perfectly equal subdivision (Blackwood's microtonal equal temperaments)—the former rhythmic, the latter pitch-based.
encouraging the stretching of existing auditory categories so that a novel occurrence can be contextualized in a more economical manner. One way to conceive of Blackwood's microtonality, then, is as a demonstration of the elasticity of auditory categories. These stretchy categories are made to bend—and some more than others. But do they ever break?

Dwelling in the Cracks (I): 19-TET

I begin with a cross-section of moments from Blackwood's music that problematizes the traditional distinction between step and skip, a distinction that Peter Westergaard argues is central to tonal cognition, particularly given its close relation with consonance and dissonance. The following claim motivates the ensuing discussion: of all the hundred-cent gaps between the intervals of 12-TET, the one between 200c and 300c presents enculturated listeners with the most unique cognitive demands, because it spans a sort of transition zone in diatonic space between what is typically parsed as conjunct versus disjunct melodic motion.

One of the more intriguing aspects of Blackwood's microtonal compositions is their usage of

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37. For instance, as I discuss in Chapter 2, major/minor intervals (such as major thirds or minor sevenths) are often regarded as having a wider bandwidth of acceptability than do perfect intervals (such as unisons or fifths) for most Western listeners. At certain points in this dissertation, however, I question this claim, highlighting moments in Blackwood’s microtonality that demonstrate the striking (and heretofore largely unheralded) contextual flexibility of perfect intervals themselves. I will consider one such moment from “13 Notes” later in this chapter.

38. See in particular the Appendix to Westergaard, An Introduction to Tonal Theory (1975).
intervals lying in the middle of this transition zone, which can function both as scale steps (arrayed horizontally) and as harmonic building blocks (stacked vertically)—oftentimes within the same span of music. My hypothesis is that judgments of these intervals as “dissonant” refer not just to their specific cent size but also, crucially, to the comparative lack of expectational schemata that situate them within some familiar framework. Even further, this sensation of “dissonance” is a misattribution that originates in the experience of being in between qualia and/or in between auditory categories (here due to the problems such intervals present to auditory streaming). In Blackwood’s microtonal music, intervals of this sort occur most often in those tunings where the perfect fourth is divisible in half—something, of course, that is not possible in twelve-note tunings. Simply put, parsing/contextualizing half a perfect fourth takes more “work” for a 12-enculturated listener, and it is precisely this increased cognitive load that is reinterpreted (indeed, misattributed) as a property of the interval itself—its apparent “dissonance.”

All this is not to imply that listeners rigidly and exclusively cognize all intervals that are 200 cents or smaller as “steps” (i.e., relations between numerically adjacent x-components), or all intervals that are 300 cents or larger as “skips” (i.e., relations between numerically non-adjacent x-components)—even in diatonic contexts in 12-TET. Several counterexamples abound. Consider, for instance, the augmented second between $x=6$ and $x=9$ in the harmonic

39 Of the dozen tunings in which Blackwood composes, the spelled perfect fourth is exactly divisible in half in 14-TET (6 unit intervals), 15-TET (6), 18-TET (8), 19-TET (8), 20-TET (8), 23-TET (10), and 24-TET (10). I will explore some examples from 19- and 15-TET in this chapter. Julian Hook has previously mentioned the split-fourth property of Blackwood’s 19-TET in Hook, “Enharmonic Systems: A Theory of Key Signatures, Enharmonic Equivalence, and Diatonicism” (2007), p.108.
minor scale, which is understood as a step despite its three-semitone size. The reverse case, a
200-cent interval cognized as a skip, is also possible; a characteristic example is the \( N^6-V^7 \)
progression, in which the melodic diminished third between flat supertonic \( (x=2) \) and leading
tone \( (x=7) \) is understood as a skip despite its two-semitone size. Yet these counterexamples,
while notable, are merely isolated exceptions. In other words, 300-cent steps may exist in
certain 12-TET contexts (especially anhemitonic pentatonic ones), but they are never the most
frequently occurring adjacency in any well-formed scale of cardinality 5 or greater.\(^4\) Likewise,
200-cent skips may also exist in certain 12-TET contexts, but they manifest themselves
melodically; in other words, diminished thirds never stack to form chordal objects. Here one
does well to disentangle the ability to be heard (in a particular context) as a step/skip from the
potential to self-iterate (in general) as a scalar/chordal unit. This is to say, not all 12-TET
intervals heard as steps have the right “stuff” to form the basis of scales; similarly, not all heard
skips have the “stuff” to form the basis of chords.\(^4\)

The counterexamples in the previous paragraph are no doubt interesting. But they are
also limited in that they only probe the boundaries of what I call the “conjunct/disjunct
transition zone”—the gap (roughly) between 200 and 300 cents. What is to be made of the
vast uncharted territory in between these endpoints? How big, in a microtonal context, can an

\(^4\) For more on the concept of scalar well-formedness, see Carey and Clampitt, “Aspects of
Well-Formed Scales” (1989).

\(^4\) In the present case, a four-note scale with 300-cent steps would probably strike most 12-
enculturated listeners as more of an arpeggiated (diminished-seventh) “chord,” whereas a six-
ote note close-position chord that stacks 200-cent thirds would likely strike those same listeners as
more of a verticalized (whole-tone) “scale.” I will discuss the liminal case of the fivefold division
of the octave in the next section on 15-TET.
interval heard as a “major second” be—and how small a “minor third”? Is there a critical bandwidth wherein these auditory categories seem to fuse into an uncanny singularity? Blackwood’s book provides a telling clue. In a table where he lists the possible cent sizes of diatonic intervals in different tuning systems, there is a notable gap between 231.174 cents (the largest type of major second he lists, corresponding to an 8:7 frequency ratio) and 266.871 cents (the smallest type of minor third he lists, corresponding to a 7:6 frequency ratio). One might therefore hypothesize that the window from about 231 to 267 cents affords the optimal potential, in contexts that are otherwise diatonic or quasi-diatonic, for the qualitative blurring of the categories “major second” and “minor third.” This 36-cent span might be conceived as a “gray area” of sorts. But does such a designation correspond to the realities of perception and cognition? After all, brains, operating in context, do not care for gray; they seek to resolve its partials into more determinate strands of black and white.

Onwards, at last, to some musical specifics. In Blackwood’s “Fanfare in 19-note Equal Tuning,” the 8–unit-interval perfect fourth is frequently decomposed into two 4–unit-interval, 253-cent halves that straddle the line between major second and minor third—and with it, the cognitive categories of conjunct (x-adjacent) versus disjunct (x–non-adjacent) melodic motion, respectively.

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The unusual aural effect of this interval is set into even greater relief by the recognizable diatonicity otherwise afforded by 19-TET, on which Blackwood capitalizes in this topically normative fanfare whose tonal trajectory recalls late 19th-century practice. In other words, Blackwood deploys this interval in contexts that make it particularly “stick out” to listeners enculturated to Western Euroclassical functional tonality, since the rest of the “Fanfare” is actually quite expectationally tractable (and thus cognitively “consonant”) by comparison.

Consider the excerpt below, for instance, in which the split fourth occurs in a melodically “passing” formation:

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Ex. 3.1: A voice exchange involving split fourths; excerpt begins at 1:18 of https://www.youtube.com/watch?v=GO516WYU-Zw
The governing harmony in mm.58–59 is a V6/4 in a mode centered on G#, but the exact identity of this mode is complicated by the passing F major triad on the pickup to m.59, which is rooted exactly halfway between the D# still sounding in the bass and the G# centricity of the passage. The melodic fragment boxed in the top part of Ex. 3.1, which directly splits this D#–G# fourth in half, warrants particular focus. These 253-cent intervals, I argue, produce a sensation of cognitive dissonance in 12-enculturated listeners, who are not accustomed to hearing perfect fourths split exactly in half. This dissonance is manifested in the dual scale-degree potentiality of the melodic F natural, which can be reckoned either as a (6, la, 8) in G# ionian or as a (7, fa, 8) in G# mixolydian—but not as both at the same time. Indeed, the F appears to lie on the borderland of these two familiar qualia, seemingly too high to be firmly the former and too low to be firmly the latter. Faced with an interval lying directly in between two familiar qualia—and one that suddenly calls into question the governing modal identity of the passage—12-enculturated listeners are pressed to account for this F either as more like an ionian 6 or as more like a mixolydian 7, should they wish to momentarily reduce their cognitive dissonance. Both interpretations are in principle possible, and different listeners will undoubtedly interpret the moment in different ways, according to their own listening habits, priorities, and predispositions. I will note that I personally exhibit a slight preference for the ionian interpretation, which strikes me as the more cognitively economical option. Such a

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44 The scenario is therefore another example of the “intervallic duck-rabbit” phenomenon I theorize in the previous chapter.
hearing consistently maintains the local G#-ionian identity of mm.58–61, whereas the mixolydian hearing, on the other hand, introduces a quale that is rarely ever heard during a cadential 6/4.

It is worth pointing out that under the ionian hearing, one would interpret the melodic D#–F as qualitatively smaller than the ensuing F–G#—an interpretation that contradicts the spelling of these intervals as skip and step, respectively, and thereby introduces another (visual) element of cognitive dissonance. Later in this chapter, I will take up the topic of the visual consonance/dissonance of notation in more detail. For now, however, the larger point of this example is that, because the split fourth sounds contextually anomalous and dissonant, listeners compensate for its disorienting effect by seeking out the framework of best (expectational) fit through which to filter it. Whether this means reckoning the F natural as an ionian 6 or as a mixolydian 7, the end result is the same: treating an equally spaced acoustic object as if it had an uneven constitution. As we will see, this kind of mental “distortion” is a recurring theme when one tries to hear the tonality in microtonality.

Ultimately, because the split fourth in Ex. 3.1 occurs in such a fleeting “non-harmonic” context, its effect is not as bewildering as it could be, were it to occur in a way that affects the underlying identity of an ongoing progression more directly. Earlier on in the “Fanfare,” in perhaps the piece’s first moment of profound cognitive dissonance, the halved fourth appears

45 The V6/4—>5/3 that is operative in mm.58–60 promptly leads to a G# major triad on the downbeat of m.61 (immediately after Ex. 3.1 cuts off), thereby effecting a perfect authentic cadence (PAC) in G# ionian.

46 Hearing a mixolydian seventh during a cadential 6/4 would attenuate this chord’s charge as a cadential dominant, pointing instead towards the key of the subdominant (as a potential V4/3 of IV).
in a context that is decidedly more “harmonic” in nature. Ex. 3.2 below shows the relevant excerpt, in which a root progression from IV (m.30) to I (m.32) in D# ionian is bisected by this unusual interval in the bass:

Ex. 3.2: Bass motion by four-unit-interval split fourth, connecting IV and I; excerpt begins at 0:41 of https://www.youtube.com/watch?v=GO516WYU-Zw
Measure 31 is my focus here; it consists of a minor seventh sonority rooted on a pitch (once again, F natural) that lies exactly halfway between G# (global IV) and D# (global I). But unlike the previous “Fanfare” example, in which the split-fourth dissonance is carefully introduced within the positional “security blanket” of a cadential 6/4, the F-rooted harmony in Ex. 3.2 carries more colloquial “weight.” Indeed, its metrical, dynamical, and rhetorical emphasis conspire to make its dissonance come across as rather palpably disorienting, even despite the subdued timbral/registral environment of its occurrence (as compared with Ex. 3.1). Once again, the moment is dissonant for reasons that are primarily cognitive/expectational, not sensory/psychoacoustic. Minor sevenths in 19-TET—much like major triads in the same tuning—are not especially discordant; in fact, this particular tuning produces some of the smoothest versions of these sonorities that exist in any of the tunings in which Blackwood composes. But the unusual way that these sonorities are approached and left, plus the fact that they are not easily assimilated into any one unambiguous governing modal context, comprise the main drivers of the cognitive dissonance they produce. Ex. 3.2 furnishes the first moment in the “Fanfare” that falls so viscerally between the cracks of 12-conditioned expectation, and it forces a choice between hearing the F natural in the bass as more “2̂-like” or more “3̂-like” (in some modal context where this 3 is a minor third above tonic), if one wishes to contextualize this anomalous occurrence within a more familiar (i.e., heptatonic diatonic) framework and thereby reduce its dissonance. Of course, the fact that this intervallic anomaly occurs in the bass part has nontrivial implications for the functional identity of m.31, a point to which I return in the next chapter on harmonic function.
Despite the different contexts of occurrence of the split fourths in Ex. 3.1 and Ex. 3.2, the upshot of both examples is the same: that situating this transition-zone interval into a more familiar framework entails mentally “bending” it such that one of the two halves of the fourth comes across as qualitatively larger than the other (despite their literal acoustic equality). It is as if the ear seeks to domesticate this unfamiliar equally divided fourth by imposing upon it what Norman Carey calls the “characteristic asymmetry of tonality.”\textsuperscript{47} The effect is analogous to the well-known optical illusion displayed below, in which both horizontal lines are exactly the same size but come across as unequal due to the contextual “lengthening” of the top line and the contextual “shortening” of the bottom one:

![Image 3.1: The Müller-Lyer illusion as a visual analog to parsing split fourths](Image 3.1)

I have been framing such impositions and distortions in overcompensatory terms: these are things that enculturated listeners do in the face of musical unfamiliarity in an attempt to better understand it or more efficiently contextualize it. Such actions essentially function as a form of “dissonance treatment” that the brain employs as it works in tandem with the auditory system and the pathways of expectation, prediction, and response. Yet so often, our heuristics are

\textsuperscript{47} Carey, “Review Article: Tonality and Transformation by Steven Rings” (2012), p.223.
imperfect, and they can cause us to mentally bend and warp the things we hear in accordance with our preconceptions. Several authors, among them Daniel Jordan, Roger Shepard, and W. Jay Dowling, have discussed the mental equalization of diatonic steps that takes place despite their literally unequal sizes.\footnote{See in particular Jordan, “Influence of the Diatonic Tonal Hierarchy at Microtonal Intervals” (1987), Shepard, “One Cognitive Psychologist’s Quest for the Structural Grounds of Music Cognition” (2009), and Dowling, “Qualia as Intervening Variables in the Understanding of Music Cognition” (2010).} The above examples from the “Fanfare” show that the opposite sort of process is also possible—the mental “un-equalization” of a musical object whose acoustic reality is one of completely equal spacing. This might seem counterintuitive at first, but as Dowling astutely notes, these impulses represent opposite sides of the coin of enculturation. As he writes, “The feeling that the notes of the diatonic scale are equally spaced is so strong that our perception of a scale that is actually equally spaced is distorted in the opposite direction.”\footnote{Dowling, “Qualia as Intervening Variables in the Understanding of Music Cognition” (2010), p.9. When it comes to hearing unfamiliar scales, Dowling writes, “[L]isteners, even nonmusicians, judge them with respect to the scale[s] with which they are familiar from the music they hear every day” (9–10).} Whether from literally unequal to notionally equal, or literally equal to notionally unequal, acoustic reality so often bends in the direction of auditory desire.

**Dwelling in the Cracks (II): 15-TET**

Among the other tunings used by Blackwood whose fourths are divisible in half, two in particular (15- and 20-TET) contain the fivefold equal division of the octave into 240-cent intervals, making them especially fertile sites for the bending of familiar auditory categories.
and the blurring of familiar scale-degree qualia. Taken as a whole, the fivefold equal division occupies a unique perceptual borderland that engages the conjunct/disjunct transition zone. Music theorists and pedagogues generally refer to the fourfold division of the octave as a (diminished-seventh) “chord” and the sixfold division as a (whole-tone) “scale.” The fivefold division therefore constitutes another liminal sort of “duck-rabbit”—a distinctive collection that can sound more like a scale with 240-cent “large seconds” in some contexts, or a chord with 240-cent “narrow thirds” in others. Blackwood’s 15- and 20-TET compositions often probe this collection’s contextual multiplicity. As he writes in the liner notes to the *Suite for Guitar in 15-note Equal Tuning*, “This novel arrangement is useful both melodically, and as a harmony when placed in a variety of distributions.”

I will discuss the harmonic-functional affordances of this 5-TET division at greater length in Chapter 4. For now, I focus more on the melodic affordances of its constituent 240-cent intervals. Fig. 3.2 below lists the pitches of 15-TET; Fig. 3.3 (reprinted from Chapter 1) then diagrams the unusual layout of fifth space in this tuning:

![Fig. 3.2: Blackwood’s note names and enharmonic equivalences for 15-TET](image)

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50 Blackwood, *Microtonal Compositions* (1994), Cedille CDR 90000 018, n.p. As I write in Chapter 1, Blackwood sometimes refers to this collection as the “pi chord” (though this term never makes it into any of his published works).
Consider the note D (z=3), for instance, located in plain-space. Three unit intervals and 240 cents above it lies a note that can be named either E (M2) or F (m3); three unit intervals and 240 cents below lies either C (M2) or B (m3). Blackwood’s notational scheme thus embeds at its very core this potential ambiguity between the auditory categories of step and skip, conjunct and disjunct motion.

The presence of this fivefold division in both 15- and 20-TET makes it possible for Blackwood to write analogous passages across these tunings that showcase the same transition-zone intervals in similar contexts, achieving tonal effects that lack equivalents in 12-TET. Consider the opening of the fourth and final movement of the Suite for Guitar, for instance, which features a moment of “notal” ambiguity that is very similar to the one just discussed from “20 Notes” at the end of Chapter 2:

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51 The idiosyncrasies of 15-TET actually mold quite well to the shape of the modified acoustic guitar. Each string is tuned a six-unit-interval perfect fourth (480 cents) apart, with the outer ones forming a double octave in the conventional manner. This layout, which rids the guitar of its “wolf major third,” is said to simplify the task of fingering for the player. It also perceptually accentuates the fivefold division through the resonance of open strings.
Ex. 3.3: A “stretched” upper neighbor? Excerpt begins at 0:00 of https://www.youtube.com/watch?v=pZT02bDMAfY&list=OLAK5uy_mUM6_6q6J4VL8qSrPlesFNU9FCGfmRL9q&index=17

Both moments feature a 240-cent interval in the melody-bearing voice that extends upwards from $\hat{5}$ (here, E-down) to a pitch that seems to lie right in between a major sixth and minor seventh above tonic (here, F#-down), before descending back to $\hat{5}$ again. The operative question in both cases is whether this melodic peak note—which is located exactly halfway between the perfect fourth from $\hat{5}$ and $\hat{1}$—sounds more like a stretched upper neighbor (i.e., more “$6\hat{2}$-like”) or a strained upwards skip (more “$7\hat{2}$-like”). I like to consider these moments as the microtonal analogs of “blue notes”: between-the-cracks pitches that originated in jazz/blues vocal practice but that continue to resurface in the popular consciousness in sources as diverse as the Law & Order theme song and the Pointer Sisters’ “Pinball Number Count” (best known for its inclusion on Sesame Street).

What makes the present case distinct, however, is that the operative mode of the piece is not yet clear; therefore, the ambiguity of this top note is not just a matter of $x=\hat{6}$ versus $x=\hat{7}$, but also a matter of dorian versus aeolian interpretation of the passage as a whole.

Listen in particular to the electric guitar part from 0:43–0:55 of https://www.youtube.com/watch?v=xz4-aEGvqQM.

Listen in particular to the intonation of the word “four” at 0:19, 1:08, and 1:56 of https://www.youtube.com/watch?v=HUL4T8WcFda.
By now, the story should be familiar: there are multiple plausible hearings of the F#-down “blue note” in Ex. 3.3, and one can theoretically flip back and forth between them at will across multiple hearings of the passage. Indeed, it is this very fact that one can possess several conflicting interpretations of this F#-down in their mind at once that is primarily responsible for its striking cognitive dissonance. But again, interestingly, I must note that the interpretation I prefer is one that contradicts Blackwood’s supplied spelling. That is to say, I am more inclined to hear the F#-down as a strained upwards skip from E-down (i.e., more like a 7\(^\#\)), rather than as its stretched upper neighbor (i.e., less like a 6\(^\#\)). My rationale hinges on an appeal to cognitive economy. Given the salient leaping motion from tonic to dominant in the bass that undergirds this melodic move, and considering the overwhelmingly triadic soundworld of the Suite for Guitar thus far, hearing this circled F#-down as a minor third (or tenth) above the bass would allow for a more straightforward interpretation of the red-boxed arpeggiated harmony as some sort of dominant triad. Hearing the F#-down as a major second (or ninth) above the bass, on the other hand, would needlessly posit an element that cannot be reckoned as easily within the prevailing chordal structure. And yet, it is worth pointing out that while this latter interpretation would seem to create more dissonance (in the form of a “non-harmonic” tone) than already exists, it must be remembered that the former interpretation also creates its own “extra” kind of dissonance: a visual mismatch between a spelled/notated step and a heard skip. The scenario, on the whole, serves as a pointed reminder that cognitive dissonance never truly dissipates in full, since the process of reducing it necessarily entails a selective ignorance towards (and rationalization of) those things that can remind one of the nature/stakes of the conflict in the first place.
While the 240-cent interval in 15-TET sounds conspicuously dissonant in Ex. 3.3, there are other musical contexts in which this same interval—in this same tuning—loses its uncanny luster and strikes the 12-enculturated ear as less unusual, less marked (that is, as more consonant with expectation). Consider, for instance, the opening of “15 Notes”:

Ex. 3.4: The context dependency of transition-zone intervals; excerpt begins at 0:00 of https://www.youtube.com/watch?v=MIYXm-CJgUo
Each of the three boxes in Ex. 3.4 encloses a stepwise traversing of a different interval: from left to right, a minor third, a major third, and a perfect “fourth.” And each stepwise snippet involves at least one instance of the 240-cent interval: from left to right again, D-down —> E-down, G-down —> A-down, and both in the last case. My overarching claim is that this interval sounds less dissonant in the blue-boxed contexts than it does in the red-boxed context, where it sticks out because it splits an interval that is typically not traversable by two (quasi-“diatonic”) steps. 12-enculturated listeners have heard countless instances of minor and major thirds being split into two steps in diatonic contexts, but rarely (if ever) a perfect fourth. And so, as long as the bounding thirds are relatively in tune (which, in 15-TET, they are—320 [m3] and 400 [M3] cents), listeners are likely to forgive some centwise discrepancy in the component steps. Here, once again, schematic expectation domesticates the acoustic anomaly; the gray area momentarily emulsifies into black and white.

So with all this taken into consideration, what key/mode is the passage in? This is a vexing question, for even though mm.1–3 of “15 Notes” partake in the flavor of heptatonic diatonicism, there are only six notes in the excerpt: D-down, E-down, F, G-down, A-down, and C-down. There are two ways to understand this six-note scale: either as D-centric “down-space” (cf. Fig. 3.3) plus a minor third, or as D-down “hexadorian.” The former emphasizes the presence of the (fifth-generated) fivefold equal division of the octave, whereas the latter emphasizes the prevailing heptatonic-diatonic modal quality that obtains even despite the

55 I will unpack the scare quotes in the next paragraph.

56 As I am referring principally to diatonic musical contexts, this remark excludes the case of pentatonicism, where fourths are quite often split into two “steps” (though these are always of unequal size).
reduced cardinality. One might say that the hexadorian mode consists of a lower, minor
tetrachord and an upper, “perfect” (or “neutral”) trichord.57 Both components involve the 240-
cent step, but only in the latter is this interval marked as expectationally anomalous (that is, as
cognitively dissonant).

A brief coda is in order. Inductive reasoning is central to tonal cognition and musical
expectation in general—even more so when a musical environment is unfamiliar. But the “leaky
dike of inductive learning,” to quote Huron, is not without its “patches,” and cognitive
misattribution is one of them.58 Humans are creatures that instinctively categorize,
compartmentalize, and label as a means of maintaining order and control over their
environments. Moreover, these instincts are often overcompensatory in nature: we frequently
resort to (and fall back on) behaviors of labeling, classifying, and contextualizing when we are
least certain about the facts of the matter. So it should come as no surprise that the labels we
supply are as imperfect as the heuristics we apply to generate them. Yet this should not be
taken to mean that listeners are naïve, or that music cognition is a lost cause. In fact, it bears
repeating how impressive it is that the auditory system is able to resolve so many of
microtonality’s contradictions so quickly. But the larger point here is that expectation and
prediction drive this process, and therefore, any judgments generated from it are necessarily
judgments about expectation and prediction, in the most fundamental sense.

57 Calling the ascending interval from A-down to D-down a “perfect fourth” would therefore be
a misnomer; perhaps a more appropriate name would be a “perfect third.” This is precisely the
logic behind my referring to each of the melodic motions within the three boxes of Ex. 3.4 as
“stepwise” in the previous paragraph.

**Meter as a “Consonating” Force**

Western Euroclassical tonality involves a distinctive symbiosis between harmony and meter. Blackwood frequently capitalizes on this culturally specific codependency to produce (or manufacture, or engineer) brief wisps of relative tonal/metric clarity onto which in-group listeners can latch, much like North Stars in an unpredictable sky of sound. These moments can carry strong orienting capabilities, especially in tunings that are otherwise quite discrepant from 12-conditioned expectations. They sound particularly striking because they engage “both the pleasure arising from accurate prediction and the contrastive valence arising from innocuous surprise.”

The following excerpt from “14 Notes” is a case in point—another instance of how schematic and dynamic expectations can join forces to clarify the acoustic anomalies of Blackwood’s microtonality. My claim is that Blackwood engineers a hypermetric downbeat to occur at m.47 whose predictability intensifies the local tonic accent on F-up, to the point of overshadowing the ways that this tonic triad is still traditionally/conventionally “dissonant.”

Once again, the mechanism of overcompensation is key to understanding the dynamics of this moment. More specifically, when listeners are deprived of any large-scale orienting periodicity,

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59 Ibid., p.141.

60 Engineered hypermetric downbeats are particularly common as large-scale orienting devices in the symphonic literature. See, for instance, m.343 of Brahms’s First Symphony, 1st movement, in which the onset of sonata recapitulation is “prepared” as a hypermetric downbeat. (A similar thing happens at the juncture of recapitulation in Franck’s D minor Symphony, 1st movement.) Brahms was particularly fond of this device, also employing it in the 4th movement of his First Symphony (m.220, a moment previously discussed in Cohn’s *Audacious Euphony* [2012], pp.191–94), the 1st movement of his Second Symphony (m.44, enabled by the periodic timpani rolls), and the 4th movement of his Second Symphony (m.78, preparing the entrance of the sonata’s secondary theme).
they are prone to compensate by latching all the more tightly onto any brief wisps of metrical
clarity that may emerge. As will be seen, these moments are especially ripe sites for the
attendant misattributive back-projection of other labels, such as “tonally stable” and
“consonant.”

![14 NOTES](image)

**Fig. 3.4:** Blackwood’s note names and enharmonic equivalences for 14-TET
Ex. 3.5: An engineered hypermetric downbeat at m.47 that “consonates” its governing harmony; bracketed part of excerpt begins at 0:37 of https://www.youtube.com/watch?v=rW_X0bgHlrQ
The wisp in question is the bracketed portion of Ex. 3.5—more precisely, the four bars of 2/4 (mm.43–46) that prepare the aforementioned hypermetric downbeat. This sort of local metric regularity is hard to come by in the capricious “14 Notes”; only two passages in the whole etude contain more consecutive measures in the same time signature, and both have yet to occur. So m.47 accrues a (hyper)metric accent because of the preparatory bars of pure duple meter that frame its arrival as expected (and hence, rhetorically “strong”). But this is only part of the story. [The pickup to] m.47 also delineates a phrasal boundary, the end of a tonic-prolonging sequence that begins with the bracketed pickup to m.39. This former pickup also carries the accent of motivic parallelism, since it references a common descending gesture of the etude (and in the proper anacrustic context). In short, the arrival of m.47 is accented for a confluence of reasons, most so because it is a rare island of schematic and dynamic predictability in the sea of surprises that is “14 Notes.”

It may seem surprising that so many kinds of accent should accrue to this particular moment, especially given that no harmonic progression takes place across the barline of m.47.

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61 This sensation of (hyper)metric accent is the product of dynamic and schematic expectation—the former because of the “engineered” (or “manufactured”) nature of the downbeat arrival, and the latter because of the human preference for duple groupings. For more on this latter preference, see Fraisse, “Rhythm and Tempo” (1982); Lerdahl and Jackendoff, A Generative Theory of Tonal Music (1983); Essens and Povel, “Metrical and Nonmetrical Representations of Temporal Patterns” (1985); Smith and Cuddy, “Effects of Metric and Harmonic Rhythm on the Detection of Pitch Alterations in Melodic Sequences” (1989); and Dawe, Platt, and Racine, “Inference of Metrical Structure from Perception of Iterative Pulses within Time Spans Defined by Chord Changes” (1994).

62 Also worth mentioning are the diacritic accents given to the top two parts on the downbeat of m.47, in tandem with the local dynamic swell from p to mp. When all is taken into account, m.47 simultaneously sports all three categories of accent that Lerdahl and Jackendoff describe on p.17 of A Generative Theory of Tonal Music (1983): the “metrical” and “structural” accents just described in the main text, and the “phenomenal” accents described in this footnote.
The F-up tonic arrives two measures prior, and when it is reiterated in m.47, it is clouded with upper neighbors. Five distinct pitch classes sound on the downbeat of m.47; why should this particular configuration sound like a “consonance” at all, much less a convincing assertion of tonic harmony? Even when the upper neighbors resolve to triadic tones by the downbeat of m.48, the presence of a rogue D-up (circled in Ex. 3.5) ensures that the local tonic of F-up major never sounds as a conventional three-note triad. Further, the fifth of this triad measures only 686 cents (8 unit intervals in 14-TET), which is the lower boundary of Blackwood’s “range of recognizability”\(^{63}\)—and on top of that, its thirds are the same size (4 unit intervals, 343 cents). The triad’s quality is thus equivocal, and the way it is notated presents an even further layer of visual interference: the third is Ab-up, which looks like a minor third in relation to the F-up root on the page. But does it sound like a minor third? This is a more complicated matter, and it brings the heretofore ignored D-up into the discussion. This note occupies generic scalar position \(x=\hat{6}\) and approximates a major sixth above the F-up tonic—and I argue that its inclusion can help to clarify the quality of the triad. More specifically, on my hearing, this added sixth prompts me to retrospectively reinterpret the neutral third as a “major” third, since the tonic accent of m.47 is especially strong, and it is rare for tonic-functioning chords in Western Euroclassical musics to contain tritones (which would be the case if this third were cognized as

\(^{63}\) As I mention in Chapter 1, Blackwood delineates the “range of recognizability” for the perfect fifth as lying between 4/7 (686 cents) and 3/5 (720 cents) of the 1200-cent octave. [Blackwood, The Structure of Recognizable Diatonic Tunings (1985), p.199.] Note that 4/7 is equal to 8/14, which describes the present case of the 8–unit-interval fifth in 14-TET.
This interpretation is contradictory to the supplied spelling (not to mention that 343 cents is closer to the minor third—both pure and 12–equal-tempered—than it is to the major third). But the power of schematic expectation is strong enough to “bend” this interval, as it were, in the upwards direction. That is to say, stylistically enculturated listeners can apply an expectational schema here that can reasonably contextualize the neutral third as “major” (or at least “major enough”): the knowledge, however implicit and subconscious, that tonic-functioning chords in Western Euroclassical tonal musics tend to lack tritones.

The larger point of the previous paragraph is not to be missed: that the tonic arrival in mm.47–48 still “dissonates” in many traditional senses of the term—its fifth is flat, its thirds are the same size, it contains an added sixth degree, it is initially clouded with upper neighbors (which are contrapuntal “dissonances” above the bass), etc. And yet, despite all this, I hold that many 12-enculturated listeners would likely be eager to accept what Daniel Harrison would call this “clouded and malformed” tonic anyway, hearing past its unusual surface features because the accent of its arrival is so strong. One might even say that the predictable preparatory measures (which are certainly a rarity in “14 Notes”) work to “consonate” the tonic harmony in mm.47–48 by smoothing over its aberrant features, contextually overpowering them and pushing them towards the back burner of musical consciousness. It would be interesting to test this hypothesis in a laboratory setting. Participants might hear the above.

64 Of course, dominant sevenths often function as tonics in other styles, such as blues and jazz. But the large majority of chords with tritones—what Paul Hindemith calls “Group B” chords in his Craft of Musical Composition (1937)—function as dominants in Western Euroclassical musics, not as tonics. For more on “Group B” chords, see Harrison, Pieces of Tradition (2016), pp.54–57.

excerpt both as is and with an added metrical complication introduced somewhere between mm.43–46, and be asked to rate the degree of consonance (or perhaps the perceived stability) of the tonic assertion beginning at m.47. If they rate the manipulated trials as significantly less consonant, it would constitute compelling evidence that judgments of consonance and dissonance are largely judgments about expectation that are redirected onto musical proxies. It would also affirm the crucial role that meter plays in influencing judgments about consonance, dissonance, and tonal stability.

This role is sometimes given short shrift. Commentators ranging from Joseph Yasser to Dmitri Tymoczko make virtually no mention of meter in their otherwise wide-ranging accounts of tonality. But as Sarah Fuller reminds us of the history of Western music theory, “[A] categorical and systematic distinction between consonance and dissonance lay dormant until the emergence of meter as a dominant trait of polyphonic music.” Brian Hyer writes in a similar vein: “Meter is crucial to the subordination of dissonant harmonies to consonant ones […] While most theorists concentrate on harmonic considerations, tonality is perhaps best conceptualized as a tertium quid in which melody, harmony, and meter all combine into a single musical nexus.” Despite perceptive statements such as these, however, scholars have generally been slow to take meter more seriously in their accounts of consonance/dissonance, tonality, and tonal cognition. Recent efforts by David Temperley, Jon Prince, William

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66 The order of these trials would have to be randomized. Participants would ideally be 12-enculturated listeners—half musicians and half nonmusicians.


Thompson, Mark Schmuckler, Matthew Rosenthal, Erin Hannon, Christopher White, and Megan Long, however, have stemmed this tide, invigorating a discourse that just fifteen years ago was gauntly populated by the likes of Peter Westergaard, Marilyn Boltz, and Joseph Swain (among few others). Long even goes so far, in a recent book, as to propose a “model of tonality—and of tonality’s history—that centers not pitch, but rhythm and meter” instead. It is encouraging to see the field turning towards the realization that, to a great extent, tonal stability is metrical stability (and vice versa). The next step is for music theory pedagogy to disentangle the terms and conditions of this symbiosis with greater precision: that much of what makes downbeats sound “strong” is actually our expectation that certain types of things tend to occur on them within the norms of particular styles, and that much of what makes tonic chords sound “stable” is precisely their tendency to occur in predictable temporal/metrical contexts.

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The Visual Consonance/Dissonance of Notation

Notation does things. It is not merely a passive bystander, or a neutral “copy” of sounding music. Notating music, much like analyzing it, is a pragmatic and contingent act that points up certain features of the music, regarded as essential, at the expense of others. In Chapter 1, I explore the implications of using five-line staff notation to represent microtonal music, arguing that it encourages what I call a “12-analogous Euroclassical interpretive epistemology”—essentially specifying/suggesting a sort of “listening grammar” through which one can understand Blackwood’s “compositional grammar.” Indeed, for 12-enculturated listeners who are also trained readers of the five-line staff, Blackwood’s notational system itself acts as another “consonating” force that cannot be ignored, since it enables his music to look a lot neater on the printed page than it sounds. By notating each microtonal interval through a governing scheme of representational close-quantization, Blackwood visually erases many of the auditory-expectational discrepancies/dissonances that such intervals generate. Central to this process is the way Blackwood strategically chooses enharmonic equivalences: to facilitate the spelling of each tuning’s best triads, sevenths, and scales as familiar-looking triads,


74 This scheme mirrors how nonmusicians, according to Freya Bailes, Roger Dean, and Mary Broughton, tend to perceive microtonal intervals: “as instances of neighbouring 12-TET intervals.” [Bailes, Dean, and Broughton, “How Different Are Our Perceptions of Equal-Tempered and Microtonal Intervals? A Behavioral and EEG Survey” (2015), p.1.] I have been arguing that musicians accustomed to playing/listening in 12-TET are also inclined to perceive microtonal intervals by analogy to their nearest 12-TET counterparts.
sevenths, and scales on the staff. If microtonal intervals exist between the cracks of expectation, then enharmonic equivalence is the notational caulk that binds these cracks into privileged visual shapes, allowing them to appear with optimal transpositional frequency.

Blackwood’s notational choices might thus be considered a gerrymandering of the pitch electorate to favor the customary visual appearance of familiar chords and scales. I use such terminology because Blackwood’s decisions are political in that they impose a visual, historical, and cultural value system on the act of sonic interpretation. He could have devised his own novel notational system, but he chose not to do so, and this is consequential. By drawing the lines of each “pitch district” in a way that encourages interpretation by analogy to the familiar shapes of 12-note tuning, Blackwood leverages what Kofi Agawu calls the “institutional power” of five-line staff notation in order to render his music more visually intelligible. Does this make Blackwood a colonizer of unfamiliar tunings with the language and customs of Western 12-TET tonality? Do his conservative compositional style and traditional notational choices imply that unfamiliar tunings can only speak out for themselves within a particular aesthetic infrastructure of parametric normativity? Or is he simply an intrepid explorer of uncharted musical territory trying to communicate his findings to as broad an audience as possible? It seems as if Blackwood’s microtonal music can be heard in two ideological frameworks that are diametrically opposed: as a perpetuation of 12-TET hegemony and

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75 One occasionally disorienting byproduct of this is that enharmonic relationships fluctuate across Blackwood’s dozen tunings, and they do not always match the familiar/customary ones from 12-TET. For example, the note B# is sometimes equivalent to C (21- and 22-TET), but it can also be equivalent to Cbb (13-TET), Cb (19-TET), and even Db (17-TET).

ideologies of Western Euroclassical supremacy, or as a radical deconstruction of the same. (And this is to say nothing of the vast and thorny middleground between these two extremes.)

This circles back to the complicated issue of Blackwood’s target audience for these microtonal pieces—an issue I first take up in Chapter 1. My position is essentially that, while Blackwood’s principal audience seems to be a small, notationally literate in-group of classically trained musicians, his microtonality also constitutes an unusually rare case of a “highbrow” art music that can tap into and reveal the breadth of implicit musical knowledge held by the musically untrained. I have been arguing that 12-enculturated listeners, regardless of their level of musical training or expertise, run Blackwood’s music through the interpretive filter of the 12-tone octave in order to make sense of it. But the nature of this interpretive filter, crucially, differs based on whether one is a trained musician or not. For nonmusicians, the filter is primarily aural, based on a comparison of heard sounds to a mental archive of auditory categories built through exposure to the statistical regularities of a culture’s music. For musicians, however, this aural dimension exists in a close feedback loop with an additional visual dimension that is based in one’s experience with Western staff notation. And so it is worth clarifying that the visual consonance/dissonance discussed in this section (and briefly alluded to in previous ones) is a kind of consonance/dissonance that is only experientially accessible to readers of notation. In other words, one need not be notationally literate in order to feel the cognitive dissonance wrought by a split fourth, or to mentally “bend” an equally spaced acoustic object into a more familiar asymmetric form, or to experience the ways that meter can act as a “consonating” force. But one does need to be notationally literate in order to register those moments when a plausible, economical interpretation of an interval
contradicts Blackwood’s spelling of it—moments when the sound of the music is inconsistent with, or outright different from, its look in notation.

Norman Cazden writes that listeners “cannot divest [themselves] of the entire set of assumptions which underlie [their] by now automatic responses” to music.\textsuperscript{77} I have been demonstrating, over the course of this chapter, that these assumptions and heuristics—usually trusty and reliable in 12-TET contexts—reveal themselves to be partial, imperfect, and contingent in the face of microtonality, whose novelty is such that auditory paradoxes, categorical contradictions, and expectational disjunctures are unavoidable. The previous sections have considered notable moments in Blackwood’s microtonality when established auditory categories bend to their breaking point. The present section, on the other hand, zeroes in on a sort of “breaking point” that is more cross-sensory in nature: a perceived mismatch between auditory and visual domains that engenders another distinctive sense of expectational dissonance for those listening with score. The conditions that allow such moments to arise lie in the codependent, mutually reinforcing relationship between 12-TET music and five-line staff notation that has solidified over the past century. More specifically, due to the modern ubiquity of 12-TET, notationally literate Western musicians/listeners have grown accustomed to connecting certain notated shapes on the staff (“looks”) with certain prototypical auditory realizations (“sounds”). With regards to such visual/sonic convergences, Huron cogently writes that “[i]n parsing auditory scenes, our brains prefer that our ears agree with our eyes.”\textsuperscript{78} But despite Blackwood’s best efforts to optimize consistency between


\textsuperscript{78} Huron, Voice Leading: The Science Behind a Musical Art (2016), p.130.
“sound” and “look,” there are still scenarios in which score-following listeners are wise to take his supplied spellings with a grain of salt. Notation, after all, can be cunning, deceptive, and misleading; it is not always deserving of one’s blind trust.

Consider the excerpt below from “13 Notes,” which corresponds loosely to the opening bars of the etude (a passage I discuss later on in Chapter 5):

![13 Notes](image)

**Fig. 3.5:** Blackwood’s note names and enharmonic equivalences for 13-TET

![Ex. 3.6](image)

**Ex. 3.6:** Spelled tritone, heard perfect fifth; excerpt begins at 1:25 of [https://www.youtube.com/watch?v=gA6m6DW83SM&t=0s&list=PL0Mptms4dkf7w1VFmYaZRScQ-o9qoAoFJ&index=7](https://www.youtube.com/watch?v=gA6m6DW83SM&t=0s&list=PL0Mptms4dkf7w1VFmYaZRScQ-o9qoAoFJ&index=7)
The circled F# in m.45 is something I like to call a “tonic by [gentle] imposition,” and it behaves much like the Ab in the bass of m.5 as a subtle “nudge” that motivates the upper parts to resolve normatively to a minor triad (boxed in blue). Or, more accurately, the “nudge” can be said to act on listeners—who are motivated to (re)interpret the sounding pitches in terms of the newly imposed tonic. When this F# enters, the highest sounding voice is the circled C natural, which lies seven unit intervals and 646 cents away in pitch-class space. Yet even though this interval is spelled as a tritone (not to mention that it lies closer in cents to the 12-TET tritone than to the 12-TET perfect fifth), I argue that many 12-enculturated listeners would be likely to override this apparent evidence and cognize it as a perfect fifth instead. The situation, once again, comes down to dynamic and schematic expectations working in tandem to outweigh the duo of spelling and acoustic reality. Dynamic expectation primes the “perfect fifth” interpretation because of the analogy to the etude’s opening bars; this activates the cognitive disposition to hear “parallel passages in parallel ways.” On top of this dynamic cue to hear an imposed tonic in mm.45–46, schematic-expectational cues also bolster the “perfect fifth” interpretation, since in most Western Euroclassical music (as I mention earlier), tonic-

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79 I will develop the idea of a “tonic by [gentle] imposition” further in Chapter 5 when I discuss the opening bars of the etude. This concept extends Daniel Harrison’s notion of “asserted keys” to contexts of greater rhetorical subtlety and understatedness. [See Harrison, “Nonconformist Notions of Nineteenth-Century Enharmonicism” (2002), p.144.]

80 Again, m.5 of “13 Notes” is not pictured above (or anywhere else in this chapter). It will be treated in Chapter 5. For now, it suffices to think of m.5 and m.45 as what James Hepokoski and Warren Darcy would call “referential measures”: structurally analogous moments that differ in their surface details (here, their respective centricities). [Hepokoski and Darcy, Elements of Sonata Theory: Norms, Types, and Deformations in the Late–Eighteenth-Century Sonata (2006), pp.241–42.]

functioning root-position triads contain perfect fifths and not tritones. This line of reasoning represents one possible way that an enculturated listener might efficiently (and subconsciously) wield tools of expectation, prediction, and categorization to resolve the cognitive dissonance resulting from the cross-modal mismatch between the “look” of the spelled tritone and the “sound” of the heard perfect fifth; in this particular case, sound outweighs look. The moment demonstrates just how stretchy the auditory category of “perfect fifth” can be across Blackwood’s dozen tunings: as small as 646 cents (in this particular etude) and as large as 720 (in “15 Notes,” “20 Notes,” and the Suite for Guitar)—a bandwidth of nearly 75 cents!82

Other notable instances of look/sound disjuncture occur across modulatory boundaries that involve some of the more visually perplexing enharmonic relationships featured in Blackwood’s tunings. Take the case of 17-TET, for instance:

![Fig. 3.6: Blackwood’s note names and enharmonic equivalences for 17-TET](image)

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82 It is worth investigating why the 8–unit-interval, 738-cent span of 13-TET is never deployed as a perfect fifth in “13 Notes,” considering that this interval lies closer to both the pure (~702-cent) fifth and the 12-TET (700-cent) fifth than does its 7–unit-interval counterpart.
As I discuss in Chapter 2, 17-TET is one out of just four of Blackwood’s dozen tunings that contains what he calls “recognizable diatonic scales,” and his notational scheme is designed with this fact in mind. As a result, “look” and “sound” line up particularly well in this tuning—but only within keys, not between them. This is to say, modulation in 17-TET can sometimes look peculiar on the page because of the unusual skipwise spelling of its enharmonic equivalences, and this can serve to visually “dissonate” tonal transformations that otherwise sound relatively normative, tractable (in the cognitive sense), and commonplace.

Consider the following excerpt from “17 Notes,” which transitions from D# phrygian to either Gb ionian or Ab dorian across the double bar, with A# reinterpreted as Cb:

Ex. 3.7: Confusing spelling obfuscates an otherwise conventional scale-degree transformation; excerpt begins at 0:34 of https://www.youtube.com/watch?v=_I-YkCkMUNY&t=0s&list=OLAK5uy_mUM6_6q6J4VL8qS4PlesFNU9FCGfmRL9g&index=9


84 Indeed, this is the only one of Blackwood’s dozen tunings in which enharmonic equivalences are not spelled as some form of second.
My claim, crudely put, is that this modulatory move sounds more “normal” than it looks. In other words, a 12-encultured listener with a score would likely regard this move as more dissonant than would one listening without a score, because in the former case, visual information conflicts with sonic impression. As Ex. 3.7 demonstrates, the enharmonic common tone over the boundary transforms from a phrygian $\tilde{5}$ to either an ionian $\tilde{4}$ or a dorian $\tilde{3}$, depending on one’s preferred interpretation. Either way, this move is not especially unusual; both are relatively common scale-degree transformations that 12-encultured listeners are likely accustomed to hearing (at least in the $x$ sense). The excerpt below, for instance, displays a famous $x=\tilde{5} \rightarrow x=\tilde{3}$ transformation from the film music literature.

\[Ex. 3.8: \text{A “fifth becomes (minor) third” transformation from John Williams’ “Imperial March” (1980);}^{85}\text{ excerpt begins at 0:11 of https://www.youtube.com/watch?v=hNv5sPu0C1E}\]

The difference lies in how the bounding key areas are notated. In 12-TET, $x=\tilde{5} \rightarrow x=\tilde{4}$ transformations usually connect tonal/modal areas that are separated by a spelled major (or sometimes minor) second; likewise, $x=\tilde{5} \rightarrow x=\tilde{3}$ transformations typically accompany tertian

\[85\text{ To be clear, this is not a large-scale modulation from Eb aeolian to G aeolian, and no enharmonic transformation or reinterpretation takes place here. Yet the similarities with Ex. 3.7 are clear enough—particularly in that the } x=\tilde{5} \rightarrow x=\tilde{3} \text{ transformation connects two modes that feature minor thirds above tonic. Erik Heine discusses this and other chromatic mediant progressions in a recent article that explores their usage in film music; he connects the above “Vader’ motion” with Wagner’s “Tarnhelm” progression. [Heine, ”Chromatic Mediants and Narrative Context in Film” (2018), p.121.] See also Donald Fagen, ”Mary Shut The Garden Door” (2006), in which a similar } x=\tilde{5} \rightarrow x=\tilde{3} \text{ transformation repeatedly operates on the note D, the common tone between the shuttling G minor and B minor harmonies.}\]
modulations whose centricities are separated by a spelled major or minor third. But in 17-TET, the bounding centricities in Ex. 3.7 are separated not by a spelled M/m second or third, but rather by a spelled doubly diminished fourth (top hearing) or doubly diminished fifth (bottom hearing). These intervals are extremely rare in most musical contexts, and their cameos here are striking enough to give most score-following listeners pause. As the sudden sea-change in accidentals shows, this moment traverses a wide swath of tonal space in one fell swoop—either thirteen (bottom) or fifteen (top) notches down the line of fifths, in comparison to just four notches up in the case of Ex. 3.8. The notation in mm.35–36 of “17 Notes” is therefore a form of visual interference that clouds and defamiliarizes an otherwise unremarkable/normative aural event, making it come across as more dissonant than it actually sounds.

Skipwise enharmonic equivalences, in short, are the visual price one has to pay in 17-TET for the transpositional optimization of major/minor triads and diatonic scales in notation. Whether this price is regarded as large or small varies among individual listeners, in accordance with how much trust they are accustomed to putting in notation. For those who typically take notation at its word (or rather, its “letter”), the moment in Ex. 3.7 might be regarded as more of a nuisance than anything, since its representation sands against the grain of cognitive economy, creating more “work” for listeners to do (and more contradictions for them to reconcile). Here one does well to recall Harrison’s warning that notation does not always “reliably indicate real differences in tonal meaning.” 86

* * *

Let me be explicit: I am not arguing that 12-enculturated listeners should interpret the passages in this chapter in only the ways I propose. But I am arguing that they can, that there is enough evidence to do so reasonably, and that in many cases, these interpretations contradict some fundamental aspect of notation/spelling. This last bit is the upshot: Blackwood’s notational regime relies on varying familiar enharmonic relationships in order to produce familiar visual shapes, and while this might provide for global interpretive coherence, it also creates space for local anomalies that seem to expose the holes in the system. Perhaps my choice to dwell in the aperture between “look” and “sound” is itself overcompensatory, a way of correcting my own former blind trust in notation with a hearty dose of skepticism. But it is also an act of resistance—an affirmation that we as listeners are free to conceive of the “lines of the district,” so to speak, in ways that diverge from how they have been drawn for us.

Tying It Together

So where does this leave us with consonance and dissonance? In short, with a lot more left to say. This section will tie together some loose ends before addressing some provocative open-ended questions about musical preference and value. Paul Zweifel writes that “[m]ost early attempts at micro-tuning, in particular Blackwood’s, were [a] means of optimizing chordal consonance.” Yet as we have seen throughout this chapter, such an optimization does not preclude the simultaneous existence of a profound, multilayered sense of dissonance that accompanies the act of listening to this music and reading its notation. Crucially, this dissonance is not just a matter of sensory/psychoacoustic “roughness” produced by beating

intervals and intervallic combinations. It also contains a multifaceted cognitive component that is psychological and expectational at its core. Blackwood’s microtonality arouses such cognitive dissonance in 12-enculturated listeners, musicians, and readers of notation alike because it is a paradoxical blend of expectational conformance and expectational noncompliance—seemingly both at the same time.88

There are several dimensions to this cognitive dissonance, ranging from the sense of being in between familiar qualia and/or auditory categories, to scenarios where multiple plausible interpretations of an ambiguous or expectationally anomalous event exist (but none seems to be an obvious choice), to apparent cross-modal mismatches between “look” and “sound.” There are even other dimensions that, despite being unexplored in this chapter, deserve mention anyway—like the “mimetic” dissonance that results from one’s (assumed) unfamiliarity with the Motorola Scalatron and Polyfusion synthesizer (the microtonal instruments that Blackwood uses). Arnie Cox writes that “musical imagery is partly motor imagery[, and] part of how we comprehend music is by way of a kind of physical empathy that involves imagining making the sounds we are listening to.”89 Blackwood’s microtonality, which features a combination of unfamiliar tunings/sounds and unfamiliar instruments/technologies used to render them audible, makes such “physical empathy” difficult for most listeners. Indeed, many of those who hear this music may well wonder how it was even possible to play to begin with—

88 This calls to mind Ezra Sims’s memorable characterization of microtonal consonance/dissonance as a sort of “chiaroscuro.” [Sims, “Reflections on This and That (Perhaps A Polemic)” (1991), p.255.]

89 Cox, “Embodying Music: Principles of the Mimetic Hypothesis” (2011), [2–3] [emphasis in original].
and this leads to another sense of expectational remove, bewilderment, and dissonance that is
not to be overlooked.

In the face of all this dissonance, listeners can throw a variety of cognitive tools at
unfamiliar music in an attempt to make sense of it. And when they do so, they do so efficiently:
in a manner contingent on the time-worn grooves of enculturation. Yet, as I have argued, this
process involves a good deal of jumping to false conclusions, throwing around inaccurate
labels, and bending reality to fit preconceived desires. Misattribution, as Huron claims, “is the
price we pay for trying to draw conclusions from small amounts of information.”\textsuperscript{90} So why do
we do it anyway? What is the payoff?

Huron has written extensively about the interconnections among misattribution,
emotion, and the prediction response, explaining that “[i]n trying to ensure that we learn a
useful lesson, our minds tolerate learning all sorts of wrong lessons as well.”\textsuperscript{91} In the case of
listening to microtonal music, the long-term “useful lesson” is the ability to develop a
sensitivity to its idiosyncrasies and regularities, and thus to be able to better predict it (and
music like it) in the future. We are inclined to do this because accurate prediction arouses
pleasure and attendant positive emotions.\textsuperscript{92} Yet this is a premise that can be harnessed towards
some controversial conclusions. Can we only enjoy music to the extent that we can predict it

\textsuperscript{90} Huron, \textit{Sweet Anticipation} (2006b), p.137.

\textsuperscript{91} Ibid. See also Huron, “The Plural Pleasures of Music” (2005).

\textsuperscript{92} As Huron writes in \textit{Sweet Anticipation} (2006b), “When a listener accurately predicts some
stimulus, misattribution is ready to pin the positive emotion onto any convenient bystander. Similarly, when a listener fails to predict some stimulus, misattribution is ready to spread the blame [….] The innocent bystander [is] the stimulus itself” (138).
accurately? And when we evaluate music as “good,” are we not fundamentally rewarding ourselves, in some circuitous way?

To the first of those two questions, I would answer in the resounding negative—this is too much of an oversimplification. The sounds of ticking metronomes and analog clocks are easy to predict, but I doubt that many would regard them as enjoyable music. Similarly, a hypothetical piece that consists of just a single note (or interval, or chord) recurring at a regular periodicity would probably fail to strike many as interesting, even though it is technically extremely predictable. Of course, it goes without saying that variety, surprise, and suspense are fundamental to musical experience (and enjoyment), precisely for the cathartic trajectories of tension and release they engender. Leonard Meyer has famously theorized that musical meaning resides in the emotions that are generated when expectations are violated. And Bharucha has argued that “expected events aren’t necessarily preferred over unexpected events […] If there is any relationship between expectation and preference, it takes the form of an inverted-U function: a moderate amount of violation of expectations is generally preferred

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93 And this is the case even despite established empirical evidence that “[h]uman listeners strongly prefer chord progressions that fulfill their expectations, and this preference is unaffected by musical training.” [Loui and Wessel, “Harmonic Expectation and Affect in Western Music: Effects of Attention and Training” (2007), p.1091.]

94 In the words of Fred Lerdahl, “The best music utilizes the full potential of our cognitive resources.” [Lerdahl, “Cognitive Constraints on Compositional Systems” (1992), p.118.]

over always fulfilling expectations or always violating them.” In short, expectation and prediction may be necessary conditions for musical enjoyment, but they alone are not sufficient to explain the sensation in all its manifold complexity (nor is this the dissertation to do so).

The second question above, though, is not so easily dismissed. This chapter began by framing consonance and dissonance in expectational terms, noting that these lower-level misattributions have the potential to trickle up to inform judgments of centricity, stability, and value. I have dealt with centricity and stability in the foregoing analytical vignettes; now is the time to reflect upon the question of value. I think that we should take seriously the possibility that our value judgments about music tell us more about ourselves than about the music—specifically, about our capacity to understand it, process its surprises efficiently, and contextualize it in terms of what we know. The polarizing case of twelve-tone serialism is representative: many listeners accustomed to the syntactic regularities of tonal music find it frustrating and opaque, and therefore dislike it. Others are able to develop an appreciation for it, but only over time, once they have listened to enough of it that they can better

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97 There is a good discussion of this in Chapter 16 of Huron’s *Sweet Anticipation* (2006b), pp. 331–53. See also Hicks, “Serialism and Comprehensibility: A Guide for the Teacher” (1991) and Lerdahl, “Cognitive Constraints on Compositional Systems” (1992). Of course, one could make the same point about other styles of music that are commonly labeled as “dissonant,” such as free jazz.
internalize its nuances and idiosyncrasies. Simply put, serialism is an acquired taste, and this is why tone rows do not make for Billboard hits, now or then. But for those avowed aficionados of twelve-tone technique (or, say, of Blackwood’s microtonal music), I do wonder the extent to which their enthusiasm for the music originates in a self-congratulatory impulse.

Of course, there are lots of other valid reasons to like or dislike music, and I am not denying their existence. But I ask: are we willing to take this one more seriously, or at least to acknowledge that it can play a greater role in our judgments than we might be aware? It may seem a stretch—or perhaps overly reductive—to connect consonance/dissonance to value. But I believe it to be a line of implication worth tracing here (and a relationship worth pursuing further). Whether or not we like a piece of music is undoubtedly complicated, subjective territory. But it is more than conceivable that these higher-order judgments say something, however indirectly, about our expectational and predictive capacities, which themselves are

contingent upon the music we are accustomed to hearing. If it all circles back to mere exposure,\textsuperscript{99} can exposure be so mere?

In *Curb Your Enthusiasm*’s Season 9 finale, Marty Funkhouser (played by the late Bob Einstein) arrives a few minutes late to a dinner table already populated by Larry David (himself), Susie Greene (Susie Essman), and Jeff Greene (Jeff Garlin). After a brief argument regarding the quality of Funkhouser’s apology for being late, Susie proposes that they order a bottle of wine, and Funkhouser enthusiastically agrees. Larry then asks Funkhouser, “So, what’s happening?” and he responds with “I had a colonoscopy; clean as a whistle.” Immediately thereafter, some cheery transition music begins to play, and the scene cuts abruptly to the following day.¹ None of the ensuing dinner is shown on screen.

What makes this brief scene funny? Certainly, reproducing it on this page comes nowhere close to capturing its humor on screen. To be sure, Funkhouser’s response is not exactly the most conventional answer to the question “So, what’s happening?” (nor is it the most appropriate for dinner-table conversation), and his nonchalant, matter-of-fact delivery of the line certainly adds to the bizarre, incongruous nature of the scene. But while this is part of the equation, it does not tell the whole story. Funkhouser’s line may be mildly comical on its own, but its full comedic effect, I argue, does not kick in until the scene abruptly cuts and the transition music starts to play. In other words, his line is not so much a punchline in itself as it is a setup for the ensuing music and scene cut, which act like a “punchline” in their own right—or

¹ See in particular 11:47 to 12:00 of the episode, which can be viewed on HBO Max at [https://www.hbo.com/curb-your-enthusiasm/season-9/10-fatwa](https://www.hbo.com/curb-your-enthusiasm/season-9/10-fatwa). The transition music is Franco Micalizzi’s “Morning Promenade” (1991).
at the very least, a form of comedic punctuation that ices the cake of the scene, so to speak, and consolidates its humorous effect.

Of course, most of us are more accustomed to laughing at words and actions than at music and camera work. Indeed, when I have shown this scene to others and prompted them to describe what they find funny about it, nearly all have pinned this sensation on the scene’s last spoken line. And yet, not a single person who laughed or smiled in response did so until after the camera cut away from the restaurant and the transition music started to play. The actual trigger of the humor, it seemed, was getting lost in translation.

Perhaps this is what the laugh track has morphed into in a century when it finds itself increasingly absent from its former comedic home. No longer is piped-in laughter prompting audiences to laugh; instead, this function is often performed by rapid cuts of scene that are accompanied by music, or—in the case of Adult Swim’s Robot Chicken—literal static. Oftentimes, when these sorts of punctuating devices are used, we think we are laughing at the preceding punchline. But is it possible that we are actually laughing more so in response to, or “at,” the static?

In this chapter, I propose that hearing harmonic function in tonal music works in much the same way. Harmonic function is often colloquially invoked as something that inheres in individual chords, or point-like musical entities. This has become somewhat of a pedagogical convention: students are asked to perform Roman numeral analyses of (usually homophonic) music, and every chord is neatly outfitted with its own numeral and associated function. I want to push back against this widely ingrained notion of harmonic function and consider it instead as something that pertains to spans of music and relations among intervallic collections (the
latter being my alternate term for “chord”). This means considering harmonic function as more of a retrofitting than an instantaneous outfitting: much like the transition music or the static that prompts us to laugh in post of the punchline proper, the way that an intervallic collection (henceforth “IC”) is followed is what retroactively gives it much of its perceived sense of function.

Of course, this is not to discount the fact that the way an IC is preceded—much like the setup of a joke or punchline—also contributes to that IC’s perceived sense of function. Indeed, harmonic function is something I like to call “two-tailed,” in that an IC’s functional identity can be regarded as the sum total of how it is approached and how it is left. Much of the time, these two tails align. Cadential dominants preceded by ii₆ (or ii6/5, or IV, etc.), for instance, are approached like dominants and left like dominants (provided they resolve to some tonic-functioning harmony). Dominants preceded by their own (secondary) dominant, however, are approached like tonics and left like dominants, which can lead to some confusion as to how secondary dominants function in general, not to mention some initial confusion about the functional identity of the dominant itself. However—and this is the larger point—such initial confusion is immediately cleared up upon the resolution of that dominant to tonic. This demonstrates that while the context in which an IC initially appears can trigger very specific predictions about how it might function, this functional identity is not fully determined,

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2 This is closer to the way harmonic function is framed in the corpus-based approach of White and Quinn, “Chord Context and Harmonic Function in Tonal Music” (2018).
confirmed, or revised until that IC is followed by another. Therefore, function is something that is at least partially back-projected onto harmonies, and for this reason, it represents another form of cognitive misattribution that is widespread in musical thinking: treating something that pertains to a relation as if it pertained to an entity (and further yet, treating that thing as if it inhered in the entity the second it sounds).

Harmonic functions, just like scale degrees and consonance/dissonance, are examples of musical qualia, which I have been framing as “misattributions that originate in limbic responses to expectation.” This means that harmonic-functional apperceptions derive from implicit statistical learning processes and reflect expectational/predictive judgments about how ICs tend to behave in particular cultural and stylistic contexts. My account of harmonic function in this chapter follows logically from my account of scale degrees in Chapter 2. If scale-degree qualia describe what “happens” when one groups a series of sounding pitches based on what it is like to hear these pitches in context (i.e., as intervals relative to an organizing focal point), then harmonic function qualia describe the related, higher-level process of grouping a series of sounding intervals based on what it is like to hear these intervallic collections in context (i.e., as intervallic successions relative to that same focal point).

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3 This is especially the case when one is still in the midst of the tonic-finding process, whether at the very beginning of a piece or during its moments of tonal flux within. Without an anchoring tonal frame within which to place and contextualize sounding musical events, listeners must work to create one themselves, and this engages the back-projective logics of inductive reasoning more heavily than do those moments in which a frame is already established. I will return to this distinction between “finding” and “monitoring” tonality (which extends Danuta Mirka’s notions of “finding” and “monitoring” meter) in the next chapter. [See Mirka, Metric Manipulations in Haydn and Mozart: Chamber Music for Strings, 1787–1791 (2009), p.22.]

But what may seem less logical, at least on the surface, is my account of the “stuff” of harmonic function. I want to take seriously in this chapter the controversial possibility that harmonic function may not actually be about “harmony” at all—insofar as this refers to the conventional/colloquial sense of the term as a vertical abstraction tied to a static concept of “chord.” Rather, I want to argue that harmonic function emerges from the interaction of generic scalar position (x) and metrical position, and thus, that it is more about (colloquial) “melody” and meter than it is about harmony or chords. In other words, harmonic function is a product of both scale-degree content and temporal context, and as we will see, this view triangulates the recent scholarly tendency to conceive of function (and classify functional theories) in terms of one or the other pole.⁵

**Annals of a Floating Signifier (I)**

“Harmonic function” is one of those unfortunately versatile terms that has been used so often, and in so many different contexts, that it is exceedingly difficult to pin down a precise definition. As David Kopp laments, “In our time, any search for a commonly accepted definition of function will be frustrated, for the meaning of the word has proved adaptable to support a wide variety of statements concerning harmon[ic] meaning and action […] Yet we use it as if its meaning were fixed and intuitively evident.”⁶ Kopp then goes on to list at least

⁵ Of course, this tendency is not exclusive; see [http://openmusictheory.com/harmonicFunctions.html](http://openmusictheory.com/harmonicFunctions.html) for an account of function that centers the interplay of content (i.e., a chord’s “internal characteristics,” or “the notes that belong to it”) and context (“the chords that tend to precede and follow it, and where it tends to be employed in the course of a musical phrase”).

seven competing definitions of harmonic function, linking the concept at once to individual scale degrees,\(^7\) to representative Roman numerals,\(^8\) to phrase-structural syntax,\(^9\) and to the “intrinsic potentiality” of certain chords to progress in certain ways (among other accepted meanings).\(^{10}\) What makes things even more complicated, according to Kopp, is that “we commonly associate an idea of function with the thought of many theorists of common-practice tonality, and regularly identify the presence of ‘function’ in theory which significantly predates the introduction of the formal concept” by Hugo Riemann in his *Vereinfachte Harmonielehre* of 1893.\(^{11}\) In other words, the concept of harmonic function is frequently subject to the biases of “presentism,”\(^{12}\) to borrow a term from Thomas Christensen, in that it is often projected backwards onto pre-Riemannian thought and read into earlier theories of harmony where it did not yet exist as such.

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\(^{12}\) Christensen, “Music Theory and Its Histories” (1993), *passim*. 
The root-motion theories of Jean-Philippe Rameau, for example, are commonly cited as an origin point for harmonic-functional thought. Because Rameau was the first to use the terms tonic (tonique), dominant (dominante), and subdominant (sous-dominante), he is often credited with anticipating many of the ideas about harmonic function that would crystallize over a century and half later in the writings of Riemann. But while these terms, on the surface, may seem to align with Riemann’s three principal functions (drei Hauptfunktionen), they connote very different things for each theorist. For Riemann, these labels describe immanent properties of chords themselves; for Rameau, on the other hand, they describe connections/progressions among chords. As Kopp writes to this point, “Riemann’s functions inhere as tonal meanings in individual chords; they do not determine action from one to the next.”

In the middle of the temporal chasm separating Rameau and Riemann lies another strain of music-theoretic thought typically regarded as “proto-functional”: the Stufentheorie ([scale]-degree theory) tradition whose representatives include Johann Philip Kirnberger. For a succinct chapter-length discussion of these treatises and their place in Rameau’s oeuvre, Joel Lester’s “Rameau and Eighteenth-Century Harmonic Theory” (2002) is a good resource.

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13 Rameau’s early treatises tend to be marshaled as evidence for this claim, particularly Traité de l’harmonie (1722), Nouveau système de musique théorique (1726), and Génération harmonique (1737). For a succinct chapter-length discussion of these treatises and their place in Rameau’s oeuvre, Joel Lester’s “Rameau and Eighteenth-Century Harmonic Theory” (2002) is a good resource.

14 More specifically, tonique names a freedom to progress by any acceptable interval of the fundamental bass, whereas dominante is associated with progression by descending fifth, and sous-dominante with progression by ascending fifth.


16 See in particular Volume 1 of Kirnberger’s Die Kunst des reinen Satzes (1774), pp.15–19, which may contain the earliest documented usage of Roman numerals put in the service of musical analysis.
Georg Joseph Vogler, Gottfried Weber, and Simon Sechter. Weber is often taken to be the paradigmatic figure in this lineage, even though he was not the first to use Roman numerals. Though Stufentheorie is heavily indebted to Rameauvian ideas, it parts company with Rameau’s root-motion theories (and differs from Riemann’s mature Funktionstheorie) in that it considers individual scale degrees, not extrinsic relations/progressions among chords (or chords themselves), to constitute the brass tacks of harmony. For these theorists, chords are identified by the scale degrees on which they are rooted, and Roman numerals accomplish this task. Therefore, what is most important about chords, to Stufentheorists, is “their participation and position in a key, not their relation to each other or their tendency to progress.”

17 Representative works include Vogler’s Tonwissenschaft und Tonsezkunst (1776), his Grunde der Kuhrpfälzischen Tonschule (1778), and his Handbuch zur Harmonielehre (1802). For more on Vogler’s life and teachings, see Grave and Grave, In Praise of Harmony: The Teachings of Abbé Georg Joseph Vogler (1987).

18 The classic work is Weber’s Versuch einer geordneten Theorie der Tonsetzkunst (1817–21), which popularized the method today known as “Roman numeral analysis” (and is sometimes erroneously cited as inventing this method outright).

19 See especially Sechter, Die Grundsätze der musikalischen Komposition (1853–54) and Die Richtige Folge der Grundharmonien (1854). William Caplin’s Classical Form (1998) regards Sechter’s former treatise to be “the first comprehensive formulation of [Viennese] Stufentheorie” (261); a similar pronouncement is made in Wason, Viennese Harmonic Theory from Albrechtsberger to Schenker and Schoenberg (1985), p.33.


21 While Vogler (and sparingly, Kirnberger before him) used Roman numerals to label tonally situated chord roots, it was Weber who first introduced the convention of using uppercase and lowercase Roman numerals to indicate a chord’s quality.

way, while I, V, and IV nominally map onto tonique, dominante, and sous-dominante, respectively, Rameau’s labels connote action, whereas the former numerals used by Weber et al. connote identity and membership. Scale-degree theories also differ from Riemann’s theories of chord progression (Harmonieschritte) in that the latter are formulated as key-agnostic. According to Kopp, Riemann “makes this clear in an impassioned refutation of Weber’s Roman numeral notation, arguing for an essential identity of individual chord progression types existing independently of the character which they take on in the context of a key.” This makes Riemann’s Harmonieschritte less of a “harmonic” theory and more of a “contrapuntal” one, according to a recent distinction proposed by Ian Quinn (though Quinn would probably classify Riemann’s separate Funktionstheorie differently).

To summarize the preceding, no music theorist explicitly mentions harmonic function by name until Riemann in 1893, but this has not stopped later theorists and historians of theory from imputing proto-functional intentions to figures as diverse as Sechter, Weber, and Rameau. While none of these earlier figures actually sets out to propose a theory of harmonic function, traces of their insights are nevertheless palpable in many of the competing definitions of

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23 Ibid., [9]. For the original “impassioned refutation,” see Riemann, Katechismus der Musikästhetik (1890), p.65.

24 See Quinn, “Tonal Harmony” (2019), passim. According to Quinn, “Contrapuntal laws are those that operate independently of a controlling tonic and can be expressed without recourse to a scale-degree concept,” whereas “[h]armonic laws are those that describe the ways in which a tonic exerts its control and must be expressed in terms of scale degrees” (469, emphasis in original).

25 As Quinn writes, “Function theories and scale-degree theories have in common the principle that a chord’s tendencies depend on the scale-degree identity of its members, or at least of its root”; both are thus dependent on “harmonic,” rather than “contrapuntal,” laws. [Quinn, “Tonal Harmony” (2019), p.468.]
harmonic function in use today. The recent history of the term “harmonic function” is therefore one rife with presentism and confirmation bias. As we are beginning to see, it is fundamentally a story about misattribution—in many senses of the word.

Annals of a Floating Signifier (II)

So how do the music theorists of more recent generations sort through this multiplicity of definitions? Many attempt to impose a sense of order on this growing chaos through acts of classification—by drawing typological distinctions that separate different strands of thought about harmonic function and their roles in broader theories of tonal harmony. Different scholars have slightly different ways of doing this, but in general, there exists a broad degree of categorical overlap among their schemes. For Kopp, there are three major strands of thought, represented by the paradigmatic case studies of Rameau, Weber, and Riemann. 26 This tripartite scheme is mirrored exactly in a later article by Dmitri Tymoczko, which “considers three theories that have been used to explain tonal harmony: root-motion theories, scale-degree theories, and function theories.” 27 While Tymoczko cites the same representative trio of figures as Kopp, 28 he also problematizes the rigidity of such a scheme, assuring the reader that he is aware of its limitations: “Historians may well feel that I am drawing overly sharp distinctions between root-motion, scale-degree, and functional theories. Certainly, many theorists have


28 He does not, however, cite Kopp himself.
drawn freely on all three traditions. (Rameau in particular is an important progenitor of all the theories considered in this paper.) The upshot is a familiar one: neat typologies can make a messy smattering of data points easier to understand, but at the cost of creating apparently siloed narratives that downplay the roles of intellectual influence, lineage, and exchange—all of which cut across typological borders.

Eytan Agmon proposes a tripartite model that is slightly different, laying out an opposition among *Stufentheorie*, *Funktionstheorie*, and a third approach that “emphasizes hierarchical structure and voice leading.” Root-motion theories are absent from this model, instead replaced by a Schenkerian strand that centers voice-leading activity and prolongational scale-step motion. Brian Hyer, writing a few years later, posits a binary distinction between “the function theories of Rameau and Riemann on the one hand and the scale-degree theories of Gottfried Weber and Schenker on the other,” effectively turning the three-pronged classification systems of Kopp, Tymoczko, and Agmon into a two-pronged one that makes room for all of their paradigmatic category representatives. But Hyer, like Tymoczko, is careful to invoke his heuristic scheme *historiographically*, not historically: as a means to characterize the state of the discourse surrounding theories of functional tonality, not as a way to make

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29 Tymoczko, “Root Motion, Function, Scale-Degree: A Grammar for Elementary Tonal Harmony” (2003), pp.36–37. By “treating these three theories in isolation,” Tymoczko further clarifies, his goal is not “a historical one,” but rather “to see how well we can explain the most elementary features of tonal harmony on the basis of a few simple principles” (36–37). Additionally, his discussion of root-motion theories is less centered on Rameau and more on a then-recent article by Nicolas Meeus, “Toward a Post-Schoenbergian Grammar of Tonal and Pre-Tonal Harmonic Progressions” (2000).


claims about individual historical actors and their intentions. Hyer also does not treat his categories as mutually exclusive, acknowledging that many tonal theories can be understood as “a hybrid of both.”

This seems to be the case: that theorists’ conceptions of harmonic function often merge aspects of multiple categories mentioned in the previous two paragraphs—even the ones they themselves typologize as separate. Agmon’s own theory of harmonic function, for instance, is a self-described hybrid, maintaining some key continuities with Riemannian *Funktionstheorie* while also remaining “compatible with a hierarchical [i.e., Schenkerian] approach.” Willi Apel’s article on function in the second edition of the *Harvard Dictionary of Music*, similarly, links the concept with notions of scale-step prolongation, thereby combining aspects of *Stufentheorie* with Schenkerian voice-leading theory. And Kevin Swinden’s claim that “[c]haracterizing bass-line patterns are the primary determinants of harmonic function” integrates considerations of bass motion (not necessarily root motion), characteristic scale steps, and the properties of the Tonnetz into a single Gestalt. Definitions such as these demonstrate just how porous the aforementioned categorical boundaries can be in practice. And this is precisely the larger

32 Ibid.


point: that basically all theories of harmonic function are hybrids of some sort, not just because of the fundamental intellectual interconnectedness of music-theoretic thought over time, but also because of the fundamental experiential interconnectedness of musical domains—such as melody (qua scale degrees), counterpoint, harmony (qua chords), and meter—that are often strategically posited as separate.

**Content and Context**

Despite this interconnectedness, however, much of the scholarship on function over the last decade has been structured by another binary that is often framed as oppositional: either harmonic function is a matter of chord content (i.e., its scale-degree makeup), or it is a matter of chord context (i.e., its conventions of usage). After surveying some of this relevant literature (and speculating on the origins of this binary framing), I then ask a simple question: why can't it be both?

In Chapter 4 of his 2013 Ph.D. dissertation, Christopher White claims that “[h]armonic function depends upon a chord’s content and/or context, and functional categorizations can either emphasize the former or the latter.” White eventually proposes that harmonic function can be understood entirely under the aegis of the latter. Using a Hidden Markov Model (HMM), an algorithm “that identifies contextual categories of objects within streams of observations,” White argues that “a purely contextual model—i.e., one that does not take a chord’s pitch or scale-degree content into consideration—is sufficient to create functional chord classes within

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[the] corpus [of Bach chorales].” This chapter was later turned into an article, co-authored by Ian Quinn, that doubles down on the content/context binary and makes an “aggressively data-driven” case for the latter by applying the HMM to two more corpora in addition to the Bach chorales: the Kostka-Payne corpus and the McGill Billboard corpus. This article is even more explicitly structured around the opposition between content and context. In its literature review, White and Quinn make the distinction up front between “two ways of defining harmonic functions: context-driven approaches are concerned with chords’ usage, and content-driven approaches are concerned with chords’ scale-degree constituents.” They cite Daniel Harrison and Fred Lerdahl as two theorists whose conceptions of harmonic function are aligned with the “content” pole, and Drew Nobile as one aligned with the “context” pole.

37 Ibid.

38 White and Quinn, “Chord Context and Harmonic Function in Tonal Music” (2018), p.314. The Kostka-Payne corpus is comprised of all the musical examples included in the instructors’ edition of Kostka, Payne, and Almén’s Tonal Harmony, with an Introduction to Twentieth-Century Music (2012). The McGill Billboard corpus, on the other hand, is comprised of 649 randomly chosen songs that appear on the Billboard “Hot 100” list sometime between 1958 and 1991.

39 Ibid., p.315 [emphasis in original].

40 Harrison, Harmonic Function in Chromatic Music (1994), particularly Chapter 2, which links harmonic function with the notion of “scale-degree assemblies.”

41 Lerdahl, Tonal Pitch Space (2001), particularly pp.214–31. According to White and Quinn (2018), Lerdahl “derives function from the placement of pitches and chords within a tonal hierarchy” (315)—what Lerdahl calls the “basic space.”


The work of Nobile—which is not corpus-based, and which deals primarily with pop/rock music—deserves further mention. His is another recent voice that leverages the content/context binary to make the claim that harmonic function is purely about syntax. As he argues, “A theory of harmonic function rooted in chord category—e.g., ascribing dominant function to any chord related to V—inadequately accounts for rock’s harmonic organization”; instead, he advocates for a “syntactical definition of harmonic function such that function is acquired not by a chord’s scale-degree content but by its role in the context of a song’s form.” For Nobile, then, form does not merely follow function (as the cliché goes); oftentimes, in rock music, form is function.

Alongside the guiding content/context binary, Nobile also employs a tripartite classification scheme to organize the kinds of definitions of harmonic function typically used in music theory. These are “function-as-category” (i.e., “what kind of chord is this?”), “function-as-progression” (i.e., “what other chord[s] does this chord want to proceed to?”), and “function-as-syntax” (i.e., “what role does this chord play in its musical context?”). We might imagine these three conceptions of harmonic function as existing on a continuum from the most content-based (function-as-category) to the most context-based (function-as-syntax), with function-as-progression lying somewhere in between. Importantly, Nobile notes that these conceptions often tacitly cross-pollinate in common-practice definitions of harmonic function.

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45 This is a foundational assumption in Nobile’s recently published book, Form as Harmony in Rock Music (2020).

As he writes to this point, “[C]ommon-practice theorists rarely if ever use function-as-syntax without also employing function-as-category”\(^{47}\); similarly, “Function-as-progression often [also] presupposes function-as-category, as when tonic, subdominant, and dominant categories are said to arrange themselves in the paradigmatic progression T–S–D–T.”\(^{48}\) Nobile brings up these implicit entanglements to argue that a purely contextual/syntactical conception of harmonic function, particularly in the common-practice literature, is hard to come by.\(^{49}\) But while his goal in writing—to advance such a conception—is nominally similar to White’s,\(^{50}\) these two authors sometimes differ widely on how to classify certain theories of their predecessors.

\(^{47}\) Ibid., p.151. This implicit linkage, Nobile argues, is not transferrable to pop/rock contexts, where it is rather common for chords unrelated to V (such as ii, IV, or bVII) to take on dominant function.

\(^{48}\) Ibid., p.153. This pattern is often regarded as the quintessential marker of functional tonality. Riemann offers an early argument for the primacy of this pattern in his *Grosse Kompositionslehre, Volume 1* (1902), p.33. Later theorists have taken up this T–S–D–T succession and called it different things, from a basic “four-place pattern” (Guck, “The Functional Relations of Chords: A Theory of Musical Intuitions” [1978], p.34) to a standard “phrase model” (Laitz, *The Complete Musician* [2016], pp.273–76) to an “expanded cadential progression” (Caplin, *Analyzing Classical Form* [2013], pp.374–75).

\(^{49}\) He cites Kopp’s “phrase-based syntactical meaning” formulation (which itself cites an illustrative passage from Aldwell/Schachter’s *Harmony and Voice Leading* [1989]) as perhaps the only qualifying definition in the literature. [See Kopp, “On the Function of Function” (1995), p.1.] It is to be noted, however, that what Kopp finds to be “phrase-based” about Aldwell and Schachter’s (1989) conception of function—namely, their distinction between “opening” and “closing tonic[s]” (84)—is also present in Marion Guck’s earlier article “The Functional Relations of Chords: A Theory of Musical Intuitions” (1978), which reformulates Riemann’s T–S–D–T as “T1–P–D–T2” (34).

\(^{50}\) I say “nominally” because White’s more zoomed-in, local-succession–based conception of “syntax” may strike some readers as partaking nontrivially in Nobile’s “function-as-progression” category. Nobile’s own conception of “syntax,” on the other hand, is more macroscopic in orientation.
Take Lerdahl’s theory of harmonic function, for instance. Nobile regards it as “the most explicitly syntactical [function theory] in the common-practice theoretical literature,” claiming that Lerdahl “eschews function-as-category definitions and constructs a functional model that identifies chords’ roles in their musical context.” But White, on the other hand, classifies it as a “content-driven approach” (despite its surface appearance as syntactical), because of Lerdahl’s reliance on tonal hierarchies as measures of pitch/chord stability. As White and Quinn argue to this point, “What seems like a context-oriented function is, in fact, tethered to an elaborate and precisely determined notion of a hierarchical pitch space.”

But why must an ideal theory of harmonic function be purely about context, as opposed to content, when so many preexisting conceptions of harmonic function—as Nobile and White each point out in their own way—implicitly bake in elements of both? Could it be that this recent turn to context-exclusive definitions is symptomatic of a broader overcompensatory trend in music-theoretic thought: to be more attentive to matters of context (whether musical, historical, cultural, or otherwise) in the wake of musicology’s contextual turn of the 1980s and 1990s? Some may find this hypothesis of a delayed/indirect ripple effect across subdisciplines to be intriguing and suggestive; others, however, will probably find it somewhat of a stretch. I

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52 Nobile, “Harmonic Function in Rock Music: A Syntactical Approach” (2016), p.155. He goes on to note one exception: “The only function that contains explicit function-as-category elements is T, which is defined based on Lerdahl’s ‘tonic-finding rule’ (essentially a measure of pitch stability)” (155).


54 Ibid., p.316.
want to propose an alternative explanation: that some music theorists were already framing tonal context and tonal content in “either/or” terms as early as the 1980s.

This strain of scholarship arose as a response to the work of Carol Krumhansl, who observed empirically that different tones in a key afford different hierarchical levels of perceived tonal stability. More specifically, the tonic pitch is typically judged as the most stable, followed by the remaining members of the tonic triad, then the remaining members of the diatonic (major) scale, and finally the remaining members of the chromatic octave (in that order and according to those clusters). Krumhansl’s work was widely influential, but as I will discuss at greater length in the next chapter, it was also sometimes misunderstood. Indeed, her pioneering experiments precipitated some heated debates regarding which aspects of tonality are the most perceptually salient, and David Butler would emerge as her most vocal challenger. Butler frames his theory of “intervallic rivalry” as a foil to Krumhansl’s work in nearly every way: it is dynamic, relational, and sensitive to temporal and musical contexts.

See in particular Krumhansl and Shepard, “Quantification of the Hierarchy of Tonal Functions Within a Diatonic Context” (1979), which introduced the now-famous probe-tone method.

See Krumhansl and Keil, “Acquisition of the Hierarchy of Tonal Functions in Music” (1982), p. 244, for a graphical representation of this tonal hierarchy for major keys.

See the following trio of articles for their brief but contentious back-and-forth: Butler, “Describing the Perception of Tonality in Music: A Critique of the Tonal Hierarchy Theory and a Proposal for a Theory of Intervallic Rivalry” (1989), Krumhansl, “Tonal Hierarchies and Rare Intervals in Music Cognition” (1990), and Butler, “Response to Carol Krumhansl” (1990). Butler’s (1989) position is that “listeners recognize the tonal center in tonal music on a best-evidence basis, and the clearest evidence is carried in the rarest-occurring intervals in the diatonic set” (219). This aligns his theory with Richmond Browne’s earlier notion of “position finding,” according to which comparatively rarer intervals (like tritones and minor seconds) reveal more information about tonal positioning than do more common intervals (like fifths and thirds), “which could hold any number of places in a diatonic field.” [Browne, “Tonal Implications of the Diatonic Set” (1981), p.7.]
whereas Krumhansl’s tonal hierarchies are (allegedly) static, fixed, and not sensitive enough to contextual factors.\textsuperscript{58} While Krumhansl does eventually defend herself and clarify her position, attempting to bring her and Butler’s theories into more of a “both/and” relationship,\textsuperscript{59} the Butler-inspired “either/or” rhetoric still persists in subsequent theories of tonal perception (though with considerably less hostility).

Perhaps the first scholar to explicitly frame this debate in terms of an opposition between “content” and “context” is Helen Brown in her 1988 article “The Interplay of Set Content and Temporal Context in a Functional Theory of Tonal Perception.”\textsuperscript{60} Her empirical findings indicate that “perception of tonality is too complex a phenomenon to be explained in the time-independent terms of psychoacoustics or pitch-class collections, [and] perceived tonal relationships are too flexible to be forced into static structural representations.”\textsuperscript{61} Brown thus argues for the primacy of temporal context over pitch-class–set content—and though she is

\textsuperscript{58} See especially Butler, “Describing the Perception of Tonality in Music: A Critique of the Tonal Hierarchy Theory and a Proposal for a Theory of Intervallic Rivalry” (1989) and Butler and Brown, “Describing the Mental Representation of Tonality in Music” (1994). An important precursor to Butler’s 1989 article is Butler and Brown, “Tonal Structure versus Function: Studies of the Recognition of Harmonic Motion” (1984), which posits the same basic binary distinction but does not yet use the term “intervallic rivalry.”

\textsuperscript{59} See in particular Krumhansl, “Tonal Hierarchies and Rare Intervals in Music Cognition” (1990); the most explicit attempts at rapprochement are on pp.309 and 317. The vitriol seems to have cooled by the publication of Brown, Butler, and Jones, “Musical and Temporal Influences on Key Discovery” (1994), which frames tonal hierarchy and intervallic rivalry not as oppositional models, but as compatible ones.

\textsuperscript{60} This article is based on her earlier Ph.D. dissertation, “The Effects of Set Content and Temporal Context in Musicians’ Aural Perception of Tonality” (1985), written at Ohio State University.

discussing the broader phenomenon of tonal hearing, she frames her claim in a manner that is closely mirrored by the later argumentative formulations of Nobile and White/Quinn discussed above. While these latter authors do not actually cite Brown's study in their respective articles, traces of her influence can nevertheless be felt throughout their work.

**Moving Away from “Chord”**

As I have hinted previously, my conception of harmonic function will consider how aspects of scale-degree content (particularly \(x\)) and aspects of musico-temporal context (particularly \([hyper]meter\)) can interact to produce sensations of tonal vectoredness in enculturated listeners. But before rolling out this conception in full, it is first necessary to situate my main terminological intervention—the substitution of “intervallic collection” (or “IC”) for “chord”—alongside those other theorists whose ideas of function are unsutured from conventional notions of “chord.”

I begin with Daniel Harrison’s aforementioned book, which from the outset declares a vested “interest in having function and chord regarded as separate things.”\(^{63}\) His overarching contention that harmonic function inheres in scale degrees seems to paint his theory as a successor to the Stufentheorie tradition. There is, however, a crucial difference. Stufentheories link harmonic-functional behavior with scale degrees—but only insofar as these scale degrees are understood as roots of chords. Harrison’s theory, on the other hand, pushes back against

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\(^{62}\) White does, however, cite Brown’s article in his dissertation—and multiple times. But none of these occurs in his chapter on harmonic function, where he first introduces the content/context distinction.

this notion that a chord is a singularity (and that its scale-degree root is its synecdochic essence), instead assigning different functional roles to different triadic members. And so, on top of triadic roots (which he terms functional “bases”), triadic thirds (functional “agents”) and fifths (functional “associates”) also take on unique and distinct functional responsibilities.64 What gives agents their “agency,” for example, is the fact that they are prime movers in the voice-leading dimension of harmonic function—a dimension that Harrison refers to in terms of “functional discharge.”65 As he argues to this point, “All agent discharges are to one of the two other functional elements—base or associate.”66 Fig. 4.1 below provides a simple illustration of this principle.

Fig. 4.1: The patterned, systematic voice-leading behavior of functional agents (i.e., triadic thirds)

Harrison’s theory of scale-degree assemblies inverts the old Aristotelian adage that the whole is greater than the sum of its parts. Rather, under this conception of harmonic function, the sum of a chord’s scale-degree “parts” is at the very least equal to, if not (in a sense) greater than, the “whole” of the chord—insofar as such a chord is understood as a unified

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64 Ibid., pp.46ff. These roles hold regardless of chordal inversion.

65 Ibid., pp.90ff. This topic is central to Chapter 3 of the book, “Establishment, Discharge, and Chromatic Behavior of Functions.”

66 Ibid., p.96.
“synergism” represented by its root. Such a conception represents a new take on Stufen-theorie that frees it from its prior dependency on harmonic verticality and its privileging of chordal roots. But Harrison’s theory still does privilege one particular type of chord—the triad—in the rollout of his functional apparatus, and this leads to the assumption that only certain specific configurations of scale degrees can participate in properly “functional” behavior. It also perpetuates a distinction between triadic members (as colloquially “harmonic” tones) and triadic nonmembers (as “nonharmonic” tones) that indirectly reinforces and upholds a form of the very same chord-concept that Harrison seeks to eschew.

One particular strain of subsequent scholarship, spearheaded by Quinn and White (writing both separately and together), actively seeks to challenge this assumption and problematize this distinction. Its inception comes in a 2010 article on key-finding by Quinn that begins with a radical redefinition of what constitutes a “chord.” As he writes, “Our sense of the word ‘chord’ will differ substantially from its ordinary pedagogical usage, referring [instead] to a snapshot of all pitch-classes sounding at any given moment”; the result is a “radically localized conception” of chord such that “every time a new note sounds, a new chord is identified.” A few consequential things result from this. First, there are no “restriction[s] on what can constitute a chord; the model knows no distinction between consonance and dissonance, diatonic and chromatic, tertian and quartal,” and so on. Second, as a result of this, Quinn’s

\[\text{Ibid., p.43.}\]

\[\text{Quinn, “Are Pitch-Class Profiles Really ‘Key for Key’?” (2010), p.152.}\]

\[\text{Ibid.}\]
model dissolves the “distinction between chord tones and non-chord tones,” effectively arguing that no tone can be called “nonharmonic” if there exists no \textit{a priori} notion of what a “harmony” is (or should be) in the first place. And third, because chords are no longer regarded as abstractions that have an idealized form, there need not exist the concept of “root.” Instead, chords are “characterized with reference to the bass [i.e., lowest sounding] voice,” with any upper parts “identified in terms of their intervallic relationship to the bass.”

Quinn leverages this new concept of “chord” to claim that mere transitions/progressions from one to the next are “sufficient as windows for key-finding,” in effect arguing against the reductionism of pitch-class profiles as key-finding aids. He demonstrates the empirical utility of this claim through a model that “is able to reach an almost stunning degree of subtlety in its harmonic analysis of chorales it’s never heard before,” despite its not being programmed to know any explicit information about chord progressions other than their “transpositional distribution[s] in the training corpus” (to say nothing of the model’s ignorance of conventional concepts such as triad, key, tonic/dominant/subdominant, and the like). While the main objective of Quinn’s model is to determine the key of a passage, one of its most interesting fallouts is its suggestive potential to frame harmonic function as emerging from the

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\textsuperscript{70} Ibid.

\textsuperscript{71} Ibid., p.153.

\textsuperscript{72} Ibid., p.151.

\textsuperscript{73} Here Quinn is specifically referring to the key-finding procedure developed by Carol Krumhansl and Mark Schmuckler that is laid out in Krumhansl’s \textit{Cognitive Foundations of Musical Pitch} (2001).

\textsuperscript{74} Quinn, “Are Pitch-Class Profiles Really ‘Key for Key’?” (2010), p.151.
interaction/relation between successive “time-slice[s]”  

This would be the rationale behind a conference paper by Quinn and Panayotis Mavromatis from the following year. Their corpus study retains the “time-slice” notion of “chord” (though it never actually uses the former term) and investigates whether harmonic-functional information can be read out of the voice leading between adjacent such chords. By performing a cluster analysis on the wide variety of voice-leading types (or “VLTs”) that connect adjacent chordal “slices,” they are able to empirically confirm their hypothesis that such VLT clusters “are bound together by principles related to harmonic function,” despite not “building into the[ir] model any assumptions about harmonic function.” They also find that syntactic differences exist between their two chorale corpora, which demonstrates that harmonic function is a stylistically contingent phenomenon that manifests itself differently in different musical idioms.

These particular insights—that harmonic function is corpus-dependent, that it can exist even in the absence of traditional notions of “chord,” “triad,” or “root,” and that it can be modeled in terms of the relationship between successive musical “slices”—become major insights.

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75 Ibid., p.152.


77 Ibid., p.239.
themes in the work of White, who began developing his dissertation topic under Quinn at the same time as Quinn’s aforementioned work in this area. Indeed, as White argues in the opening chapter of his dissertation, any model that “depends on [a] corpus for its own identity” must necessarily be “fettered to that corpus’ culture, style, time, and place.” Subsequent works by White reiterate this theme; many of them touch at least tangentially on the demographic relativity of harmonic-functional behavior. In addition, as I have already mentioned earlier, White’s dissertation advances a context-based conception of harmonic function that is neither beholden to the scale-degree makeup of sonorities nor sutured to a triadic chordal ideal. “Since a chord’s content does not influence its participation in the model,” White writes in reference to his Bach-chorale corpus, “non-tertian harmonies that consistently act in predictable ways can participate in functions. Since [027] often intercedes between tonic chords and dominant chords, the model judges it to be a predominant chord.” Fig. 4.2 below illustrates:

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79 See in particular White, “Changing Styles, Changing Corpora, Changing Tonal Models” (2013), which contends that “chord-progression norms are connected to specific historical situations” (244); White, “A Corpus-Sensitive Algorithm for Automated Tonal Analysis” (2015), which prioritizes a methodological “sensitivity to the characteristics of individual repertories” (115); and White and Quinn, “Chord Context and Harmonic Function in Tonal Music” (2018), which argues explicitly against “assuming the universality of one functional system” (314).

White adopts Quinn’s “time-slice”\(^8\) method throughout but refers to its products as “salami slices” instead.\(^8\) This culinary neologism would soon replace its less tasty predecessor in subsequent scholarly works that leverage this looser conception of chord to make claims not just about harmonic function, but also about related concepts like key finding, voice leading, meter, part writing, and the statistical regularities of tonal praxes.\(^8\)

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82 White, “Some Statistical Properties of Tonality, 1650–1900” (2013), pp.141ff. White links this latter term with Quinn’s 2010 article, even though it never actually appears within. The authors later clarify that the term “is a homage to György Ligeti, who described first conceiving his 1968 harpsichord piece *Continuum* as ‘a paradoxically continuous sound […] that would have to consist of innumerable thin slices of salami’ due to the characteristic envelope of a note played on the harpsichord.” [White and Quinn, “The Yale-Classical Archives Corpus” (2016), p. 57; for the original Ligeti quote, see Várnai et al., *György Ligeti in Conversation* (1983), p.22.]

I treat harmonic function in this chapter in a way that is sensitive to many of these more recent strands of discourse, but not reducible to any one of them. While function does depend on a sonority’s scale-degree makeup, particularly in Western tonal musics, this dependence is not evenly distributed between $x$ and $y$. I have already begun to unravel this relationship in my Chapter 2 discussion of “Body and Soul,” where I isolate a moment of ambiguity in which $x$ and functional category change together while $y$ and $z$ remain fixed across interpretations. Later in this chapter, I probe the reverse side of the coin, isolating a situation in which $x$ and functional category remain constant while $y$ and $z$ differ across modal variants of the same basic progression. In other words, I make the case that changes in $x$ alone (all else being equal) are sufficient to precipitate functional differences in kind, whereas changes in $y$ alone can only produce functional differences in degree. For example, $\{\hat{1}, \hat{3}, \hat{5}\} \rightarrow \{\hat{7}, \hat{2}, \hat{5}\}$ is fundamentally a T —> D progression in (say) ionian, aeolian, and mixolydian alike, but each T —> D succession has a slightly different contextual flavor due to changes in specific modal character ($y$).

But function is far more than something that “resides” in point-like harmonic abstractions, in frozen collectional “snapshots,” or in the individual scale degrees that comprise either of these. Rather, it is an interpretive judgment that pertains to a network of relations: between adjacent sonorities, between those sonorities and a governing tonic, between sonority placement and metrical position, and (more generally) between sounding music and the expectational/predictive capacities of enculturated listeners. Zeroing on the multiply relational nature of “chords,” then, entails more than just reframing a chord as “any simultaneously sounding collection of scale degrees,” as the salami-slicing method dictates.  

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Instead, it requires the acknowledgement that scale degrees themselves are relational entities, because they are understood as intervals relative to a governing tonic. On top of this, the constituents of a sonority also participate in intervallic relations [1] with respect to a sounding bass note, [2] with respect to analogous voice parts in the preceding and following sonorities, and [3] with respect to the other constituents in that same sonority. Quinn has recently formulated an explanatory framework for harmonic succession in tonal music that takes particular stock of this last class of relations: "Rather than treating a chord as a confederation of individual scale degrees, we will consider a chord's tendencies to be the sum of the tendencies of its constituent dyads, since those dyads seem to have very clear tendencies." But this "dyadic interaction framework," as he calls it, prioritizes some of the above intervallic-relational categories over others—caring more about bass notes and following sonorities than it does about governing tonics and preceding sonorities.

As I state earlier in this chapter, I prefer to use the term “intervallic collection” (or “IC”) rather than “chord,” because this former label evokes more desirable associations with relationality and contextual embeddedness. The “I” in “IC” casts an intentionally broad net, being attentive/sensitive to all the various kinds of intervallic relations that are broached in the previous paragraph. Each of these, I argue, can be a potentially potent subcomponent in harmonic-functional judgments, which are always synthetic and holistic, drawing on multiple

\[85\] Ibid., p.476.

\[86\] Ibid., p.480.

\[87\] “IC” is always capitalized to avoid confusion with lowercase “ic,” which is already an established music-theoretic term standing for “interval class.”
sources of musical input, kinds of musical knowledge (mostly implicit, but sometimes also explicit), pathways of expectation, and forms of memory, all at once. Therefore, my principal terminological intervention in this chapter is one of reconciliation, not one of disentanglement (as was the case in Chapters 2 and 3). One could say—and the pun is certainly intended—that my account of function aims to bring several historical and contemporaneous strands of reasoning concerning this topic into closer harmony.

And yet, the irony of this pun is that the essence of harmonic function extends far beyond conventional/colloquial notions of “harmony” and “chord.” Indeed, as I have been arguing—and as I will soon illustrate with some musical examples—harmonic function arises when certain generic scalar positions are temporally/metrically configured in ways that reflect their typical conventions of usage within a historically situated corpus. I am certainly not the first scholar to link harmonic function with rhythm and meter, or to frame functional sensations as qualia that are contingent on one’s exposure to particular repertoires. But what makes my account unique is my view that functional qualia can be understood as subjective misattributions to ICs. Each of these misattributions integrates several moving parts that by now should sound familiar to attentive readers: [1] a judgment about expectation/prediction is framed as a judgment about music, [2] a judgment about musical relations (i.e., successions/progressions among ICs) is framed as a judgment about musical entities (i.e., individual chords in isolation), and [3] a retrofitting (i.e., a back-projection of functional identity onto an IC once

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88 Joseph Swain, for instance, writes that “[h]armonic rhythm, harmonic function, and meter are all intimately related in rather complex feedback relationships.” [Swain, Harmonic Rhythm: Analysis and Interpretation (2002), p.120.] See also White, “What if Harmonic Function is All About Meter?” (2020) for a more recent take on this topic.
that IC is succeeded by another) is framed as an outfitting (i.e., an instantaneous revelation of functional identity that is clear from the moment an IC initially sounds).

**The Numbers Game**

Because harmonic function is something whose nature and specifics vary among individual repertoires, styles, and corpora, there is not a hard-and-fast answer to how many harmonic functions exist in general. But even within individual repertoires, styles, and corpora, as White argues, “There is not as much one ‘correct’ number of functional categories as there are different lenses providing different levels of functional focus.” White demonstrates this insight through a cluster analysis showing that the Bach chorale corpus is comprehensible not only through the lens of the traditional three-function model, but also through the more fine-grained lens of a thirteen-function model. These models, according to White, serve different purposes and are not to be regarded as mutually exclusive. The simpler three-function model, he claims, “might represent a listener’s experience that favors three functions and focuses on tertian sonorities,” whereas the more complex thirteen-function model “might represent expert compositional knowledge.” While White does not rigorously pursue the question of whether

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90 These thirteen functions are named early tonic, medial tonic, late tonic, early dominant, weak dominant, late dominant, weak predominant, medial predominant, strong predominant, vi, applied to vi, applied to ii, and applied to V. Their independent existence confirms White’s initial hypothesis that “the traditional three functions might have disciplined and predictable chord functions embedded inside them.” [White, “Some Statistical Properties of Tonality, 1650–1900” (2013), p.190.]

a listener and/or expert composer actually experiences or thinks about harmonic function along these lines, his study makes a convincing case for “a definition of harmonic function that is not fixed to a particular number of categories, but allows for shifts in quantity depending on the corpus involved and the purpose of the analysis.” He extends this insight further in an aforementioned article with Quinn that considers the applicability of a four-function model to the Kostka-Payne corpus and an eight-function model to the McGill Billboard corpus, despite the fact that these corpora, too, are typically discussed with reference to the traditional three-function model.

A look inside most present-day music theory classrooms will probably give off the impression that the traditional three-function model is alive and well, despite our being more than a century removed from Riemann’s initial promulgation of these functions (and yet another century removed from much of the music that this model seems best to fit/describe). Students continue to learn about tonics, dominants, and pre/subdominants, and to affix sonorities with these labels in one-to-one fashion, as if they were coextensive with that sonority in isolation.

92 Ibid., p.184.


94 These four functions are named tonic (T), pre-predominant (P′), predominant (P), and dominant/pretonic (D/T). “Pre-predominant” might be thought of as the “extra” fourth function here; slightly more than half of this category is comprised of vi triads. The term “pre-predominant” is adopted from Christopher Doll’s 2007 Ph.D. dissertation “Listening to Rock Harmony.”

95 These eight functions split into a central circuit of four functions—named tonic (T), antitonic (S), pre-antitonic/post-tonic (T+), and post-antitonic/pretonic (S+)—and a peripheral circuit of four functions, which itself is split into two pairs labeled Q/P and X/W. Q and P include more extended sonorities (featuring sevenths and ninths) that are influenced by jazz-based harmonic languages and that tend to progress to one another in shuttle-like fashion, whereas X and W mainly include minor-mode sonorities that also tend to shuttle back and forth.
The centrality of homophonic chorale-style music in this curriculum continues to perpetuate the idea that harmonic functions inhere in point-like musical entities, with little attention paid to how harmonic transitions are what actually create emergent sensations of functional behavior. Riemannian ideas are routinely presented to students in ideologically sanitized form, stripped of their metaphysical baggage and their attachment to dualism. This leads to a few notable on-the-ground consequences, such as the usage of “subdominant” as a blanket term that applies to harmonies other than the IV of Riemann’s original formulation (or the ii6/5 of Rameau’s sous-dominante). In addition, it is not uncommon for pedagogues to treat the terms “subdominant” and “predominant” as synonymous (while simply choosing the one they prefer, or even allowing students to use them interchangeably).

These terms are also rather slippery in the scholarly literature, as White and Quinn have noted. Deborah Stein, for example, uses the term “subdominant” to refer to both [1] a

96 This centrality is currently being questioned, however, as evidenced by conversations across the larger music theory community concerning whether chorales are still relevant teaching tools in the twenty-first-century classroom. See, for instance, the Friday evening session from the 2019 Annual Meeting of the Society for Music Theory entitled “Corralling the Chorale: Moving Away from SATB Writing in the Undergraduate Music Theory Curriculum.”

97 While there does exist a nontrivial body of music-theoretic scholarship from the late twentieth century that aims to rehabilitate aspects of Riemannian dualism, from Lewin’s “A Formal Theory of Generalized Tonal Functions” (1982) and “Klumpenhouwer Networks and Some Isographies that Involve Them” (1990) to Harrison’s Harmonic Function in Chromatic Music (1994) and Mathieu’s Harmonic Experience (1997), there are also several vocal detractors to this philosophy. One of the most outspoken voices in this regard is Finn Egeland Hansen, who argues in his 2006 book Layers of Musical Meaning that while “dualistic theories are beautiful and simple, they reflect musical practice so badly that they all must be rejected as useless” (198).

98 See in particular the literature review section of White and Quinn, “Chord Context and Harmonic Function in Tonal Music” (2018), pp.314–16.
“preparation for the dominant” and [2] a “neighboring harmony that prolong[s] the tonic chord.”\(^\text{99}\) Kevin Swinden, on the other hand, advocates for the functional separation of these two meanings, reserving “subdominant” for the latter tonic-prolongational context while referring to the former as “dominant preparation.”\(^\text{100}\) Stein’s (left) and Swinden’s (right) respective conceptions of harmonic function are schematized in the diagrams below.\(^\text{101}\)

![Diagram of harmonic function](image)

**Fig. 4.3:** Conflation of multiple meanings of “subdominant” (left) versus distinction between “subdominant” and “predominant” (right); I adopt the latter scheme throughout this dissertation.

Other theorists have sought to further supplement the traditional triptych of Riemannian functions by distinguishing among certain patterned behaviors that typically fall under the

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\(^{101}\) These diagrams are taken from White and Quinn, “Chord Context and Harmonic Function in Tonal Music” (2018), p.316. It is interesting to note that while Swinden’s perspective distinguishes among four base functions, these do not exactly match the four functions eventually identified by White and Quinn as best fitting the Kostka-Payne corpus. More specifically, there is no equivalent for “pre-predominant” in Swinden’s half of Fig. 4.3 above (this would amount to an arrow pointing from “S” to “P”); instead, S exists solely in a bidirectional (i.e., prolongational) relationship with T, whereas P is vectored unidirectionally towards D (and cannot, by definition, progress back to T).
banner of “prolongation.” Lerdahl, for example, postulates four subordinate functions that prolong the canonical T/S/D identities: departure (Dep), return (Ret), neighboring (N), and passing (P). Given Lerdahl’s particular interest in prolongational structure, it is not surprising that his theory of functions would seek to supply names for more fine-grained nuances in this area. What is more surprising, however, is that there are other theories of harmonic function based in linguistic theories of syntax that actually postulate fewer than the three traditional Riemannian functions. Allan Keiler’s harmonic theory, for instance, also leverages tree diagrams to make claims about the structure of harmonic prolongation. But unlike Lerdahl’s seven-fold functional model, Keiler’s model only has room for two functional categories: tonic and dominant. This has led certain scholars writing in Keiler’s wake to claim that his model oversimplifies the nature of tonal harmony and is insufficiently attentive to its nuance. Marion Guck, for one, writes that “[o]ne cannot apply what is in many essential ways a theory of language to music without misrepresenting—warping—the musical relations.”

A two-function model may indeed seem overly reductive to most present-day readers. But to Keiler’s credit, his harmonic theory captures something fundamental about most all tonal music conceived in the Western tradition: that it is chiefly animated by a predictable relationship between a stable, “home” sonority and another sort of sonority that typically

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103 See in particular Keiler, “The Syntax of Prolongation I” (1977) and “Bernstein’s The Unanswered Question and the Problem of Musical Competence” (1978).

104 Any sonorities that may function in a manner similar to a pre/subdominant, for Keiler, are subsumed into the larger catch-all categories “Tonic Prolongation” and “Dominant Prolongation.”

leads/proceeds to the former. Still, however, there exist a great deal more sonorities that typically occur in such music but that fall outside of the above binary scheme—and this is probably why the “pre/subdominant” category has always been the murkiest and thorniest for theorists and pedagogues alike to pin down. The approaches of White and Keiler might thus be considered opposite poles on a continuum of potential theoretical treatments for this category: the latter erases its presence altogether, whereas the former breaks it up into more subcategories than are accorded to tonic and dominant combined!106

Quinn’s recent model of tonal harmony in the thoroughbass era embraces this contradiction in a distinctive way, essentially de-centering and centering the subdominant at the same time. He begins by “assert[ing] two special collections of scale degrees[:] the two primary triads,” tonic \{1,3,5\} and dominant \{5,7,2\}, and “their complements,” the “antitonic” \{7,2,4,6\} and “antidominant” \{4,6,1,3\} collections.107 He then argues that “[t]he ‘missing’ subdominant is a feature, not a bug: my claim is that what we think of as subdominant function, at least at this early stage of tonality’s consolidation, is an emergent property of the

106 More specifically, the thirteen functions that White posits as applicable to the Bach chorale corpus can be broken up into three T-related functions (early tonic, medial tonic, and late tonic), three D-related functions (early dominant, weak dominant, and late dominant), and seven functions that could potentially fall under the aegis of P/S (weak predominant, medial predominant, strong predominant, vi, applied to vi, applied to ii, and applied to V). [White, “Some Statistical Properties of Tonality, 1650–1900” (2013), particularly pp.201–05.]

complex interaction between tonic/antitonic and dominant/antidominant.” But the subdominant is far from “missing” in Quinn’s eventual schematic model of functional progression; rather, it is placed at the center of an axis of symmetry that frames the tonic/dominant opposition. As he claims, “This is a fundamentally different symmetry than the one promulgated by Riemann and the dualists, which places tonic function, and a dominant/subdominant opposition, at the center.”

However they are schematically arranged, the three traditional functions do not always furnish neat categorical boundaries that separate one from the others. Agmon’s graded-category approach to harmonic function, for example, holds that while I, IV, and V are the most prototypical exemplars of T, S, and D functions, respectively, vi and iii can also function as tonics, vii
, ii, and vi can also function as subdominants, and iii, vii
, and ii can also function as dominants, depending on the musical context. According to this system, then, each diatonic triad except for I, IV, and V possesses dual functional allegiances. But as we have seen, there are certain repertoires whose syntactic regularities call into question even the fuzzy divisions postulated by Agmon’s prototype theory. Nobile, for one, argues rather forcefully that IV can

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108 Ibid. This resonates with a remark White makes at the end of Chapter 5 of his dissertation: “Tonic and dominant chords garner their functions because of the frequency of particular chord classes, while predominant and plagal chords are defined by how they act in relationship to the former two functions.” [White, “Some Statistical Properties of Tonality, 1650–1900” (2013), p. 262.]


110 Agmon, “Functional Harmony Revisited: A Prototype-Theoretic Approach” (1995), p.201. While the Roman numeral labels I supply here pertain specifically to the ionian mode, Agmon also intends for his triadic classification scheme to generalize to aeolian-mode contexts as well. He does not, however, consider any of the other diatonic modes in his article.
function both as a predominant and as a dominant in rock music—sometimes taking on both roles within the same verse of a song.¹¹¹ And even within the Western Euroclassical tradition, as Swinden explores, there are moments “when functions collide”: when sonorities seem to merge properties of both subdominant and dominant functional elements in the same instance of occurrence.¹¹²

I raise these points to reinforce my position that, when it comes to harmonic function, playing the numbers game is somewhat of a trap. There is not one correct answer to the question of how many harmonic functions exist—and this is the case not just across styles and corpora, but also within styles and corpora. All theories of harmonic function must necessarily strike that precarious balance between the descriptive accuracy of many fine-grained categories and the explanatory power of just a few. For many years, the traditional three-function model has stuck around simply because it is good enough at cataloguing the recurring idiosyncrasies of harmonic progression in Western Euroclassical tonal music. And while I acknowledge that these functions can sometimes break down into more nuanced subcategories based on one’s desired lens of focus, or in other moments, blur together in practice, I do not aim to supplant the traditional model with a radically new set of labels in


¹¹² Swinden, “When Functions Collide: Aspects of Plural Function in Chromatic Music” (2005). Swinden proposes two labels, $S^D$ and $D^S$, to capture the functional multiplicity of such moments. In the former case, a bass scale step characterizes $S$ function, but a sonority’s upper structure contains dominant-functioning elements; in the latter, on the other hand, a bass scale step characterizes $D$ function, but a sonority’s upper structure is “imbued” with the “essential harmonic character” of subdominant function (261). It is surprising that, during this discussion, Swinden does not give much attention to secondary dominants or other applied harmonies (whose functional identities are also a unique kind of hybrid).
what follows. Rather, I want to probe the limits of these labels, meditate on which musical parameters (other than “harmony”) enable them to be heard as such, and investigate what sorts of taken-for-granted premises can be revealed about harmonic function when one tries to hear the tonality in microtonality.

**But First, 12-TET Music**

In Chapter 2, after laying out my genus/species conception of scale-degree qualia, I tease the possibility that harmonic function may be more closely correlated with the “genus” part (x) than it is with the “species” part (y). I illustrate this by examining the opening harmonic shuttle of Anita Baker’s “Body and Soul,” whose representative string of z’s admits of multiple plausible hearings. All of these hearings, crucially, are linked together by the same string of y’s, differing only in [1] their associated string of x’s and [2] their harmonic-functional profiles. I now return to Baker’s recording in more detail. This time around, I pay closer attention to the role that hypermeter plays in mediating tonal/functional judgments. The top system of Ex. 4.1 below is an identical reproduction of Ex. 2.4 from Chapter 2. The bottom system, however, is new here; it contains the first few bars directly following the song’s instrumental intro.
Ex. 4.1: Hypermeter as a clarifying force during situations of tonal ambiguity:

Example excerpt begins at 0:00 of https://www.youtube.com/watch?v=5duKPSN164

Vox line
Bass
Piano/Bass Redux

[F# mixolydian]

(1̂, sol,6)      (3̂, ti,10)     (5̂, re,1)             (7̂, fa,4)(6̂, mi,3)(6̂, mi,3)      (3̂, ti,10)(5̂, re,1)(3̂, ti,10) (2̂, la,8)        (1̂, sol,6)

And I cannot sleep. I cannot tell. What have you done to me?

Vocals

[4/4 mixolydian]

(1̂, sol,6)                (5̂, re,1)                                        (1̂, sol,6)                        (5̂, re,1)

T                                                          D             T               D

Function

Bass voice

[6/4 mixolydian]

(5/4, do,3) (6/4, mi,3) (3/4, la,8) (1/4, sol,6) (6/4, do,3) (6/4, mi,3) (3/4, la,8) (1/4, sol,6)
Readers will notice that by the time Baker’s vocals enter in m.9, only the F# mixolydian interpretation remains, suggesting that the shuttle’s tonal orientation becomes clarified at this point. The way that this happens is quite clever. Typically, harmonic shuttles with an initially ambiguous centricity require the intervening/mediating presence of a third element (usually another IC) to clarify the governing centricity. But here, no new ICs join the mix; in fact, the only change occurring in m.9 is that the shuttle is simply reversed, with the F#-rooted IC now falling on the odd-numbered measures and the C#-rooted IC on the even-numbered ones. Reversing the order of a shuttle that is already ambiguous to begin with may seem, on the surface, like a way to engender even more confusion. Yet the aural effect is just the opposite: it is here that there finally emerges a relative sense of certainty about where the song might be centered. This emergent sense of F# mixolydian “victory” arises for reasons that are primarily hypermetrical. Since the introductory vamp establishes the presence of two- and four-bar groupings, m.9 marks the expectationally “strongest” hyper-downbeat in the recording thus far. Locations that are hypermetrically strong tend to support harmonies that are structurally stable; David Temperley formulates this as a preference rule: “Prefer a tonal interpretation in which the tonic harmony is hypermetrically strong.”113 And so, because m.9 is the moment of greatest hypermetrical strength since the beginning of “Body and Soul,” its associated IC provides the strongest evidence as to the song’s centricity going forward. By the end of my transcription in Ex. 4.1, it is still the case that only two types of IC—one with C# in the bass, and another with F# in the bass—have occurred in the entire recording. And yet, through an understated sleight of hand that separates the introductory vamp from the first verse, the

song’s tonal orientation is provisionally clarified. There is no need for a third IC to come in and elucidate the relationship between the first two; hypermeter itself is that clarifying element.

Now, to be clear, I am not arguing that the shuttle’s directional reversal in m.9 retrospectively clarifies the tonal orientation of the previous eight-bar intro—only that it clarifies the tonal orientation of “Body and Soul” for the moment, from m.9 onwards. Indeed, this momentary clarity does not wholly excise, or render moot, the fundamentally ambiguous nature of mm.1–8. All three hearings of this intro that I propose in Ex. 4.1 still have their own merits, even if a listener familiar with the song knows exactly what is coming in m.9. The C# dorian hearing of mm.1–8, for example, is highly plausible in that it also respects Temperley’s aforementioned preference rule about the alignment of hypermetric downbeats with articulations of tonic harmony. Someone listening in this framework might then pivot to an F# mixolydian hearing over the double bar separating mm.8–9 without much trouble, since tonics would still be occurring in every odd-numbered bar. Likewise, another hypothetical listener could choose to hear the opening 8-bar vamp in F# mixolydian; not only would this interpretation have the advantage of tonal continuity, by not requiring a change in centricity over the double bar, but it would also allow each two-bar unit of the introductory shuttle to be heard as a harmonic procession from tension (D) to release (T). And finally, even the B ionian hearing of the opening shuttle has its merits—particularly for those listeners who are able to delay their gratification. This last hearing is probably the least initially plausible of the three, since it features no instances of a literal tonic between mm.1–8, only a continual P <-> D shuttle that calls attention to that tonic’s absence. But even this interpretation is dignified later
on in the song's form when, exactly eight bars prior to the first chorus, the shuttle that begins in m.9 is transposed up a perfect fourth to sound in B mixolydian, with this section also beginning on a strong hyper-downbeat. As a result, the B-centric tonic triad that is withheld in the intro does eventually occur after a long wait. But its surrounding modal climate has shifted (from expected ionian to actual mixolydian) in the meantime, capitulating to the modal inertia wrought by the move to (F#) mixolydian in m.9.

The broader takeaway here is that hypermeter exerts a major influence on the way that harmonic function qualia are felt and experienced. In “Body and Soul,” the initial functional ambiguity of the harmonic shuttle is only clarified once metrical factors step in, effecting a transition from an introduction that can be heard in three plausible frameworks to a first verse in which one of these three becomes more plausible than the others. On the face of it, this takeaway is not necessarily a new or groundbreaking insight. There exist countless instances in popular and other musics alike when hypermetric downbeats encourage the hearing of their associated harmonies as new/emergent tonics, even when these harmonies effect modulations into tonal areas that are generically non-normative or seemingly totally unrelated to the

114 Beginning at 0:40 of https://www.youtube.com/watch?v=5duKqPSNt64, on the lyrics “Now once I could turn away.”

115 For example, “Breathless” (2000) by the Corrs, which contains an unusual instance of a chorus occurring in the global subdominant. This begins at 0:57 of https://www.youtube.com/watch?v=vzerbXFwGCE; the sudden transition into this unexpected tonal area is smoothed over by the fact that it occurs on a hyper-downbeat.
affective world set up previously. But what is especially distinctive about “Body and Soul” is that this metrical clarification of tonal position takes place without the accompanying introduction of any “new” tonal areas (or even any new ICs)—instead being accomplished by merely reversing the order of an ongoing shuttle that was previously multiply ambiguous!

Turning back to function’s apparent covariance with $x$, Fig. 4.4 on the following page illustrates the reverse side of the coin. Every cell of this diagram contains the same fundamental T–P–D–T progression, with the intervallic specifics of each tweaked slightly to include only the naturally occurring tones of a given diatonic mode. The primary upshot of this diagram is that, from cell to cell, only two things remain the same: the $x$-components of each scale degree and the basic functional trajectory of the progression as a whole. Meanwhile, no two cells contain the same configuration of $y$-components, and even the $z$-components of each cell differ slightly, in accordance with characteristic differences in modal shape. This situation, while artificially constructed, constitutes the exact notational inverse of the ambiguous opening of “Body and Soul.” In the latter, $y$ and $z$ stay the same across potential hearings while $x$ and function differ, whereas in the former, $x$ and function stay the same across cells while $y$ and $z$

For example, “We Roll Deep” (1993) by the Conscious Daughters, whose chorus begins in a key about a minor second lower than that of its verse. This moment sounds like a sudden transition between back-to-back tonics due to the hypermetric emphasis accorded to the chorus’s structural downbeat. [The first such transition in the song occurs at 0:58 of https://www.youtube.com/watch?v=jKkMAGSIrM.] Notice that I say “about” a minor second lower, because this tonal transition may actually be one by a microtonal (!) interval measuring slightly less than the hundred-cent minor second of 12-TET (despite the fact that all of the musical material within each section of the song lies squarely in 12-TET). A fascinatingly disorienting—and yet also strongly orienting—moment indeed.

Readers may recall that I also frame tonicization as the notational inverse of tonal ambiguity in Chapter 2. While no tonicizations take place in Fig. 4.4, the basic principle resulting from my conception of the term—a shift between “parallel” modes—is exactly what separates each cell.
differ. Both scenarios illustrate the same basic principle in complementary ways: that harmonic function is primarily a property of generic scalar position over and above the other subcomponents of scale-degree experience.

Fig. 4.4: The notational foil to the “Body and Soul” intro: only x and functional category remain constant across modally analogous progressions, whereas y- and z-strings vary from mode to mode
And yet, despite the basic essential similarity of the functional trajectories in each cell of Fig. 4.4, there are still some subtle affective differences between these successions in different modes that I want to highlight. An ionian dominant leading to an ionian tonic, simply put, does not arouse exactly the same sensations as a dorian dominant leading to a dorian tonic—even though both successions can be understood under the aegis of the same broader category (namely, that of D–T progression in the abstract). To capture these slight differences in modal affect while retaining the sense that the basic functional categories do not evaporate between modes, I have color-coded each harmonic-functional label in accordance with the surrounding modal context, with color wavelength directly proportional to modal “brightness” (as defined in Chapter 2). Therefore, a tonic occurring in a lydian context is written as “T,” a predominant in an ionian context is written as “P,” a dominant in a mixolydian context appears as “D,” and so on. I continue to adopt these color-coded labels in the analytical vignettes that follow, reserving black-texted capital letters only for those moments when I am referring to harmonic-functional behavior in the abstract.

Blackwood’s Microtonality (I): Starting Out Simple

So how well does all this translate to microtonal terrain? It depends, of course, on the kind of microtonality under consideration. There are countless theoretical approaches to microtonal

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118 This color-coding system is meant to address the fact that traditional harmonic-functional labels do not reflect distinctions among modes. One could also conceivably use this system to label Roman numerals, which would go a long way towards addressing the ways that major/minor bias seeps into this kind of notation as well.

119 The missing mode in Fig. 4.4, locrian (least bright of all), would thus receive the remaining color of the rainbow: violet (smallest wavelength of all).
composition, and a great many of them simply do not lead to musical results that are recognizably “tonal,” “modal,” “diatonic,” “functional,” or even “centered” at all. But there are others that, rather than brazenly eschewing all things familiar, concern themselves with manipulating the familiar and stretching its limits. Blackwood’s microtonality is therefore a fruitful test site for exploring the scope of functional tonality and the margins of harmonic-functional behavior. Because all of his microtonal pieces are linked by the same compositional aim—to simulate the style, demeanor, and soundscape of Western Euroclassical tonal music—I maintain that the canonical harmonic-functional labels previously discussed are applicable enough to this music that they need not be discarded or replaced. But, as we will see in the remainder of this chapter, they occasionally require neological supplementation, since there are certain novel moments in Blackwood’s music that slip between the cracks of 12-conditioned expectation and necessitate individual treatment of their functional idiosyncrasies.

I begin with a relatively straightforward example of a T–P–D–T succession that closes the first movement of “21 Notes,” to illustrate how traditional functional labels can sometimes transfer quite smoothly to microtonal contexts:

![Fig. 4.5: Blackwood's note names and enharmonic equivalences for 21-TET](image)
Ex. 4.2: A concluding cadential progression that uses both “natural” and “harmonic” forms of the aeolian mode; excerpt begins at 1:04 of https://www.youtube.com/watch?v=vn_JH4TBku8

This passage approximates familiar diatonic behavior rather closely, being in F aeolian but making liberal use of a leading tone (Eb-up, mm.45–48) that is chromatically raised from its natural aeolian location (Eb-down, m.45). I have labeled the ICs containing this Eb-up as “D_H,” to indicate that they are aeolian dominants inflected with the characteristic leading tone of harmonic minor (thus the subscript “H”). Compare these to the natural aeolian dominant on the downbeat of m.45, which is labeled with a plain old “D.” This is one way to capture the qualitative subtleties differentiating aeolian-derived dominants that are more (subscript) or less strongly (no subscript) vectored towards tonics.

Upon first listen/glance, this passage may seem to bear out Blackwood’s conviction that, when it comes to the tonal affordances of microtonal tunings, “[O]nly the familiar seven-note [i.e., heptatonic diatonic] system contains anything like those functions commonly called...
tonic, dominant, and sub-dominant.” But a closer look at Ex. 4.2 reveals that more than seven notes (ten, in fact) are involved in the articulation of F aeolian—and none of these necessarily comes across as “extra,” falling “between the cracks,” or sounding “out of place.” How is this possible? Ordered-triple notation can help to clarify that when Blackwood uses the word “note” above, he is tacitly referring to generic scalar position (x). In 12-TET, a mode is typically associated with seven generic scalar positions, seven specific modal characters, and seven pitch classes; that is, it is associated with the same number of x’s, y’s, and z’s. Microtonal music, however, complicates this relationship of equality. In the above excerpt from “21 Notes,” there are seven generic scalar positions (1 through 7), eight specific modal characters (x=7 can be either y=sol or y=si), and ten pitch classes (x=7 can be either z=5 [sol] or z=7 [si], x=4 can be either z=17 [re] or z=18 [re], and x=2 can be either z=12 [ti] or z=13 [ti]). The situation with x=7 (see the circled pitches in m.45), to be clear, is not unique to microtonality; it represents the familiar phenomenon of intra-aeolian borrowing from harmonic minor. In this case, a difference in z (5 vs. 7) registers auditorily as a difference in y (sol vs. si) that nevertheless falls under the banner of the same overarching x (7). But the situation with x=4 and x=2 (cf. the circled pairs of pitches in mm.47–48) is unique to microtonality. In these latter two cases, a difference in z (18 vs. 17 and 13 vs. 12, respectively) does not register auditorily as a difference in y (both re and both ti, respectively). This is to say, the same modally situated x/y pair can be represented by different values of z—even within the same brief span of non-modulating music. I will return to this phenomenon in the next chapter, when I discuss the

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120 The Easley Blackwood Papers, Box 44, letter to Webster College President Leigh Gerdine (in “Correspondence, 1977–1984”), p.1. Blackwood prefers “subdominant” to “predominant.”
applicability of Dmitri Tymoczko’s “five components of tonality”\textsuperscript{121} to Blackwood’s microtonality. But for now, the main takeaway is that these additional pitch classes and solfège syllables do not perturb the overarching sense of F aeolian in Ex. 4.2, nor do they muddle the undergirding functional succession that consolidates this tonal area. If the recognizability of traditional harmonic-functional behavior is associated with seven of anything—coming back now to Blackwood’s above-mentioned quote—then it is seven generic scalar positions, not seven solfège syllables or seven pitch classes. This only further strengthens the link between x and function for which I have been arguing in this chapter.

Blackwood’s Microtonality (II): Split Fourths, Again

It can be oddly satisfying to experience those moments in Blackwood’s microtonal music that imitate, trope, or analogize the sorts of functional behavior to which we have become accustomed in 12-TET. But for each moment like this, there exists another that showcases the sorts of things that are not possible in 12-TET. Particularly when these disorienting moments are embedded within larger musical contexts that are relatively normative, questions arise as to their functional allegiances, tonal ramifications, and potential cognitive consequences. I now turn back to one such moment previously discussed in Chapter 3 from the “Fanfare in 19-note Equal Tuning,” in which a perfect fourth in the bass voice is divided into two equal parts.\textsuperscript{122}


\textsuperscript{122} In his “Research Notes: NEH Grant R0-29376-78-0642” (1979–81), Folder 1, Blackwood discusses how the bisectable 19-TET fourth is capable of producing the “most strikingly individual chromatic progressions” (51).
Fig. 4.6: Blackwood’s note names and enharmonic equivalences for 19-TET

Ex. 4.3: When scale-degree content is equivocal, rely all the more on temporal/phrasal context for functional cues; excerpt begins at 0:42 of https://www.youtube.com/watch?v=GO516WYU-Zw

[D# Ionian]: (♯, fa, 12) (♯, ♯, 8) (♭, do, 4)

(OPTION 1)  P  D  T
(OPTION 2)  S  S+/T-  T
How does the IC in m.31—a minor seventh rooted on F natural—function? As I mention in the previous chapter, this harmony breaks up a local IV–I progression in D# ionian, and its root is exactly equidistant from those of the surrounding measures (four unit intervals away from each), producing a sonic effect unlike anything possible in 12-TET. None of the pitches in m.31 is easily assimilable within the governing D# ionian collection; as a result, scale-degree content is no longer the reliable indicator of harmonic function that it usually is. In the absence of such scalar anchoring, the functional identity of m.31 is best inferable from the surrounding phrasal and temporal context. I have proposed two plausible options in Ex. 4.3 above. In the first, the IC in m.31 is regarded as a dominant simply by virtue of its interceding between predominant (IV) and tonic (I) harmonies. This interpretation has the advantage of adhering to Occam’s razor, abstracting away from the unusual scale-degree particularities of the IC and focusing instead on its functional role in the grander scheme: as directly preceding the final tonic of an otherwise normative 8-bar phrase. But admittedly, this interpretation relies on a loose abstraction of dominant function that seems to ignore both scalar/modal situatedness as well as quality; after all, the IC in m.31 is a minor seventh, which tends to function as a pre/subdominant in most ionian contexts. For this reason, I propose a second interpretation that stops short of calling the IC in m.31 a “dominant,” instead reckoning it as a “post-subdominant/pre-tonic” (S+/T-). Under this interpretation, the IC in m.30 can no longer be regarded as a predominant, because it does not proceed to a dominant. Instead, I label it as a subdominant, and I consider the subsequent IC in m.31 to function as the sum total of how it is approached (S+) and how is left (T-). This supports my earlier contention that harmonic function is fundamentally a “two-tailed” phenomenon. Notice, however, that in both interpretations, the
functional label for m.31 is written in black text, rather than in the surrounding orange of ionian. This reflects the impression that such functions are phrase-based behavioral abstractions that are not associated with any one particular mode, instead relying on contextual cues outside of scale-degree situatedness for their identity.

The functional situation gets a bit more complicated when a split perfect fourth in the bass unfolds itself across a longer musical timespan, as this excerpt from “19 Notes” illustrates:

**Ex. 4.4**: An IC’s function largely depends on the structural level at which one is attending to it; excerpt begins at 0:59 of https://www.youtube.com/watch?v=N8lK38l1Anc
The black-circled Db is the exact midpoint between E (the passage’s global tonic) and B (its global dominant), and yet the harmonic arrival on Db in m.36 lacks much of the visceral punch that accompanies the analogous arrival on F natural in m.31 of the “Fanfare.” For one thing, the transition into and out of this midpoint is smoother in “19 Notes”; it is lubricated by the enharmonic equivalences in mm.35 and 37, bounded by the only T–P–D–T successions that occur on the local level of my analysis, and given hypermetric support in the larger scheme of the phrase.  

These contextual factors, coupled with the parallelism of mm.35–36 and mm.37–38, effectively mask the fact that the arrival on Db ushers in an affective world at great remove from the E-centric phrase that surrounds it. For this reason, I proffer a plausible “zoomed-in” hearing of the passage in Ex. 4.4 that regards each waystation of the divided perfect fourth (E, then Db, then B) as a metrically buttressed local tonic arrival; each functional label in this hearing is modally situated in either aeolian or ionian. Compare this to the “zoomed-out” hearing listed right below that, in which the whole passage is reckoned under the aegis of an E centricity (and the “local tonic arrivals” in m.36 and m.38 are no longer reckoned as tonics). Under this latter interpretation, the Db-rooted IC in m.36 is labeled as a black-texted, modally agnostic “post-tonic/pre-dominant” (T+/D−, or just P), following the rationale established in the previous “Fanfare” example. This functional identity, once again, is a behavioral abstraction that derives purely from an IC’s contextual temporal placement within a phrase, having nothing

123 In addition to all this, the downbeats of m.36 and m.38 are approached by contrary minor-second motion in the outer voices, intensifying the sense of local tonic arrival in both cases.
to do with its scale-degree allegiance to a particular governing collection. Overall, this passage demonstrates several aspects of my conception of harmonic function rather well: that function is two-tailed, that an IC’s function can change depending on one’s structural lens of focus, and that function and (hyper)meter are largely codependent phenomena.

**Blackwood’s Microtonality (III): Functional Collision**

This section examines the harmonic-functional affordances of another equally spaced acoustic object—the fivefold equal division of the octave—in terms of Swinden’s notion of functional “collision” between pre/subdominant and dominant elements. I have already discussed the melodic properties of this IC’s 240-cent component intervals in Chapter 3; now, I turn to its potential to be heard as a harmonic totality. The excerpt in question is from the opening movement of the *Suite for Guitar in 15-note Equal Tuning.*

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124 From this and the previous split-fourth example, then, one might cautiously cull the following general insight: that while function is typically a byproduct of generic scalar position (content) interacting with temporal conventions of usage (context), whenever one of these types of cues is absent, the onus falls even more squarely on the other to provide functional information.

125 This is one way to solve a recurring problem in the theoretical/pedagogical literature as to how to classify the function of a secondary dominant. Take V/V, for instance: on the most zoomed-in, local level, it functions more as a dominant because of the way it resolves. But on a more zoomed-out, global level, it functions more as a predominant because it precedes dominant harmony within a larger phrase. Thus, the short answer to the question of how a secondary dominant functions is that “it depends on how you look at it.”

Fig. 4.7: Blackwood’s note names and enharmonic equivalences for 15-TET

Ex. 4.5: A potential functional collision in m.2 and m.6 as a result of the fivefold equal division of the octave; excerpt begins at 0:00 of https://www.youtube.com/watch?v=YJQsR-Z5aDc

Measures 2 and 6 are the interesting ones; both arpeggiate the components of the same 5-TET IC, the former in “open” position (and involving solely open strings on the modified acoustic guitar) and the latter in “close” position. But how does this IC function in

\[ D/DDD \]
\[ DP/D \]
\[ DT \]

\[ [A-down]: \]
\[ T \]
\[ D^5 \]
\[ T \]

\[ D \]
\[ D/D \]
\[ D^9/D \]

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\[ DDD \]
\[ DP/D \]
\[ DT \]

\[ [A-down]: \]
\[ T \]
\[ D^5 \]
\[ T \]

\[ D \]
\[ D/D \]
\[ D^9/D \]

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\[ 127 \] This IC consists of all the pitches in 15-TET that are notated with a “down” circle-arrow: E-down (z=5), F#-down[=G-down] (8), A-down (11), B-down[=C-down] (14), and D-down[=C#-down] (2). There are two other 5-TET ICs in 15-TET; these are comprised of the pitches that make up what I have been calling “plain-space” and “up-space,” respectively.
each case? Measure 2 clearly separates two statements of tonic in m.1 and m.3, but its scale-degree components send mixed functional signals. The bounding pitches of E-down act like two sturdy pieces of dominant bread, but the sandwich they enclose contains lukewarm, modally equivocal lunchmeat. The resulting taste is one of curious functional hybridity, and I have split my interpretation of this IC into two potential “tracks” based on whether one hears the F#-down in m.2 as a mixolydian $7\dag$ (top) or an ionian $6\dag$ (bottom). In the top hearing, there is no cross-pollination between dominant and subdominant, but there is a modal switch: the mixolydian D in m.2 encourages the hearing of the ensuing tonic in m.3 in this same modal framework. In the bottom hearing, on the other hand, there is no modal switch—the interpretation remains in ionian throughout—but the IC in m.2 is reckoned as a merging of dominant and subdominant function. Following Swinden, I label this IC as a “D$5$” because the bass motion in mm.1–3 (♭5–♭♭1) is a quintessential “characterizing pattern” that encloses dominant function,\(^{128}\) making this IC lean closer to dominant identity despite the fact that its upper voices are also “imbued” with the “essential harmonic character” of subdominant function.\(^{129}\) In other words (to return to the sandwich metaphor from above), the taste of the bread overpowers that of the lunchmeat in this particular case.

The story is similar for the second system of Ex. 4.5, since the parallelism between mm. 1–3 and mm.5–7 encourages an analogous treatment of the IC in m.6. The difference, however,


\(^{129}\) Ibid., p.261. Blackwood himself has referred to the 5-TET IC as a “piquantly discordant, but weakly dissonant subdominant.” [Blackwood, “Modes and Chord Progressions in Equal Tunings” (1991), p.192.]
is that m.5 and m.7 project global *dominant* function, and so m.6 has more of an applied feel. Once again, my interpretation splits into two potential tracks. As before, the top hearing involves a brief modal pivot to mixolydian but no Swindenian functional hybridity, whereas the bottom hearing remains in ionian throughout but posits a functional collision in m.6. Notice that the superscript in this hybrid is now “P” instead of “S,” owing to the fact that this IC now precedes a dominant instead of prolonging a tonic. In addition, the bottom system also differs in that its two tracks merge back together by m.7, since the dominant IC in this measure contains the global ionian leading tone (G-up), which negates/erases the previous traces of mixolydian potentiality.

The larger point of all this is that, regardless of the interpretive track one chooses, both hearings involve milking contextual asymmetries (and attendant functional qualia) out of a completely symmetrical acoustic object, contradicting the prevailing wisdom that equal divisions of the octave are usually either functionally inert (augmented triads, whole-tone scales) or functionally ambiguous (diminished sevenths). The functional apperceptions in Ex. 4.5 therefore represent yet another imposition of tonality’s “characteristic asymmetry” onto an IC that is actually equally spaced. In other words (to return to a comparison that I first make in Chapter 3), the Müller-Lyer illusion’s auditory cousin has struck again.

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130 This pitch is mistakenly notated as G-down in m.7, despite its unmistakably sounding as G-up in the recording (cf. the identical harmony in m.5, where this pitch is notated correctly).

Blackwood’s Microtonality (IV): Two Senses of “Antitonic”

One consequential fallout of my characterizing tonal cognition as relational and misattributive is the contention that there is no such thing as a harmonic function that exists in isolation. Certainly, this seems intuitive in the case of dominants, which garner their functional identity by virtue of their relationship with tonics, and pre/subdominants, which are conventionally understood in terms of their relationships with both dominants and tonics. But the case of tonics, at least on the surface, seems more complicated. One could conceivably mount the argument that tonic function is uniquely able to exist in isolation, citing a hypothetical example of a piece that drones on a single IC for its entire duration—or even more reductively, one that repeats a single pitch over and over, never including any others. While such repetitive musical behavior creates a seemingly incontrovertible sense of centeredness, this sense is not tantamount to an expression or assertion of “tonic function,” as I understand it. For function is fundamentally (re)action, not inertness; in the words of Brandon Derfler, it is an “operation [that] transform[s] one Klang into another harmonic object.”

And so, if there is just a single Klang, and not another harmonic object, function cannot exist. This isolated Klang may sound or seem like a tonic—and one would probably be correct in asserting it as a notional “center” of sorts. But, crucially, it does not behave like a tonic, and therefore, it does not function like one. In fact, it does not function like anything. It simply exists, and it arouses its own attendant set of predictions and expectations about how it might continue to exist. But even as these predictions and expectations are confirmed, and even as their confirmation over time creates a

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very real sense of certainty, this sense cannot rightfully be called “tonic” (or “tonic function”) in the absence of one or more “foils” for the isolated Klang.\footnote{As Norman Cazden writes to this point, there exists a “strange logic by which a composition cannot begin on its tonic harmony. The work may be, let us say, in the key of C major, and it may begin with a simple C major chord, but there is no functional relationship as yet that makes us accept that chord as having a tonic role, and the further progress of the composition may easily demonstrate that it is really in another key.” \cite{Cazden_1954} One piece that fleshes out Cazden’s remark rather well is Debussy’s “Général Lavine” (1913), whose intro insistently asserts an apparent sense of C-centricness, but whose ensuing bars reveal the prelude’s global center to be F instead—retrospectively painting this introductory material as dominant-functioning rather than tonic-functioning. A recording is available at \url{https://www.youtube.com/watch?v=v6Kv3B5fDho}.}

Each of Blackwood’s microtonal compositions articulates tonic function at some point, and in its own idiosyncratic way. But not all of the tunings in which he composes are capable of producing analogs to traditional “dominants” and “pre/subdominants,” raising the legitimate question of how to regard those ICs that act as the “foils” against which tonic function can be heard as such. Consider, for instance, the case of “23 Notes,” which Blackwood regards as “[a] particular challenge, [since] 23-note tuning contains no diatonic configurations and no chromatic structures in common with any of the other tunings explored in this study.”\footnote{Blackwood, \textit{Microtonal Compositions} (1994), Cedille CDR 90000 018, n.p. Julian Hook, similarly, regards “23 Notes” as “[t]he one truly exceptional Etude,” since “[its] notation is not consistent with any enharmonic system.” \cite{Hook_2007}}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{23_notes}
\caption{Blackwood’s note names and enharmonic equivalences for 23-TET, with Eb-centric approximations to the pelog (black) and slendro (brown) collections circled.}
\end{figure}
What 23-TET does contain, however, is a reasonable approximation of the two principal scales of Indonesian gamelan music—the slendro and the pelog. “23 Notes” is therefore unique among Blackwood’s microtonal compositions in that it evokes a non-Western style: it approximates non-Western scales, simulates non-Western timbres, and mimics the heterophonic texture characteristic of gamelan.

Ex. 4.6: Metrically regular toggling between Eb-centric pelog (odd-numbered bars) and slendro (even-numbered bars) ICs creates the emergent impression of tonic/antitonic alternation over a tonic pedal; excerpt begins at 0:34 of https://www.youtube.com/watch?v=qXy7HPeJPQM

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135 Blackwood explains this in Keislar, “Six American Composers on Nonstandard Tunings” (1991), p.199. Ethnomusicologist Jaap Kunst was the first to notice this property of 23-TET.

136 For more on American microtonal composers’ longstanding fascination with Indonesian gamelan music, see Perlman, “American Gamelan in the Garden of Eden: Intonation in a Cross-Cultural Encounter” (1994).
And yet, there are still certain aspects of this etude that are peculiarly Western, above and beyond its usage of five-line staff notation and its insistence on octave equivalence. I want to focus on the brief stretch of Eb-centric music, reproduced in Ex. 4.6 above, that emerges in m.23 and constitutes the first expression in the etude—indeed, one of the only—of what a Western-enculturated listener might cognize as “tonic function.” This emergent sense of tonic, however, is not established by means of triadic progression or directional inertia on the line of fifths—nor is it linked to any one specific heptatonic diatonic collection. Instead, it is established by a regular back-and-forth toggling between pelog\textsuperscript{137} (in the odd-numbered measures) and slendro\textsuperscript{138} (even-numbered measures) collections. This periodic scalar oscillation creates a fleeting impression of harmonic/functional oscillation, with the hypermetrically emphasized pelog IC momentarily playing the role of “tonic” and the hypermetrically subordinate slendro IC momentarily playing the role of that tonic’s “foil.” Moreover, these ICs share two pitches, Eb and Bb, that might be heard as a shared “overtonal”\textsuperscript{139} frame that anchors the oscillation by providing it with the stasis of a harmonic pedal.

But the question of how to modally situate these ICs is a challenging one—as is the question of what to call this “tonic foil.” Option 1 in Ex. 4.6 illustrates this difficulty. The pelog

\textsuperscript{137} The Eb-centric pelog in “23 Notes” consists of five pitches: Eb (z=6), G-down (13), A-down (16), Bb (19), and D-down (3), producing an intervallic pattern of <73373>\textsuperscript{23}. All of these except A-down are used in the above excerpt.

\textsuperscript{138} The Eb-centric slendro in “23 Notes” also consists of five pitches: Eb (z=6), F (10), Ab[=G#] (15), Bb (19), and C-up (1), producing an intervallic pattern of <45455>\textsuperscript{23}. All five of these are used in the above excerpt.

\textsuperscript{139} For more on “overtonality,” see Harrison, \textit{Pieces of Tradition: An Analysis of Contemporary Tonal Music} (2016), Chapter 2.
collection in the odd-numbered measures sounds reasonably like an arpeggiated major seventh, an IC that is native to two modes: ionian and lydian. While a statistical learning argument may favor the ionian-tonic interpretation, it must not be forgotten that the Eb-centric pelog scale also contains an A-down (absent from these measures but present in other moments of the etude) that seems to fall directly in between an ionian $4\hat{}$ and a lydian $4\hat{}$. Thus, it is irresponsible to assert the pelog collection as a definitive subset of any one heptatonic diatonic mode. The same goes for the slendro IC in the even-numbered measures, which seems to straddle the line between an ionian subdominant and a mixolydian dominant (over a tonic pedal). This difference hinges on the modal ambiguity of C-up (the exact midpoint between Bb and Eb), which can be regarded either as ($6\hat{}, la, 1$) (entailing S) or as ($7\hat{}, fa, 1$) (entailing D) relative to the Eb bass. But again, there is no interpretive advantage to quantizing this ambiguous interval into one neat scale-degree box at the expense of the other. This excerpt from “23 Notes,” while it does create a palpable impression of tonic function aided by metrical means, ultimately demonstrates the futility of trying to pigeonhole non-Western scales into Western modal clothes—even when it seems like a relatively close fit.

Option 2 therefore presents another hearing of the passage that acknowledges its gestural troping of functional oscillation but does not situate these functions within Euroclassical scalar confines. This hearing regards the odd-numbered measures as communicating a behavioral abstraction of tonic function, but it intentionally avoids labeling the “foil” IC as a “dominant” or “pre/subdominant,” since 23-TET is not capable of producing unambiguous, distinctive analogs to these conventional relationships with tonic. Instead, I label
m.24 and m.26 as modally agnostic “antitonics” (A) that occur over a tonic pedal.\textsuperscript{140} Under this interpretation, the functional oscillation in the passage takes place more so on Eb than it does in Eb—insofar as this latter implies a situatedness within any particular diatonic or pentatonic collection(s).

The label “antitonic” is more of a contextual designation in this case than it is one based on mutual exclusivity of pitch-class membership. My usage here thus aligns more closely with White and Quinn’s conception of the term in their discussion of the McGill Billboard corpus\textsuperscript{141} than it does with Quinn’s slightly later employment of it in his model of thoroughbass harmony.\textsuperscript{142} In short, I call the ICs in Ex. 4.6 “tonic” and “antitonic” simply because [1] there are no other ICs in the passage besides these two, [2] both progress back and forth to one another in shuttle-like format, and [3] one is more (metrically) stable than the other. I can imagine, however, that some readers might bristle at my usage of “antitonic” in this context, especially considering that two pitches—including the notional tonic itself—are shared between the

\textsuperscript{140} Some readers may take umbrage at my eschewal of the terms “dominant” and “pre/subdominant” but not “tonic,” preferring that I throw out all three of these Western labels when discussing nominally non-Western music. (Indeed, one could substitute any number of other binary pairs for the labels “tonic” and “antitonic,” such as “home” and “away.”) But I choose to retain the label of “tonic,” here, because I believe it captures the passage’s rather Western modus operandi: creating tonal accent via metrical means.

\textsuperscript{141} See White and Quinn, “Chord Context and Harmonic Function in Tonal Music” (2018), p. 323. For these authors, an antitonic simply “provides transition into and out of tonic” (323), without any additional requirement that it have no pitch classes in common with that tonic.

\textsuperscript{142} See Quinn, “Tonal Harmony” (2019), p.479. For Quinn, an antitonic consists of the scale-degree complement to the tonic triad—the \{7,2,4,6\} to its \{1,3,5\}. This conception of tonic and antitonic is akin to the mutual exclusivity between the notes produced when inhaling versus exhaling into a harmonica. For more on “harmonica space,” see De Souza, Music At Hand: Instruments, Bodies, and Cognition (2017), Chapter 3.
pelog and slendro collections used in “23 Notes.” For these readers, a quintessential antitonic might sound more like the following IC from m.110 of “14 Notes,” which shares the three contextual criteria listed earlier in the paragraph but also contains no z-overlap with the tonics that surround it:

![Fig. 4.9](image)

**Fig. 4.9**: Blackwood’s note names and enharmonic equivalences for 14-TET

![Ex. 4.7](image)

**Ex. 4.7**: Tonic/antitonic alternation between two ICs with no pitch-class overlap; excerpt begins at 1:48 of [https://www.youtube.com/watch?v=rW_X0bgHlrQ](https://www.youtube.com/watch?v=rW_X0bgHlrQ)
Every note in mm.109 and 111 (and 108, for that matter) has an odd-numbered $z$-component and is spelled with a circle-arrow, whereas those in m.110 have even-numbered $z$-components and no circle-arrows. This modally agnostic antitonic differs from the ones previously discussed in Ex. 4.6 in that the present case involves a change of bass and no pitch-class overlap between the two ICs, which sets m.110 into even starker relief against the surrounding tonics. The aural effect of this progression is not unlike that of the following progression from the *Fortnite* Battle Royale menu theme:

![Ex. 4.8](image)

Ex. 4.8: An analogous instance of tonic/antitonic alternation with no pitch-class overlap; excerpt begins at 0:18 of [https://www.youtube.com/watch?v=lzJ3eUGVRHA](https://www.youtube.com/watch?v=lzJ3eUGVRHA) (music by Rom Di Prisco)

Both of these progressions occur in tunings where expressions of dominant and pre/subdominant function are also possible, which further sets them apart from the oscillatory “23 Notes” progression previously discussed. But what is unique about “14 Notes,” as I will explore further in the next chapter, is that these traditional functions can be perceived as such even when the music is fully equiheptatonic, or in 7-TET. This is to say, harmonic function and tonal centeredness can be perceived even in the absence of literal heptatonic diatonicism, because 12-enculturated listeners are so accustomed to a distinction between major and minor seconds that they will mentally “bend” a 7-TET scale to create these desired asymmetries—which are so fundamental to enabling a “centered” hearing—even when they do not exist. In
theory, a 7-TET scale can be marshaled in composition (and subsequently “warped” in listening) to evoke associations with any of the diatonic modes. But in “14 Notes,” as we will see, it usually comes across as a mix between ionian and mixolydian. This will make for a fitting culmination to my recurring exploration, in this dissertation’s interior chapters, of the various kinds of equally spaced acoustic objects native to non–12-TET tunings that can be subconsciously distorted into their nearest (asymmetrical) 12-TET counterparts as a means of hearing the tonality in microtonality. Not only does this phenomenon occur with split fourths, triads whose thirds are identical, or fivefold equal divisions of the octave; it can also occur with entire heptatonic scales.

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If harmonic process can be likened to humor—and certain well-placed ICs to “punchlines”—then harmonic function represents an interpretive judgment not about these punchlines themselves, but about the particular ways that these punchlines are set up and moved past, relative to the enculturative particularities of one’s expectational and predictive apparatuses. This chapter has been pushing back against the tacit yet widespread pedagogical tendency to frame harmonic function as something that inheres in chords the second they sound, with little attention paid to their broader contexts of occurrence, the conditioning influence of (hyper)meter, and the like. In the process, I have been arguing for an understanding of function in which content and context both play indispensable roles, and I have been doing so while paying particularly close attention to the ways that so-called “scene cuts” and “transition music” consolidate an IC’s functional qualia. It is my hope that future generations of musical discourse are more explicitly cognizant of the realization that, when it
comes to sensations of harmonic function, the setup and punchline are simply not complete without the ensuing static. And this constitutes the ultimate irony of all: that only when we attend more closely to the “static” (as a noun) can we then truly claim to have moved past a “static” (as an adjective) conception of harmonic function.
Chapter 5  |  The “Stuff” of Tonality

Imagine that you are teaching a rather straightforward tonal piece in an undergraduate theory classroom. Ask the class “what key are we in?,” and you are likely to receive some quick responses. Follow up by asking them “how do we know?,” however, and you are likely to be met with a healthy dose of silence (at least at first). Certain students may find the query facile: of course it’s in C major—it says so right there in the piece’s title! Or they may find it mildly frustrating, even pointless: it just is! What else could it be in? Other students, though, may simply be at a loss for words, unexpectedly struck by the gravity of a question that is far less simple than it seems at face value. For how exactly do we know that a key is a key, and a tonic a tonic, without resorting to circular or tautological reasoning?

This one-two punch of questions has become a go-to gambit of mine in the classroom over the past few years. In asking the second question of the pair, I am prompting my students to reflect on what I call the “stuff” of tonality: the slew of factors that led them to answer the first question of the pair as they did. Of course, many of these factors are subconscious—the result of a lifetime of exposure to tonal musics and the implicit knowledge that comes with it. Others are explicit topics covered in the course itself, such as the tendency for “stronger” metrical positions to house more structurally stable tonal events. When a student eventually mentions an explicit factor such as this and points to certain locations in a score to illustrate their point, I immediately ask: “So where is tonality located, then? In the notes on the page?” Most catch on right away that this question is a leading one and that notation alone does not tell the full story. At this point, the expressions on many of their faces indicate that they need
some time to process their thoughts. And so I ask them to reflect on these matters in writing for
our next class—specifically, to address the ways that musical/theoretical factors, historical/
cultural factors, and psychological/cognitive factors interact to influence their judgments of key.
One student remarked to me upon entering the room for our next meeting that they felt they
somehow knew “far more about tonality, and yet also far less about tonality,” than they ever
did before. This sort of productive confusion was exactly what I was after.

It is what I have been after, too, in this dissertation. The regime of Euroclassical-derived
tonality as configured in 12-TET has become so ubiquitous, given, and seemingly obvious in
Western musical culture over the past century that we often do not stop to question why and
how it is the way it is. We tend not to hear its peculiarities, its idiosyncrasies, and its puzzling
contradictions as such, because things are rarely ever otherwise. The liminality of Blackwood's
microtonal music—as both a part of this regime and yet seemingly apart from it as well—
therefore makes it a productive tool to shine a light on some of tonality's oft-overlooked
mechanisms of operation. It has been my contention all along that attending closely to this
music can lead to some refreshing clarity about the nature of tonality—perhaps that most
prominent floating signifier in the sea of music-theoretic terms and concepts. But this eventual
clarity can only come at the cost of initial confusion: that sense that one's most deeply
ingrained predispositions about tonality may not actually be as self-evident as they seem. I
have been begging the reader's patience through these moments of disorientation and
cognitive dissonance, promising that productive confusion can only be productive in the end if
one first embraces the generative power of confusion. I want to reiterate here that, when it
comes to unlocking the “true nature” of tonality (or harmonic function, or consonance and
dissonance, or scale-degree qualia), I do not have all the answers. Nor does anyone else, for that matter. What I do have, however, is a useful prism in Blackwood’s microtonality that, when held up to our “everyday” experiences of tonal music, can refract some previously invisible facets and reveal some fresh and novel insight—so long as we are willing to savor the attendant fuzziness and paradox.

**Fruit Salad, Again**

Donald Tovey has written that “[t]onality is a thing which you can no more describe except by metaphors and comparisons than you can describe the taste of a peach.”¹ But a cursory survey of what Brian Hyer has called the “veritable profusion of definitions” accorded to tonality makes one wonder whether scholars have actually been eating different fruits all along.² Gerald Balzano, for instance, formulates an account of tonality that is heavily indebted to group-theoretic criteria but that also attempts to bridge the mathematical and the perceptual. He frames the concept in terms of an interaction between three isomorphic groups that form three differently generated spaces—semitone, fifth, and triad—encouraging readers to think of tonality as “corresponding to a perceptible region in the[se] spaces.”³ Norman Carey and David Clampitt posit a mathematical explanation of a different sort, zeroing in on a single

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active ingredient rather than a triptych of interacting spaces. As they write, “[A] single structural principle […] the well-formed scale […] can serve as a principled basis for tonal music,” since it accounts not only for pentatonic, diatonic, and chromatic scales but also for the tonic/subdominant/dominant relationship (not to mention other non-Western and microtonal pitch collections).⁴

In a later article, Carey approaches the question from an information-theoretic perspective, arguing that “the information content of scales is related to their capacity to promote a tonic.”⁵ More specifically, the best scale candidates, for Carey, are those that “carry relatively little information and are fairly rich in redundancies.”⁶ On the surface, this seems to resonate with Paul Erlich’s notion of “harmonic entropy,”⁷ which measures “uncertainty in pitch perception” and “provides a physical correlate of tonalness” such that “high tonalness corresponds to low entropy” (and vice versa).⁸ But Erlich’s “tonalness” describes the “closeness

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⁴ Carey and Clampitt, “Aspects of Well-Formed Scales” (1989), p.177 [emphasis in original]. Well-formed (WF) scales are defined as “scales generated by consecutive fifths in which symmetry is preserved by scale ordering” (189).


⁶ Ibid., p.41.

⁷ Erlich developed this term in a series of online posts to the Mills College Tuning Digest beginning in September 1997. Some of this material is archived at http://www.tonalsoft.com/enc/e/erlich/harmonic-entropy_original.aspx.

of the partials of a complex sound to a harmonic series,” whereas Carey’s conception of
atonality does not rely on the harmonic series—or on any sort of acoustical criteria, for that
matter. For Erlich, just intonation is the standard, the referential yardstick, when extending
notions of consonance and tonality to microtonal terrain; for Carey (as well as Balzano before
him), tonality is more about replicating generalized intervalllic behaviors than it is about
approximating specific frequency ratios or cent sizes.

Of course, the whole of tonality is greater than the sum of its intervalllic parts, and
several commentators have formulated definitions of tonality that center the tendency for these
intervals and intervalllic collections to be (heard as) vectored towards a single privileged z. Aline
Honingh, for instance, describes tonality as “the orientation of melodies and harmonies
towards a referential (or tonic) pitch class.” But she also notes that there is often
disagreement as to whether such orientation is “natural or inherent in [the] music” or whether it
is “constructed by the composer, performer, and listener.” What is left unaddressed, though,
is the possibility that ostensibly naturalistic accounts of tonality may actually be products of
cognitive misattribution.

Obviously, I cannot make any further claims about specific theories or theorists in this
regard. But I can safely say that naturalistic definitions of tonality have largely been in decline

9 Ibid., p.371. This differs from David Temperley’s probabilistic definition of “tonalness” as “the
degree to which a [pitch-class] set is characteristic of the language of common-practice tonal

definition is basically identical to the one proffered in Hyer, “Tonality” (2002), p.726.

over the past few decades, in favor of accounts that stress the subjectively constructed nature of tonal sensations. These latter accounts have largely been bolstered by recent research in music perception and cognition (much of which I discuss in Chapter 1) that unpacks the roles of expectation, prediction, and enculturation in structuring one’s experience of tonality. David Temperley’s *Music and Probability*, for instance, discusses tonality in terms of the real-time mental processes involved in perceiving keys and metrical structures. Steven Rings’s *Tonality and Transformation*, moreover, pursues tonality’s “esthesics” in a phenomenological account that frames tonality as “something experienced,” rather than something “immanent [in] musical works.” And even Dmitri Tymoczko’s *A Geometry of Music*, which has a very different set of goals and commitments than the previous two books, proposes five components of tonality (conjunct melodic motion, acoustic consonance, harmonic consistency, limited macroharmony, and centricity) that are all framed and/or discussed at some point in terms of their capacity to be heard as such.

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13 Rings borrows this term from Nattiez, *Music and Discourse: Toward a Semiology of Music* (1990), pp.12ff. Nattiez notes that the word “esthesic” was coined by Paul Valéry in his 1945 inaugural lecture at the Collège de France.


15 Robert Hasegawa’s review-article “New Approaches to Tonal Theory” (2012) provides a good discussion of the differences in method and ideology between Rings’s and Tymoczko’s contemporaneous accounts of tonality.

Tymoczko’s principal goal in formulating these five features is to isolate certain properties that link together a wide swath of tonal musics—both “Western and non-Western, past and present.” Other accounts are more general yet, sharing Tymoczko’s focus on stylistic plurality and temporal flexibility but stopping short of positing an overarching list of common features that make all tonal musics tonal. The purpose of such definitions, which typically engage what Hyer calls the “broadest possible sense” of tonality as a “systematic arrangement of pitch phenomena and relations between them,” is to optimize the term’s cultural coverage and thus its explanatory power. Philip Tagg’s conception of tonality as “the system or set of norms according to which tones are configured in any musical culture” is a perfect example of this. Tagg’s account is remarkable for its decolonial approach, its meticulous terminological clarity, and its colloquial focus on the intuitive aspects of “what most people hear.” But his framing also raises some questions: who, for instance, is excluded from the banner of “most people”? And is there really only one dominant “system or set of norms” in each musical culture? Christopher White’s insistence that “within Western music history, there has not only

17 Ibid., p.4.  
20 See in particular Chapter 1 (pp.45–64), which carefully and concisely disentangles the terms “note,” “pitch,” “tone,” “tonal,” “modal,” “tonical,” and “tonality” (among a few others).  
21 This latter phrase, of course, is explicitly foregrounded in the book’s bold subtitle: “Towards a Tonal Theory of What Most People Hear.”
been one tonality, but multiple tonalities”²² comes to mind as a notable objection to this latter claim. Both White and Tagg emphatically push back against the idea that Western Euroclassical tonality is a unitary and hegemonic phenomenon that serves as the benchmark for the rest of the world’s tonal musics. But they go about their respective projects of provincialization in vastly different ways.

A zooming-out is warranted here, before the plethora of fruits starts to overwhelm and the metaphorical bowl starts to overflow. While there are some discernible trends in recent scholarship about tonality—foremost among them a greater emphasis on cognition and a de-centering of Euroclassical functional varietals—broad disagreements still exist regarding the term’s historical scope, its cultural domain of application, whether it can be distilled into a list of basic ingredients, and if so, what those ingredients might be. There is also ongoing debate as to tonality’s proper “location” (i.e., in notation, in sound, in the mind, in the body, in multiple of these, or in none of these), the relationship between musical properties and perceptual ones in this nexus, and the relative importance of concepts and percepts in processes of tonal hearing. And finally, there has been a longstanding ambiguity arising from what Lloyd Hibberd calls “the application of ‘tonality’ to a theoretico-historical concept on the one hand, and to a psychological sensation on the other.”²³ In the face of all this, it is important to reiterate that my intent in this dissertation has not been to fix a definition of this slippery term; that would be


a counterproductive exercise. Instead, my aim all along has been to wield Blackwood’s microtonal compositions as a strategic lens through which one can gain a fresh look at diatonic tonality from a uniquely liminal perspective that is at once outsider (eschewing the familiar 12-tone octave) and insider (evoking its phantom presence anyway). Perhaps this is exactly what the well-worn concept of tonality needs: a jolt from some music whose paradoxical nature can compel one to stop and think about those elements of tonality (and tonal hearing) that tend to be downplayed, passed over as unremarkable, or taken for granted in conventional accounts and everyday experience.

The remainder of this chapter contains two major sections that delve into the “stuff” of tonality. The first meditates on the nature of tonal salience, investigating the respective roles that musical “entities” (like individual tonal pitches) and musical relations (like the intervals among those pitches) play in broader sensations of tonality, and asking whether such entities/relations might stand out to listeners because of their relative frequency, their relative rarity, or some combination of the two. The second section, then, lays out some fundamental propositions about tonality that Blackwood’s microtonal compositions reveal rather well, ultimately leading into a discussion of tonality’s physiognomy, its enabling conditions, and its practical limits. In this latter section, I propose the term fuzzy heptatonic diatonic tonality as a way to synthesize the various inflections of tonality discussed throughout this dissertation—both within Blackwood’s microtonal music and beyond—into a conceptual gestalt.
On Salience (I): The “Rivalry” of Tonal Hierarchy and Intervallic Rivalry

What makes something tonally salient? Does the relative frequency of a musical occurrence make it stand out more, or is the opposite the case: that the less frequent it is, the more it strikes the ear as carrying noteworthy information? This section argues that both can be the case simultaneously, since there are multiple kinds of tonal salience that operate independently, in conjunction with pathways of expectation, memory, and prediction that are themselves independent. The ensuing discussion picks back up on two interrelated threads from previous chapters: the distinction between processing music-syntactic (ir)regularities and acoustic (ir)regularities (as outlined in Chapter 1), and the reconciliatory framing of tonal context and tonal content that is enabled by such a distinction (as outlined in Chapter 4). I begin by returning to a moment of scholarly contention mentioned in the previous chapter—a brief debate in the late 1980s and early 1990s between David Butler and Carol Krumhansl concerning the brass tacks of tonal hearing—and unpacking it in more detail. After recapitulating and mediating this debate, I illustrate some different kinds of tonal salience through two contrasting analytical vignettes from Blackwood’s microtonality, and then I consider more broadly the misattribution of qualia that are relational to entities that are static.

Certain scholars have attempted to model tonal hearing by specifying tonal hierarchies, according to which different layers of the hierarchy afford different levels of tonal stability. Fred Lerdahl, for instance, proposes the following “basic space,” in which higher rows are more structurally stable than lower ones, with the result that pitch classes (i.e., columns) with more x’s are of comparatively greater tonal importance in C major:

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Lerdahl’s theory is indebted in large part to Carol Krumhansl, whose prior work established the empirical observability of tonal hierarchies through the pioneering probe-tone method, which she developed in conjunction with Roger Shepard. Under this paradigm, listeners hear a short snippet that establishes a tonal context followed by an isolated single tone, which they are then asked to rate according to its perceived goodness of fit with the preceding context. These ratings can be schematized as below:

![Fig. 5.1: Lerdahl’s basic diatonic space, normalized to C major](image)

Notice the similarities with Lerdahl’s basic space in Fig. 5.1 above—except here, the more stable layers of the hierarchy are the lower rows (and there is no separate fifths level). Once

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26 See especially Krumhansl and Shepard, “Quantification of the Hierarchy of Tonal Functions Within a Diatonic Context” (1979).

27 Image is from Krumhansl and Keil, “Acquisition of the Hierarchy of Tonal Functions in Music” (1982), p.244.
again, the more populated columns indicate the notes that are of greater comparative tonal importance in a C-major context, but in Krumhansl’s case, these ratings reflect actual judgments of fit by participants rather than theoretical postulates unconnected from empirical observation.

One advantage of tonal hierarchies is that they have been found to correlate rather well with each note’s relative frequency of occurrence in a (major-key) tonal context. Matt Hughes’s study of Schubert’s Op. 94, No. 1,\(^\text{28}\) for instance, records the sum-total durations for each of the twelve chromatic scale tones in the piece; as it turns out, these share a correlation of \(r=0.97\) with Krumhansl’s tonal hierarchy for G major. This close relationship is summarized below:

\[ \text{Fig. 5.3: A strong correlation between tone durations and probe-tone ratings}^{29} \]


But while this is an impressive correlation, it must be clarified that Schubert’s Op. 94, No. 1 is actually in C major, and so the best fitting tonal hierarchy in this case is that of the dominant key, not the tonic. This illustrates rather well the complications involved in treating statistical frequency as a direct measure of tonal stability. As David Huron points out in this regard, “[T]he dominant pitch is the most frequently occurring scale degree [in Western tonality]; however, the tonic pitch is judged by listeners as evoking the greater pleasure.” Ian Quinn, similarly, cautions against placing too much trust in the static reductionism of pitch-class profiles, arguing against the assumption that tonal hierarchies are transpositionally invariant. 

Krumhansl has taken great pains to clarify that her tonal hierarchy is “not a theoretical model, but instead a summary of psychological data”—a disclaimer that is carefully repeated in more recent books by Eytan Agmon and Daniel Harrison. But much of the confusion that led to this remark in the first place, I contend, is not actually of Krumhansl’s own doing. The catalyst is a 1989 article by David Butler that launches a critique of what he calls the “tonal hierarchy theory” and its associated probe-tone technique, proposing in its place a theory of “intervallic rivalry.” Butler frames his theory in opposition to Krumhansl’s work, charging that

30 Huron, Sweet Anticipation (2006b), p.139. The reason that 5 occurs more frequently than 1 in Western tonal music is that 5 is a member of both the dominant and tonic triads.

31 See in particular Quinn, “Are Pitch-Class Profiles Really ‘Key for Key’?” (2010) and Quinn and White, “Corpus-Derived Key Profiles Are Not Transpositionally Equivalent” (2017).

32 Krumhansl, “Tonal Hierarchies and Rare Intervals in Music Cognition” (1990), p.310.


34 Harrison, Pieces of Tradition (2016), p.27.

her tonal hierarchies “do not describe the mental processes by which the tonal center of a piece of tonal music is recognized, nor [do they] account for the dynamic perception of tonality as it unfolds during actual music listening.” 36 Butler’s alternative theory claims to be more attentive to these real-time dynamics. As he argues, “[L]isteners recognize the tonal center in tonal music on a best-evidence basis, and the clearest evidence is carried in the rarest-occurring intervals in the diatonic set.” 37 In other words, rare intervals such as tritones provide the more perceptually salient cues in what Richmond Browne calls the process of tonal “position finding” 38 than do more common intervals such as thirds and fifths, since these latter occur naturally in multiple places within diatonic scales, whereas tritones only occur naturally in a single position. 39

A series of neat oppositions thus emerges: tonal hierarchies are static, whereas intervallic rivalries are dynamic. The former locate the most valuable tonal information in zeroth-order statistical frequencies, whereas the latter locate it in first-order statistical rarities. With tonal hierarchies, the carriers of such information are individual pitch classes. But under the intervallic rivalry theory, as the name indicates, these carriers are intervals. Butler’s polemical style reduces the complexities and nuances of tonal hearing to a simple binary. But at the same time that it reduces, it also raises the stakes of debates surrounding the elusive

36 Ibid., p.219.

37 Ibid.


39 The logic of position finding and intervallic rivalry calls to mind Huron’s remark that “[w]hen something is novel, it makes sense that an organism should direct its attention towards it.” [Huron, “A Psychological Approach to Musical Form: The Habituation-Fluency Theory of Repetition” (2013), p.9.]
nature of tonality and tonal hearing, creating a discursive environment in which interlocutors can often feel pressured to choose sides. Robert Gjerdingen’s review of Krumhansl’s *Cognitive Foundations of Musical Pitch*, for instance, is indicative of the “either/or” nature of the discourse at the time: “I share Krumhansl’s belief that people initially learn to understand music through sensitivity to statistical regularities in the music they hear. But I suspect that the entities making up those regularities are relational in nature—intervals, rhythms, and contours rather than individual pitches.”

Traces of this oppositional strain even persist into the next century, as the following quote from Dora Hanninen attests: “[M]usic emerges not within the notes one can point to on the page, but between notes, among sounds, within contexts, over time.”

Butler’s 1989 article prompted a brief but intense back-and-forth between he and Krumhansl the following year. In it, Krumhansl pushes back against Butler’s charge that tonal hierarchies are static, arguing that “the cognitive representations revealed by the [probe-tone] experiments carry important time-variant information,” and citing her own prior work on “contextual asymmetry” to bolster her point. She also stresses the distinction between data

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42 Krumhansl, “Tonal Hierarchies and Rare Intervals in Music Cognition” (1990), p.322.


44 According to this Gestalt principle, “When a [probe] tone lower in the hierarchy is followed by one higher in the hierarchy, they are perceived as psychologically less distant than when the two tones are played in the opposite order.” [Krumhansl and Cuddy, “A Theory of Tonal Hierarchies in Music” (2010), p.59.]
and theory, claiming that Butler (mis)takes her notion of tonal hierarchy for the latter when it actually encapsulates the former. But the main thrust of her response is one of rapprochement: “It is important to emphasize from the outset that the tonal hierarchy is just one component of experienced listeners’ abstract knowledge of relations among tones, chords, and keys.”

According to Krumhansl, several kinds of tonal cues exist, from the statistical regularities of the diatonic set to the rare intervals of tritones and minor seconds, and “they are not mutually exclusive. Listeners may use a number of cues in combination, with the weighting possibly dependent on the musical passage in question.” With this response to Butler, Krumhansl tries to change the register of the debate from the polarizing exclusivity of “either/or” to the pluralistic nuance of “both/and.”

It would take a few years for Butler to cede any ground on the matter. His immediate response to Krumhansl only doubles down on his position, arguing that the probe-tone method lacks ecological validity, that Krumhansl portrays his intervallic rivalry theory as “severely limited,” and that her own understanding of chromaticism and tonicization is too “simplistic,” which leads her to confound “tonality” and “diatonicism.” It is here that the debate reaches its peak intensity—but from this point forward, the temperature would cool. Krumhansl never directly responds to Butler again, and by 1994, he adopts a more conciliatory tone. In an article from that year by Helen Brown, Butler, and Mari Riess Jones, tonal hierarchies and intervallic rivalry—once framed as warring factions—are now regarded as compatible.

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45 Krumhansl, “Tonal Hierarchies and Rare Intervals in Music Cognition” (1990), p.309.
46 Ibid., p.317.
models. As they claim, “[T]he intervallic rivalry model and the tonal hierarchy model complement one another insofar as the former may function with rare intervals to guide and confirm key discovery, while the latter may come into play with common intervals to express tonal implications between the established key and related ones.”\textsuperscript{48} This suggests a tonality-focused analog to Danuta Mirka’s distinction between “finding” and “monitoring” meter\textsuperscript{49} that is best illustrated with two contrasting moments from Blackwood’s microtonal music.

**On Salience (II): Illustrative Vignettes**

In both of the following moments, tonal groundedness is either suspended, ambiguous, or in flux; my focus is on how one might go about (re)gaining their bearings in the face of (micro)tonal equivocality. A crucial premise here is that “being in a key” is not one single sensation, since there exists a robust continuum of tonal articulation. Keys can be established, denied, foisted, dangled, or clouded by various syntactical and rhetorical means—and doing so enlists the help of myriad configurations of musical parameters and materials. Tonal interpretation, in short, is never an all-or-nothing affair. Rather, it is a nuanced process that is always-already in flux. The following analytical vignettes therefore treat key areas not as “static entities,” to quote Harrison, but as “part of the apparatus of becoming.”\textsuperscript{50}


Harrison’s study of late-nineteenth-century enharmonicism proposes a sixfold typology of “graduated key articulations”\textsuperscript{51} that comprises an appropriate starting point for inquiry into Blackwood’s treatment of keys, not least because several of his microtonal compositions evoke this same late-nineteenth-century soundworld. Harrison’s six categories are formal keys (established by “large-scale cadential articulations”), asserted keys (“created by rhetorical means” and “established by force”), surface keys (“lightly articulated” with “weak establishing rhetoric”), passing keys (“largely analytical artefacts” that arise from “pointing to a key but withholding its tonic”), chord keys (“temporary special effect[s] created by a rhetorical accent” on a triad lying outside of a local key), and feigning keys (surface keys with a “dissonant tonic chord at the cadence”).\textsuperscript{52} I contend that all of these above types occur unambiguously at some point in Blackwood’s microtonal music. But more interesting are those moments that do not fit so neatly within Harrison’s typology—moments that reveal rather pointedly, in their rhetorical and contextual novelties, that key articulation and tonal hearing are things that exist on a rich continuum of qualitative possibilities. In what follows, I discuss two such moments, paying particular attention to the roles that rare intervals and tonal hierarchies can play in shaping the processes of “finding” and “monitoring” tonality.

I begin with the opening bars of “13 Notes,” which provide an interesting case study in the matter of “finding tonality.” My overarching contention is that the listener does not find the tonic here; rather, to quote Harrison, “[t]onic finds the listener.”\textsuperscript{53} More specifically, the

\textsuperscript{51} Ibid., p.143.
\textsuperscript{52} Ibid., p.144.
\textsuperscript{53} Harrison, Harmonic Function in Chromatic Music (1994), p.75.
boxed Ab in the bass of m.5 behaves like what I will call a “tonic by imposition”—though its rhetoric of assertion is gentle, understated, and (as Blackwood’s timbral marking reads) “veiled.”

Ex. 5.1: A “tonic by [gentle] imposition” in m.5; excerpt begins at 0:00 of https://www.youtube.com/watch?v=gA6m6DW83SM
This is far from a brash Harrisonian “asserted key,” nor is it quite a full-fledged instance of what Charles Smith calls “presentational tonality.”\footnote{Smith, “The Functional Extravagance of Chromatic Chords” (1986), p.129. Smith’s “presentational tonality” and Harrison’s “asserted keys” are described in similar ways (both authors, for example, use the word “force”).} For one thing, the moment is extremely subdued—certainly not the “brute-force reiteration” of tonic that Smith describes as prototypical.\footnote{Ibid.} The moment does, however, dovetail with Smith’s condition of “registral prominence”: the boxed Ab in Ex. 5.1 enters once the parallel thirds in the upper two voices have reached their melodic peak, and this effects their directional reversal. The bass-voice Ab, then, might be imaginatively conceived as imposing a force field on the notes already sounding above (hence the term “tonic by imposition”)—a gentle “nudge” that motivates them to resolve normatively to a minor triad above the sounding root.\footnote{Ibid.} The Ab therefore acts as an agent of retroactive tonal clarification; its presence allows perceptible scale-degree identities to accrue to the upper voices, which then bend to its unwavering will. This tonic may not sound like the conventional tonal tyrant—the durchbruch D major of Mahler’s Titan, or the assault-like orchestral apotheoses of Liszt, for instance. But though it speaks softly, it carries with it a highly charged regime of expectation: the “big stick” of tonality.

So a moment of relative tonal clarity results from this Ab in the bass, even as the full-fledged arrival of the tonic triad itself is delayed by a double suspension. The Ab contains sufficient magnetism to impose momentary order on the equivocal scalar wandering of the first
four bars—which is no small feat, considering the unusual nature of this 13-TET scale. Sporting eight notes and an intervallic pattern of \(<21221221>_{13}\),\(^{58}\) this collection’s closest 12-TET analog is an aeolian scale with both a minor seventh \((y=\text{sol})\) and a major seventh \((y=\text{si})\) above tonic. But as the parallel ascending thirds in mm.1–4 demonstrate so viscerally, this scale can also exist at great affective remove from the “home world” of 12-TET. I like to conceive of mm.1–4 as presenting the tonal equivalent of the linguistic “garden path” phenomenon.\(^{59}\) The effect is subtle: the 277- and 369-cent thirds in this passage (measuring three and four unit intervals, respectively) are rather narrow, but as individual dyadic verticalities, they can be cognized as thirds without much issue. Yet when these intervals are iterated several times upward over an eight-note scale, centwise discrepancies accumulate to the point where it sounds like an extra scale step is needed to traverse the octave. This throws one’s sense of scale-degree bearings into disarray by m.3: what starts out so innocently as a passage of parallel rising thirds now seems like an uncanny portal through a tonal wormhole. Metrical interpretation, too, is thrown off by the sudden reconsideration of alleged scalar bearings.\(^{60}\) All in all, the “extra” minor second in this eight-note scale greatly complicates the process of position finding for those listeners who are accustomed to this interval’s relative rarity in typical diatonic contexts. Indeed

\(^{58}\) Blackwood calls this collection the “sub-minor” scale in several of his published and unpublished writings.


\(^{60}\) Blackwood’s curiously idiosyncratic phrasing (and at times rhythmically shaky rendering) of these first few bars—particularly after the slightly awkward voice crossing in m.2—certainly does not do a listener any favors, either.
(and perhaps unsurprisingly given the main argument of Chapter 3), much of this passage’s
dissonance is expectational in nature, originating in the cardinality mismatch between the 8-
ote scale of the etude and the 7-note aeolian scale that acts as a referential orienting
collection for many 12-enculturated listeners.

Huron refers to the moments of confusion that attend garden-path experiences as
“glitches,” noting that they “def[y] straightforward classification as either schematic or dynamic
surprise.”\textsuperscript{61} When the boxed Ab enters in m.5, then, the glitch begins to resolve. Listeners are
“nudged” to reinterpret the scale degrees just heard in terms of this newly imposed tonic (Ex.
5.1 illustrates this for the pitches of m.4), and the system—at least momentarily—is debugged.
The emergent sense of Ab aeolian extends beyond the bracketed point in Ex. 5.1; members of
its tonic triad also appear on the downbeats of m.7 and m.8 in the highest voice part (labeled
above), providing periodically regular points of reference that tonally anchor the novel, snaking
melodic line. Of course, the Ab pedal also remains in the bass until measure 12.

Now compare this with the following moment of relative tonal clarity that emerges
amidst the quarter-tone contrapuntal bustle of “24 Notes”:

\begin{figure}[h!]
\centering
\includegraphics[width=\textwidth]{24_notes.png}
\caption{Blackwood’s note names and enharmonic equivalences for 24-TET}
\end{figure}

\textsuperscript{61} Huron, \textit{Sweet Anticipation} (2006b), p.281. He goes on to say that “[t]he surprise itself is
schematic, but the setup is clearly passage-specific” (281).
Whereas the previous example from “13 Notes” deals with finding tonality, this one engages processes of monitoring tonality. Measure 42 features the longest cessation of contrapuntal motion—at half a measure without any voices moving—since m.28, and this will not happen again until m.71. The moment, quite uniquely, is marked for its lack of activity, which helps to create a rhetorical accent (both agogic and metrical) on the boxed Gb major triad. One could argue that this triad acts rather like a Harrisonian “chord key,” particularly given that we “remain on the chord long enough for it to be proposed as an asserted key.” But certain of his other requirements, such as the tendency for chord keys to “move towards a cadential progression in a new (generally surface) key,” are not fulfilled. In addition, it is difficult to make the claim that this triad is “not diatonic to the local key,” since the frequent switching

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63 Ibid.

64 Ibid.
back and forth between quarter-tone collections muddles any sense of a clear local tonic or an unambiguous referential scalar collection.

More interesting, though—and more determinate—is the triad’s diatonic relationship to the etude’s global key of Bb aeolian. Indeed, it shares two pitch classes, Bb and Db, with this key’s tonic triad. It is thus parseable as a first-inversion VI: a tonic proxy whose outer voices provide an associational link with the nominal tonic of the etude. I say “associational,” rather than “hierarchical” or “prolongational,” because this Bb aeolian tonality is not embedded in the etude’s “deep structure,” so to speak. It is never confirmed with syntactic progressions or familiar cadences. Rather, it is just sort of there when it needs to be: the etude, formally a passacaglia, opens with the anacrucistic Bb–Db of its main subject (each subject also ends on a Bb), and it closes with a nineteen-measure pedal point on Bb. Between these endpoints, there are few signs of Bb acting as a conventional tonal center. Instead, it acts rather like a placeholder: the etude is more nominally “on” (or “enclosed by”) Bb than it is “in” Bb. Because most of the etude presents a clouded tonality brought on by continuous toggling

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65 Not to mention that Bb and Db are also the first two notes of the etude’s passacaglia subject, which begins another entry just prior to the occurrence of the IC under discussion (pickup to m. 41, bracketed in Ex. 5.2).

66 For more on “associational” versus “prolongational” relationships among musical events, see Straus, “The Problem of Prolongation in Post-Tonal Music” (1987).

67 This latter Bb certainly does not sound like a tonic pedal when it enters in m.69; it ushers in some of the most dense chromaticism of the etude, featuring its only instances of quarter-tone “mixture” within individual ICs. By the time the pieces of Bb aeolian fall into place (mm.81–83), the ensuing close seems perfunctory—even anticlimactic, resigned. Blackwood invokes a strong norm of fugal writing, the pedal point, in name only; its usual functional charge is drained.

68 This is precisely why I use the term “nominal tonic” earlier in the paragraph.
between quarter-tone collections, listeners are likely to compensate for this disorientation by latching all the more tightly onto any brief wisps of tonal clarity that may happen to emerge. As far as “24 Notes” is concerned, the downbeat of m.42 presents as clear a tonic function as there will be, relatively speaking, between the aforementioned endpoints of the etude. That the IC in question is only a proxy, a triadic substitute for the nominal tonic, does not matter; we will take what we can get.

Rhetorical accent created by the absence of musical motion: this is exactly what agogic accent is, and yet in a sense, it also seems strangely counterintuitive. After all, is it not usually the case that something—or some series of things, like a cadential progression—has to happen in order for an IC to be confirmed as a tonic? The situation is counterintuitive, too, from an expectational standpoint. One of my guiding claims in this dissertation is that 12-enculturated listeners compensate for the lack of specific intervals, ICs, and progressions familiar from 12-TET by relying all the more strongly on schematic and dynamic expectations to make sense of Blackwood’s microtonality. As it turns out, 24-TET is the only one of Blackwood’s dozen tunings that contains the exact pitches of 12-TET (boosting the likelihood of veridical resonances), but he marshals 24-TET in composition so as to defamiliarize the pitches of 12-TET, largely by flouting schematic expectations about how keys are confirmed. What is more, m.42 of “24 Notes” even flouts dynamic expectations in that the predictable 8th-note stream of contrapuntal patter suddenly stops. Sure, it is on a downbeat, but this is the second downbeat since the passacaglia subject’s most recent entry—typically a “weak” measure in hypermetric terms. In short, this is an odd spot for a tonic to emerge. Yet it does, and this emergence is powerful enough to outweigh the fact that the tonic is not even in root position!
I have chosen the two illustrative vignettes in this section with a single rationale in mind: to problematize Brown, Butler, and Jones’s claim that intervallic rivalry primarily aids listeners in finding tonics, whereas tonal hierarchies primarily aid listeners in monitoring tonics. The situation, as these examples demonstrate, is not so neatly complementary. It might be more accurate to characterize intervallic rivalry and tonal hierarchy as equally important players in both processes, finding and monitoring tonics, with this added caveat: when rare-intervallic expectations are manipulated (or if such intervals are absent altogether), listeners compensate by relying more heavily on statistical regularities of tonal hierarchies to orient themselves. This is to say, common intervals can aid one in position finding just as much as rare intervals can—if not more in some cases.

In “13 Notes,” for example, the first three dyads of the etude point towards Ab aeolian as the most probable tonic, in large part because of the tell-tale minor second between Bb and Cbb (not to mention the initial metrical support given to the triadic tones of Ab, Cbb, and Eb). But by the downbeat of m.4, which houses an octave transposition of the etude’s first dyad, one will likely come to realize that minor seconds are no longer the reliable indicators of tonal positioning that one might have initially thought. It is not just that the scale in question contains an “extra” eighth tone; it also contains an “extra” third minor second, meaning that this interval is comparatively less rare than it usually is in more familiar diatonic contexts. This makes the minor second lose much of its power as a positional indicator; in fact, it becomes a primary agent of tonal disorientation in this scenario. What eventually saves the day is the unveiling of a familiar tonic-functioning IC—a complete triad—in mm.5–6, without any of the attendant confusion previously caused by the extra minor second. In the midst of subtle chaos,
the common intervals of fifth and (minor) third above root provide a much-needed positional anchor. In other words, when intervallic rivalry fails, tonal hierarchy steps in to pick up the burden.

The situation is superficially similar in “24 Notes,” even despite the finding/monitoring distinction that separates these two examples. Listeners latch onto the comforting familiarity of a triad—that prototypical bearer of tonic function in Western tonal music—to compensate for the alien effect of toggling between quarter-tone collections that pervades the etude up until that point. Of course, quarter-tone intervals are expectationally “rare” for 12-enculturated listeners (and their proliferation in this etude certainly does not do any favors, as regards position finding). But this is a different category of intervallic rarity than the one represented by minor seconds and tritones in diatonic contexts, and this leads to an important distinction: rare intervals can only aid in position finding if they are part of a listener’s referential orienting collection. If they are not (as is likely the case with quarter-tone intervals), they only complicate the process of tonal orientation. Therefore, it is not simply the preponderance of quarter-tone intervals in “24 Notes,” but rather their occurrence at the expense of normatively functioning/resolving diatonic minor seconds and tritones, that clouds the tonality of the etude and shifts the onus of position finding onto the more common (that is, culturally familiar) intervallic combinations, which stand out even more when they occur.

Notice that I am being careful with my language here, referring to intervals and intervallic combinations rather than notes or chords. This reflects a basic premise of the dissertation: that music cognition is fundamentally relational, and that point-like constructions such as “scale degrees” and “chords” are cognitive misattributions that treat relations as if they
were entities. This position has some important implications. First, it pushes back against Butler’s idea that intervallic rivalry lies in direct opposition to tonal hierarchy, the former being dynamic and the latter static. Indeed, as is clear from the preceding examples (and even from Krumhansl’s initial response to Butler), tonal hierarchies are always-already relational in that [1] they “carry important time-variant information,” and [2] their stability/goodness-of-fit ratings refer not to individual pitches in isolation, but to intervals above a perceived tonic. And second, this position problematizes the distinction traditionally made in psychology between relational categories, “whose members share common relational patterns,” and entity categories, “whose members share common intrinsic properties.” Is there even such thing as a genuine entity category in tonal cognition? As preceding chapters have shown, categorization depends fundamentally on contextual relationships; the same “transition-zone” interval, for instance, may be heard as conjunct in one context of occurrence but disjunct in another. Indeed, I contend that all categories in tonal cognition that are notionally regarded as entities can be framed as relational in some way. Consonance and dissonance, for example, are not merely intrinsic properties of isolated acoustic signals; rather, they are also cognitive

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69 Krumhansl, “Tonal Hierarchies and Rare Intervals in Music Cognition” (1990), p.322.


71 A version of this debate is still playing out in the metrical literature, with authors divided over whether musical meter is comprised of a series of extensionless points or of the time-spans that connect those points (or both). Important contributions to this debate include Zuckerkandl, Sound and Symbol: Music and the External World (1956); Lerdahl and Jackendoff, A Generative Theory of Tonal Music (1983); Boone, “Marking Mensural Time” (2000); Mirka, Metric Manipulations in Haydn and Mozart (2009); and London, Hearing in Time: Psychological Aspects of Musical Meter (2012).
categories that relate the experience of sounding music to culturally conditioned expectations. Furthermore, unless one has perfect pitch, “notes” are colloquial redescriptions of intervals, “chords” are colloquial redescriptions of progressions, and “keys” are colloquial redescriptions of large-scale tonal relationships. All of these labels, too, are generated by relating experience to expectation.

This is not to deny that pitches (or chords, or beats, etc.) have intrinsic properties, but rather to emphasize that tonal cognition necessarily involves transducing these intrinsic properties into extrinsic/relational ones, which are more useful for making sense of music over time. Therefore, musical entities do technically exist—the frequency of a sound is one—but this information is often converted into something more useful for time-dependent processing of sound combinations, like intervallic cent size. In such a manner, the intrinsic transforms into the relational. To conclude, then, tonal hearing requires apprehending musical relations, and this process involves taking stock of both regularities and rarities, each of which contributes in its own way to sensations of tonal salience, and neither of which is more important than or logically prior to the other (though their proportional weighting, or relative cueing potential, varies according to the musical context).

Let us not forget that this very process of conversion is literally embedded in the equal-tempered piano keyboard itself, whose physical/visual layout results from a logarithmic transformation that converts pitch frequencies into interval cents. This effectively linearizes pitch space into a form where the relationally auditory takes precedence over the intrinsically acoustic.
Lessons Learned

It is now time to step back and pivot to a more summative register. The principal task of the preceding chapters has been to rethink tonality by disrupting its longstanding discursive linkage with the 12-tone octave (and 12-TET more specifically). Through the defamiliarizing lens of Blackwood’s microtonal music, I have put traditional theories and conventional accounts of tonality under the microscope, investigating how Blackwood’s distinctive compositional and notational approach can reveal certain things about tonality that would not be quite as apparent when listening from within the confines of the Western 12-TET “comfort zone.” By rupturing these culturally ingrained feedback loops, I have promised to shine a light not only on some of the possibilities for composing and attending to tonal music in unfamiliar tunings, but also on certain aspects of tonality and tonal hearing that are often taken for granted in more familiar 12-TET contexts. Doing so has involved a large-scale process of disassembly and reassembly that cuts across the four interior chapters. I have taken certain things apart (disentangling x from y in Chapter 2; separating sensory from cognitive conceptions of consonance/dissonance in Chapter 3) so that I can put other things back together again (reconciling content- and context-based accounts of harmonic function in Chapter 4; demonstrating the complementarity of tonal hierarchies and intervallic rivalry in Chapter 5).

In the remainder of this chapter, I continue in the spirit of reassembly by synthesizing my main conclusions and findings into a list of ten basic lessons that Blackwood’s approach to microtonality can teach us about tonality more broadly. And so, in lieu of a culminating, monist theory of (micro)tonality, I instead offer the following series of clarifying propositions:
1) **Tonality is not reducible to a list of features, a set of properties, or a single “magical ingredient.”**

Let us return to Tymoczko’s claim that there are five fundamental components of tonality: conjunct melodic motion, acoustic consonance, harmonic consistency, limited macroharmony, and centricity.\(^{73}\) As discussed previously, he argues that these five features “are present in a wide range of genres, Western and non-Western, past and present.”\(^{74}\) But the degree to which they transfer to microtonal terrain, I submit, is debatable.\(^{75}\) Consider the opening of “21 Notes,” for instance:

![21 Notes](image)

**Fig. 5.6:** Blackwood’s note names and enharmonic equivalences for 21-TET

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\(^{74}\) Ibid.

\(^{75}\) Of course, I have already explored at length in Chapter 3 how tonality can exist without the traditional sense of (psycho)acoustic consonance. In Chapter 6, moreover, I will examine a free jazz recording by Ornette Coleman to argue that it is possible for music to still sound tonal even when it does not subscribe to the traditional understanding of centricity—thereby challenging William Thomson’s assertion that this property constitutes “the sine qua non of tonality.” [Thomson, *Tonality in Music: A General Theory* (1999), p.242.]
Ex. 5.3: Emulating “comma drift” in an equal-tempered environment; excerpt begins at 0:00 of https://www.youtube.com/watch?v=vn_JH4TBku8
This excerpt demonstrates conjunct melodic motion, harmonic consistency, and an F aeolian centricity. But it notably lacks a limited macroharmony—in large part because of its adherence to harmonic consistency. More specifically, every local harmonic root exhibits diacritic consistency with the perfect fifth, perfect fourth, and major second above, but also diacritic inconsistency with the third above (whether this third is major or minor). This is to say, if the root of a major or minor triad is spelled without a circle-arrow, then the same will be true of its fifth (but not of its third). Conversely, if the root of a major/minor triad is spelled with a circle-arrow, then its fifth will also have a circle-arrow pointing in the same direction (but its third will not). Blackwood’s consistent adherence to this principle leads to the sacrificing of limited macroharmony; I have marked several places in Ex. 5.3 above where what sounds like the same z in close quarters is actually two different pitch classes separated by a unit interval.\footnote{In fact, twenty of the twenty-one pitch classes in this tuning appear at some point in Ex. 5.3. The only one absent is Bb-up (z=19), which just so happens to “complete the aggregate” in the very next measure after the excerpt cuts off.}

These subtle shifts operate in the service of harmonic consistency, but do they also bring about a greater degree of acoustic consonance? This is debatable. On the one hand, every minor third in “21 Notes” measures five unit intervals (286 cents), and every major third measures seven unit intervals (400 cents); the six-unit-interval “neutral third” (343 cents) is never used. In addition to the strategic absence of this “gray-area” interval, which straddles the line between major and minor quality, the 400-cent major third in 21-TET is exactly the same size as it is in 12-TET. But this is not exactly an acoustic consonance in the small-number-ratio sense of the term, since this major third is still a bit distant from its acoustically pure varietal (and even more so for the 21-TET minor third).
Despite the dubious existence of limited macroharmony and acoustic consonance, this passage still comes across as clearly tonal—though its kaleidoscopic and shifting nature makes it sound more like an emulation of “adaptive just intonation” than anything equal tempered. This may seem somewhat paradoxical: that an equal temperament is capable of emulating the behavior of an unequal tuning (especially considering that the thirds used in “21 Notes” lie closer to their 12-TET sizes than to their just-intonational versions). But this leads seamlessly into my next proposition:

2) Tonality is not coextensive with any one tuning or temperament (though enculturation exerts a strong conditioning influence on one’s tonal judgments and apperceptions).

This is something that Blackwood’s music demonstrates especially well. Each of his microtonal compositions is capable of its own idiosyncratic articulation of tonal behavior, showing that tonality is something that transcends tuning. However, as I have also been arguing since the opening chapter, this music also relies on a very specific and historically situated set of accompanying conditions for its tonal intelligibility.

When discussing the idea of intelligibility, White writes that composers often “‘compensate’ for novelty within some musical domain by being particularly conservative in


another.” In a similar vein, William Sethares remarks that “[m]usical tastes change slowly, and it can be difficult for audiences to appreciate music in which everything is new.” Blackwood, then, in an attempt to balance “old” and “new,” leverages the inertial and institutional force of Euroclassical functional tonality in order to make his microtonal tunings more intelligible to 12-enculturated listeners. As I argue in Chapter 1, Blackwood configures the pitches of these tunings (and sets up their notation) in ways that conform to certain schematic expectations about how Western tonal music “works,” and what its enabling conditions are. In such a way, both his music and its method of notation invoke what might be called the hegemonic “discourse network” of Western Euroclassical tonal practice: an assemblage of media that includes a prototypical repertoire, its familiar instruments, and its customary mode of visual representation. This is Blackwood’s response to what Temperley calls “communicative pressure”—the social injunction that composers ought to make their music structurally intelligible to (certain desired in-groups of) listeners. Blackwood does this by aligning his “compositional grammar” with his own hypothetical conception of Western tonal “listening


80 Sethares, Tuning, Timbre, Spectrum, Scale (2005), p.289.


grammar”\textsuperscript{83}—one that is strongly conditioned by the cultural ubiquity of 12-TET.\textsuperscript{84} For this reason, even though none of Blackwood’s microtonal compositions is in 12-TET, listeners culturally accustomed to this tuning cannot help but pass his music through this referential orienting filter in an attempt to understand it.

However—and this is crucial—there is not one standard or culturally sanctioned way to do so. People, simply, differ: in their musical upbringings, in the sedimented contents of their mental and cultural archives,\textsuperscript{85} in their conceptual metaphors of choice, in their levels of musical training and literacy, and so on. This occasions the next interrelated pair of propositions:

3) **Tonality is an experienced sensation (of groundedness/stability/attraction/magnetism/ etc.) that resides in the minds and bodies of listeners; it is not an inherent property of the music or its notation.**

4) **Tonality is not one single sensation; it exists on a robust continuum and admits of all degrees, modalities, kinds, and intensities.**

While tonality does not reside within musical notation, this is not to say that the visual mediation of notation plays no role whatsoever in tonal comprehension. As I discuss in Chapters 1 and 3, the way Blackwood chooses to notate his music grafts on a consequential visual dimension to the music’s aural ethos of 12-analogy, effectively priming/specifying a particular “audile technique” through which notationally literate listeners are encouraged to


\textsuperscript{84} Of course, both grammars are also strongly conditioned by Blackwood’s pianistic background.

\textsuperscript{85} For a recent account of tonality as a kind of “cultural archive,” see Rodgers, “Renaissance Formalisms in the Cultural Archive of Tonality” (2019).
And so, for those with this specific kind of musical training, the experience of tonality exists in a complicated cross-sensory feedback loop wherein aural and visual factors intermingle—often reinforcing each other because of the modern cultural symbiosis between 12-TET and five-line staff notation. But the larger point here is that this intermedial cross-pollination is the exception rather than the rule when it comes to tonality, because for the vast majority of listeners (and here I am referring primarily to the so-called musically “untrained,” or “casual/everyday” listeners), tonality is exclusively an aural phenomenon.

And it is a phenomenon that can take many forms. One could conceivably argue that there are even more tonalities than there are cultures, and that for each hypothetical form of tonality, there exist countless more ways of experiencing it. Put simply, there are too many dialects, flavors, and modalities of tonality to count—and this plurality is a feature, not a bug that renders the term meaningless. But tonality’s many guises cannot be exhaustively enumerated in a single dissertation, nor can all its mysteries be solved, its paradoxes unraveled, its secrets unlocked, and its nuances captured in a single catch-all definition. My aim throughout has been rather modest, but focused and targeted: to zero in on one particular type of tonality, Western heptatonic diatonic tonality, and to probe its limits while laying bare some of its oft-overlooked enabling mechanisms. Blackwood’s microtonal music has been especially useful in this regard, since it demonstrates so pointedly the fundamental fuzziness of Western heptatonic diatonic tonality and the fundamental stretchiness of the auditory categories involved in its cognition. As I have illustrated in the preceding chapters, this type of

\footnote{For more on audile technique, see Sterne, \textit{The Audible Past: Cultural Origins of Sound Reproduction} (2003), pp.23ff.}
tonality—even in its most syntactically restricted Euroclassical functional varieties—is surprisingly adaptable to non–12-tone tunings, where it can take on a remarkable array of local colors, flavors, and “feels.” And this adaptability occasions a rethinking of the domain and scope of heptatonic diatonic tonality to better reflect its fuzziness and elasticity.

Thus warrants my fifth proposition, which introduces the main terminological intervention of the chapter:

5) Under my conception of fuzzy heptatonic diatonic tonality, a piece of music can still be considered “tonal” even if [i] it is not written in a twelve-note tuning (i.e., what would normally be called “microtonal”); [ii] it uses heptatonic diatonic scales outside of the traditional major/minor binary (i.e., what would normally be called “modal”); and/or [iii] it uses scales that are not actually heptatonic and/or diatonic at all (for instance, those that have more or fewer than seven generic scalar positions)—provided that such collections can still be cognized with reference to a heptatonic diatonic model.

The tripartite Ex. 5.4 below illustrates the expressive range of fuzzy heptatonic diatonic tonality across Blackwood’s microtonal compositions. Each of these excerpts challenges traditional definitions of tonality in their own idiosyncratic ways, but all of them nevertheless fall under the banner of my more expanded conception outlined above.
19 NOTES

Ex. 5.4a: Etude exhibits condition [i] of proposition #5 above; excerpt begins at 0:00 of https://www.youtube.com/watch?v=N8lK38l1Anc
Ex. 5.4b: Etude exhibits condition [i] and passage exhibits condition [ii] of proposition #5; excerpt begins at 0:00 of https://www.youtube.com/watch?v=_I-YkCkMUNY
Ex. 5.4c: Etude exhibits condition [i], passage exhibits condition [iii], and postulated referential scalar collection (D-down dorian) exhibits condition [ii] of proposition #5; excerpt begins at 0:00 of https://www.youtube.com/watch?v=MIYXm-CJqUo
The only requirement of fuzzy heptatonic diatonic tonality, then, is a cognitive one: that a piece of music can be heard with reference to an orienting scalar collection that is notionally heptatonic and diatonic. This is the case regardless of the piece’s tuning—12-TET or otherwise—and furthermore, it does not require that the actual scale used in the piece be literally diatonic or even heptatonic. For instance, a seven-note scale may contain five major seconds and two minor seconds, but these minor seconds may not be spread out as much as possible, thereby failing to meet the necessary condition of “maximal evenness” that is required for diatonicism (e.g., the A acoustic scale featured in Debussy’s *L’isle joyeuse*). Similarly, a scale may contain seven generic steps, but these may come in more than two specific sizes, thereby failing to meet the necessary condition of “Myhill’s property” that is required for diatonicism (e.g., the heptatonic scales used in “21 Notes,” whose minor seconds always measure two unit intervals but whose major seconds can measure either three or four, depending on the context). And moreover, a piece may even feature a scale that is not heptatonic at all—such as

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87 This condition was first defined in Clough and Douthett, “Maximally Even Sets” (1991). As they write, a maximally even set is one “whose elements are distributed as evenly as possible around the chromatic circle” (96). Any set that is diatonic is also necessarily maximally even, as laid out in Clough, Engebretsen, and Kochavi, “Scales, Sets, and Interval Cycles: A Taxonomy” (1999), p. 78.

88 Listen in particular to the theme beginning at 0:27 of [https://www.youtube.com/watch?v=XeBZT5_iEeA](https://www.youtube.com/watch?v=XeBZT5_iEeA).

89 This condition, named after the mathematician John Myhill, was first defined in Clough and Myerson, “Variety and Multiplicity in Diatonic Systems” (1985). According to them, “A scale in which every generic interval appears in exactly two specific sizes is said to have Myhill’s property” (250). Any set that is diatonic also necessarily exhibits Myhill’s property, as laid out in Clough, Engebretsen, and Kochavi, “Scales, Sets, and Interval Cycles: A Taxonomy” (1999), p. 78.
the ascending octatonic motif recurring throughout Radiohead’s “Just” (1995),\(^90\) the eight-note scale from “13 Notes” discussed earlier in this chapter, or the six-note scale from “15 Notes” just seen in Ex. 5.4c. But as long as these above scales can be heard with respect to a heptatonic diatonic orienting model (e.g., the postulated Ab aeolian in “13 Notes,” or the postulated D-down dorian in “15 Notes”), then all of these pieces can be considered members of the same broad tonal family, according to the sense of “tonality” put forth in proposition #5.

In arguing that some 12-enculturated listeners might cognize the six-note collection in Ex. 5.4c with reference to a seven-note (dorian) model,\(^91\) I seem to be contradicting the upshot of Ex. 5.3 above, in which several more than twelve pitch classes are also allegedly mapped onto a seven-note (aeolian) model. That the latter might be the case should come as no surprise; this is cognitive economy hard at work. But why should the former be the case as well—that a listener parse a scale as if it had more notes than it actually does? This may seem like extra work on the surface, but I would argue that is just the other side of cognitive economy’s coin. For heptatonic diatonic scales are so ubiquitous in Western tonal music that enculturated listeners are prone to use them as referential orienting collections regardless of whether the musical surface actually contains more or fewer than seven pitch classes. Such a situation is analogous to the one previously discussed in Chapter 3: how 12-enculturated listeners can both mentally equalize acoustic objects that are unequally spaced (like the diatonic scale), and

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\(^90\) The first such instance occurs from 0:18 to 0:29 of https://www.youtube.com/watch?v=oIFLtNYI3Ls in the electric guitar part.

\(^91\) The qualitatively multivalent note in Ex. 5.4c is C-down, which has the capacity to be heard either as a dorian 6 or a dorian 7—that is, as (6, ti, 14) or (7, do, 14)—depending on the context.
mentally un-equalize acoustic objects that are equally spaced (like split fourths or the fivefold equal division of the octave). In both situations, seemingly opposite scenarios can be reframed as complementary responses to the conditioning pull of enculturation and the cognitive mandate of economical processing.

Now that the matter of equal versus unequal spacing is back on the table, it is worth returning once more to the idea of tonality’s “characteristic asymmetry,” which has become somewhat of a recurring theme throughout this dissertation. I have discussed in previous chapters how tonality is often associated with pitch collections that divide the octave nearly, but not exactly, evenly: major/minor triads, dominant sevenths, diatonic/pentatonic scales, and so on. It is commonly argued that the essence of tonality results from these slight asymmetries, and that equally spaced pitch collections (such as augmented triads, diminished sevenths, and whole-tone scales), while useful as voice-leading conveniences, play ancillary roles in establishing tonal centeredness. Whole-tone scales, for example, are typically regarded as tonally clouded and indeterminate, because they lack the asymmetric spacing of diatonic scales, whose telltale minor seconds guide position finding. To be tonal, then, according to prevailing scholarly wisdom, is to be slightly uneven in constitution—a physiognomy that both enables the vectorial nature of goal-directed musical motion and facilitates its perception as such.

I have been gradually pushing back against one critical assumption underlying these traditional accounts: that tonality’s characteristic unevenness is necessarily linked to literal

intervallic asymmetries in constituent pitch collections themselves. Let the following passage from the end of “14 Notes” serve as my final piece of evidence in this regard. This equiheptatonic excerpt illustrates rather strikingly that tonality can be perceived even in an environment of complete scalar symmetry—because when it comes to hearing tonality in a fuzzy heptatonic diatonic framework, the intervallic asymmetries that matter the most are the ones located within a listener’s own referential orienting collection.

Fig. 5.7: Blackwood’s note names and enharmonic equivalences for 14-TET
Ex. 5.5: Two ways of bending 7-TET to fit a diatonic model; excerpt begins at 2:25 of https://www.youtube.com/watch?v=rW_X0bgHlrQ
Measures 143 to 150 contain only the seven pitch classes in 14-TET that have odd-numbered \( z \)-components: Ab-up, Bb-up, C-up, D-up, Eb-up, F-up, and G-up.\(^{94}\) These seven pitch classes form a 7-TET scale in which each step measures two 14-TET unit intervals, or about 171 cents. Yet despite the completely equal spacing of this scale, I argue that 12-enculturated listeners have become so accustomed to heptatonic scales with multiple step sizes that they are likely to subconsciously “bend” this one to fit a diatonic model. As for this model’s specific modal quality, I hear mixolydian and ionian as the two top candidates, and I have labeled Ex. 5.5 accordingly. Neither is a perfect fit, of course. There are times when G-up strikes me as more of a mixolydian 7\(^{\text{7}}\) (e.g., the bass of m.144) and others when it sounds more like a weak ionian leading tone (cf. the melody of m.149). But the larger point here is that an unequally spaced referential scalar collection is what facilitates the hearing of this passage as tonal and centered on Ab-up, despite its consistent adherence to literal equiheptatonism.

Of course, this impression of centeredness does not emerge in a vacuum; Blackwood’s organization of pitch materials primes and encourages it. The passage tropes the familiar contour of a descending scalar bassline, with each scale degree in the descent (circled in Ex. 5.5) neatly occupying one notated measure. This metric predictability, coupled with the passage’s palpable rhetoric of closure, intensifies the sense that tonal resolution is on the horizon. In other words, there is a strong sense that the descending bassline will eventually end on the same note with which it started: Ab-up. When this ultimately occurs in m.150, the preceding bar of 3/4 creates the impression that this predictable landing point has arrived.

\(^{94}\) This closing section of “14 Notes” marks the only instance in any of Blackwood’s microtonal compositions in which circle-arrows appear in the key signature, likely as a means to reduce visual clutter on the page.
slightly earlier than expected, since the intervening dominant on the last quarter of m.149 is only given one beat of emphasis instead of two (like the rest of the degrees in the descending gesture). The resulting impression is pleasantly cathartic—exhilarating, even—because it combines what Huron calls “the pleasure arising from accurate prediction” with “the contrastive valence arising from innocuous surprise.”

In an unpublished manuscript, Blackwood outlines what he considers “[t]he three basic elements of what is perceived as tonality[:] the parts go by seconds, the fundamental melodic units; the individual chords are composed of piled up thirds, the most euphonious harmonic combinations; while the roots constantly descend by fifths.” At first glance, the above excerpt from “14 Notes” appears to conform to this (Western Euroclassical) conception of tonality, even if the conformance sounds somewhat loose. Much of its melodic motion is stepwise, involving adjacencies between the pitches of 7-TET. Likewise, most of its harmonies involve at least one third (each measuring four unit intervals, or about 343 cents) superimposed over the harmonic root. And the end of the excerpt (mm.149–50) features root motion by descending fifth, which solidifies the overall impression of tonal centeredness. But what Blackwood leaves

95 Notice that this progression over the barline in mm.149–50 still comes across as a rhetorically convincing dominant-tonic succession, even though the former harmony lacks a G-up (i.e., an $\text{X} = \overline{7}$) altogether. In fact, the upper voices in this IC contain scale degrees that are more prototypical of pre/subdominant than dominant function, and so one could posit that this IC necessitates a Swindenian superscript in its functional label (a situation I previously explore in Chapter 4 with respect to the functionally hybrid 5-TET IC in the Suite for Guitar in 15-note Equal Tuning).


out of his definition is the ingrained tendency for 12-enculturated listeners to cognize these seconds—and by extension, these thirds—as unequally spaced *even when they are not*.\(^98\)

Thus arises the following proposition:

6) **Tonal cognition involves latching onto intervallic asymmetries, and this tendency is so strong that it can lead to the projection of intervallic asymmetries onto music where none actually exist.**

The preceding example acts as a culminating illustration of my contention that pitch collections that divide the octave evenly are just as capable of being heard in a tonal framework as those that do not—provided that enough other musical parameters (meter, notation, etc.) conform to culture-specific schematic expectations about how tonality tends to sound, look, and feel. Even in the literal absence of rare intervals such as tritones or minor seconds, enculturated listeners may well seek out their phantom presence anyway in an overcompensatory effort to find their position. This demonstrates just how pervasive a role cognitive bias can play when one tries to hear tonality in microtonality.

This cognitive bias manifests itself in a number of ways. The well-known image on the following pagecatalogues many of these biases and groups them into a single circle diagram; I have marked some that are particularly relevant to the processes involved in making sense of Blackwood’s microtonality (and hearing music in a tonal framework more broadly):

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\(^98\) He does, however, write the following about “14 Notes” in his unpublished “Research Notes: NEH Grant R0-29376-78-0642” (1979–81): “I did not anticipate how the modality of ambiguous thirds could be clarified by incorporating them into pentatonic scales” (479).
Image 5.1: The Cognitive Bias Codex, designed in 2016 by John Manoogian III (zoom in to view)

One of this dissertation’s central through-lines is that a foundational substratum of mechanisms attends music listening regardless of one’s conscious awareness, and this shapes one’s instinctive responses when listening to new or unfamiliar music. To restate in greater detail:

7) Music processing in general (and tonal cognition more specifically) rests on a fundamental bedrock of statistical learning, expectation formation, and probabilistic prediction—all of which operate in the service of cognitive economy.

This proposition addresses a rather substantial question: when attending to music in a tonal framework, what exactly are we listening for (and why)? The bullet points boxed in red above offer some general principles that gesture at these bedrock mechanisms at work: (reading
clockwise from top) “We notice things already primed in memory or repeated often,” “[w]e are
drawn to details that confirm our existing beliefs,” and “[w]e project our current mindset and
assumptions onto the past and future.” All of this begins with mere exposure to the statistical
regularities of the music(s) of one’s own culture(s); such regularities are subsequently registered
implicitly (and sometimes even explicitly) in memory, serving as the basis for one’s expectations
about how future music will go. Expectation and prediction then work hand in hand—usually
subconsciously, but sometimes partially consciously in the case of certain trained musicians—to
help listeners make sense of such music, in accordance with the particularities of their
respective enculturations.

Importantly, these mechanisms and processes are subject to the constraints of cognitive
economy, a guiding principle of mental activity based on the idea that “[d]ividing the world
around us into categories of items that we can treat in similar ways facilitates our lives and
direct[s] future learning.” The bullet points boxed in magenta above illustrate how cognitive
economy is a common theme that cuts across the color-coded “quadrants” of Image 5.1:
(reading clockwise from bottom right) “We simplify probabilities and numbers to make them
easier to think about,” “[w]e favor simple-looking options and complete information over
complex, ambiguous options,” and “[w]e discard specifics to form generalities.” These
postulates are especially apparent in the case of Blackwood’s microtonal music, which is chock
full of ambiguities, categorical fuzziness, and cognitive gray areas. If one is to make sense of
this music, one must not dwell on minutiae or revel in equivocality. Instead, one must simplify,

99 Tekman and Hortaçsu, “Aspects of Stylistic Knowledge: What Are Different Styles Like and
Why Do We Listen To Them?” (2002), p.28.
assimilate, make snap decisions based on contextual clues, and focus on the bigger picture at the expense of smaller details. As the yellow box in the lower left corner of Image 5.1 succinctly states, we “need to act fact.” If we do, we will be rewarded with the pleasure associated with fluent and efficient processing; if we do not, however, we are likely to experience negative feelings of bewilderment, frustration, and perhaps even downright anger.

But is it the music that bewilders, frustrates, and angers us, or is it our perceived inability to attend to it in a framework that optimizes accurate prediction whilst streamlining cognitive load? We may be inclined to think (and say) that it is the former—perhaps due to our ingrained bias (black-boxed in Image 5.1 above) to “notice flaws in others more easily than we [do] in ourselves”—but I contend that it is more so the latter: a projection of our negative feelings onto the music itself. This is one of two major types of cognitive misattribution involved in music processing, as I outline in the proposition below:

8) Musical processing (and by extension, tonal cognition) engages two main kinds of cognitive misattribution: [i] the offloading of expectational sensations of fit/non-fit onto musical proxies of various sizes, and [ii] the pinning of qualia that originate in musical relations onto proxies that are notionally regarded as singular musical entities.

I have discussed these two interrelated varieties of misattribution both separately and together in previous chapters. I focus most explicitly on the first in Chapter 3, where I examine the expectational underpinnings of consonance/dissonance judgments. The second, meanwhile, comes to the fore in Chapters 2 and 4, where I push back against the widespread discursive

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tendency to refer to scale-degree qualia as properties of pitches or single notes (rather than intervals) and harmonic functions as properties of single chords (rather than progressions/successions among intervallic collections). As I discuss in Chapters 1 and 2, one potential reason why such language may remain so colloquially widespread is that it reflects a broader human tendency to (want to) pin down sources/causes that are concrete in order to explain outcomes/effects that are abstract (like the emotions generated by music’s manipulation of our expectations).

It may also be the case that this second kind of misattribution occurs as a result of another overcompensatory human impulse: to pigeonhole something that is dynamic and ineffable (like music) into a box that is static and fixed, as a way to make said thing easier to control and understand. Thus, my penultimate proposition:

9) While tonal hearing is strongly conditioned by enculturation, it can also be understood as a manifestation of a fundamental biological impulse: to impose a sense of order and control on a highly variable environment (in this case, a sonic one), thereby “taming” it and establishing/exercising one’s mastery over it.

This may seem somewhat farfetched—to frame music listening as something akin to domesticating a wild animal—but the comparison is suggestive, particularly in the case of music in unfamiliar tunings. For we cannot lose sight of the fact that music has a unique capacity not just to soothe us and calm us, but also to haunt, frighten, intimidate, frustrate, and threaten us. If we seek to mitigate these latter feelings, then we must do something to counter the power that music wields over us, whether this be turning it off and walking away,

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101 Pearce and Wiggins’ “Auditory Expectation: The Information Dynamics of Music Perception and Cognition” (2012) and Huron’s *Sweet Anticipation* (2006b) are two sources that discuss how listening to unfamiliar music can evoke instinctive physiological fight/flee/freeze responses in listeners.
listening addictively to it until we become desensitized to its potency, or even writing a dissertation about it as a way to mentally “outmuscle” its sheer sonic force.\(^\text{102}\)

Mark Reybrouck seems keyed into this way of thinking when he frames music cognition in terms of “coping behavior.”\(^\text{103}\) He conceives of music “as part of the sonic environment and of listening as a way of coping with this environment. Listening, on this view, relies on music knowledge that must be generated as a tool for adaptation to the sonic world.”\(^\text{104}\) Other authors share Reybrouck’s opinion that music listening (and tonal hearing more specifically) serves an adaptive function. Marcus Pearce and Geraint Wiggins, building off prior work by Huron and Leonard Meyer, discuss the importance of auditory expectation in music listening, noting that “[t]he ability to anticipate the future is a fundamental property of the human brain,” and that “[f]ailures of expectation can be fatal, so organisms should be motivated to expect as accurately as possible.”\(^\text{105}\) And Piotr Podlipniak describes the uniquely human capacity for tonal hearing as “an adaptive innovation”\(^\text{106}\) that has its roots in the Baldwin effect: “an

\(^{102}\) Indeed, one could rightfully charge that the detached and clinical analytical style long favored by many music theorists—myself included, admittedly, at certain points in this dissertation—effectively serves to flatten much of music’s power and charm, thereby enabling analysts to perform acts of ownership, dominance, and control over the musical “object.” For three perspectives on this issue, see Abbate, “Music—Drastic or Gnostic?” (2004), McCreless, “Ownership, In Music and Music Theory” (2011), and Ewell, “Music Theory and the White Racial Frame” (2020a).


\(^{104}\) Ibid., p.230 [emphasis in original].


evolutionary mechanism which transforms a culturally invented and acquired trait into an instinctive trait by means of natural selection.”\textsuperscript{107} (Micro)tonal hearing, therefore, is a site where nature and nurture merge under the rubric of imposing order on chaos.

It is imperative to tame such sonic chaos by all means necessary; at stake is nothing less than one’s well-being, and even, one’s self-image. Alfred Adler believes that “to be human is to feel inferior,” and so “[h]umans strive towards superiority to overcome this feeling.”\textsuperscript{108} I have been arguing that hearing the tonality in Blackwood’s microtonality fundamentally engages this base overcompensatory impulse, which can manifest itself in a number of specific ways. With that, I introduce my final proposition:

10) When it comes to tonal hearing, no one musical parameter, type of expectation, kind of salience, or mode of attending dominates a priori over any others—though when certain of these are lacking in reliability, listeners compensate by latching all the more strongly onto others in an effort to (re)gain their bearings.

I have already discussed several such situations. Earlier in this chapter, for example, I illustrate how internalized knowledge about tonal hierarchies can pick up the slack when the position-finding affordances of rare intervals are either attenuated or compositionally manipulated—and further, how 12-enculturated listeners can mentally manufacture scalar asymmetries and rare intervals even when they do not exist. In this and previous chapters, moreover, I explore how

\textsuperscript{107} Podlipniak, “The Role of the Baldwin Effect in the Evolution of Human Musicality” (2017), p. 5. In a review of Huron’s Sweet Anticipation (2006b), Marcus Pearce and Daniel Müllensiefen characterize the Baldwin effect slightly differently, putting forth a definition that centers the roles of learning and expectation: “The evolved capacity to learn is a biological solution to the problem of anticipation in highly variable environments (known as the Baldwin effect).” [Pearce and Müllensiefen, “Review of Sweet Anticipation: Music and the Psychology of Expectation by David Huron” (2008), p.159 (emphasis in original)].

\textsuperscript{108} Qtd. in Coleman and Croake, “Organ Inferiority and Measured Overcompensation” (2005), p.399.
listeners might seek out islands of predictability (or brief wisps of tonal/metrical clarity) as cognitive guideposts that help them wade through an otherwise unpredictable sea of sound. In Chapter 4, I examine multiple scenarios in which contextual cues are likely to be the principal drivers of harmonic-functional judgments, because the cues provided by scale-degree content—normally reliable—are momentarily equivocal. And a major theme running throughout all chapters is that schematic and dynamic expectations step in to pick up the burden when veridical expectations prove unhelpful for making sense of unfamiliar music. All this is to say that enculturated listeners possess a variety of tools that can help them impose a sense of order on sounding music, and when certain of these do not seem to do the trick, they will instinctively reach for others that can best get the job done.

A corollary of this tenth and final proposition warrants explicit mention: that tonality is not all about pitch (or harmony). Rather, it is more so about expectation and prediction than it is about any one musical parameter. But, as I have been claiming from the outset, if there is any one parameter that deserves more attention for its role in regulating the flow of tonality, it would undoubtedly be meter. In Chapter 3, I mention a series of scholars who have worked in recent years to combat the long-held belief that “[the l]iterature on how tonality and meter work together [is] surprisingly small.” I envision this dissertation as another contributor to the ongoing dialogue in this area. Since the opening chapter, I have been unpacking not just how

109 This is precisely the position of Megan Long, who argues in a recent article that “[h]armony, syntax, and centricity are actually not the most crucial elements of a tonal language […].] A tonal language is defined by the trajectories of expectation that it establishes.” [Long, “Cadential Syntax and Tonal Expectation in Late Sixteenth-Century Homophony” (2018), p.79 (emphasis in original).]

(hyper)metrical factors can influence judgments of tonality, but also how such factors can play even bigger roles in these judgments than usual whenever a musical environment contains pitch information that is either ambiguous or culturally unfamiliar.

Of course, Blackwood’s microtonal music illustrates this last point rather well. But the same is true, let us not forget, in more familiar 12-TET contexts as well. Palpable sensations of tonal centeredness can exist even in the absence of reliable, consistent, and expectationally conformant pitch information—so long as these pitches are temporally configured in a manner that is metrically predictable to Western-enculturated ears. Peter Erskine’s “Boogie Shuttle Stop” (2002), whose A section is transcribed below, is an instructive example in this regard:

Ex. 5.6: (Hyper)meter, not pitch, as the primary parametric determinant of tonality; excerpt begins at 0:00 of https://www.youtube.com/watch?v=bVr2qmQ1qc4
In this excerpt, a new tonal area is introduced every two measures by means of semitonal (leading-tone) motion in the bass part. I have labeled these tonal areas in the characteristic orange of ionian to match the specific modal character of their approach and initial presentation. The font size of each label, moreover, is directly proportional to the degree of (hyper)metric accent associated with each local tonal arrival. This string of local arrivals does not paint a very clear picture as regards large-scale tonality; the eight key areas in total trace out a descending octatonic scale—a collection that is evenly spaced throughout the octave. In the face of such large-scale positional ambiguity, I argue, the burden of tonal clarification shifts from pitch/harmonic information onto (hyper)metrical information. Under this hypothesis, if “Boogie Shuttle Stop” can be reduced to any one governing tonality, it would be the one that receives the greatest hypermetric accent: C ionian. In other words, several key areas are approached like tonics in this A section, but the forest of C ionian perceptually outweighs the other octatoniclly spaced trees on the grounds of its relative metrical predictability (which colloquially registers as “strength,” and is consequently misattributed as “stability”). This makes for a fascinating scenario: C ionian comes across as the global tonality of the tune, despite the fact that its melody uses every pitch class in the octave except for E natural—arguably the most telltale bearer of that key's ionian quality.

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111 Similar reasoning can be applied to judgments of overall key in other jazz tunes that are built around a system of evenly spaced major or minor thirds, such as John Coltrane’s “26-2” (1970), whose global tonality is F ionian according to analogous hypermetric criteria. Such examples illustrate Daniel Harrison’s insight that “tonic accent” in popular music is “create[d] largely from metric hierarchies.” [Harrison, Pieces of Tradition (2016), p.73.]
To reiterate, *pitch isn’t everything* when it comes to tonality, and this may be one of the most important take-home lessons from Blackwood’s microtonality. For tonality is, above all, a regime of expectation—one that regulates mental operations over time, and one whose many component parts array themselves over time. Losing sight of this temporal dimension is tantamount to flattening the diverse range of experiences that constitute tonal hearing into an inapt box of reductionism. Any account of tonality that aspires to experiential validity, therefore, must come to terms with what may be the most deeply ingrained misattribution of all: that tonal stability, fundamentally, *is* expectational stability—and that expectational stability, in turn, cannot exist without a sense of temporal/metrical predictability. In time, and in the mind: here is where the “stuff” of tonality truly lies.
When I first encountered Blackwood’s microtonal music, as a junior in college, I was instantly hooked. Its fascinating contradictions were endlessly alluring, and for a while, I could not stop listening. At that time, I was a lifelong concert pianist of Western Euroclassical tonal music with a rather provincial view of what music was (and what it could be). I thought through the interface of the keyboard; most all of my conceptual knowledge about music was routed through its referential orienting shape. I also had absolute pitch—but as I would be quick to point out, not the kind that made me regard slight deviations in pitch as a needling, intolerable bother. “Out-of-tuneness” always fascinated me, piqued my interest.

In short, I was initially attracted to Blackwood’s microtonal music because it validated many of the specifics of my own musical upbringing and training. The music was also clever, attention-grabbing, and ostensibly iconoclastic—closely mirroring the kind of persona I sought to cultivate at that time in my life.¹ And because it was not music that I could easily play back on my own piano, it presented a persistent itch that I could not scratch via the conventional means of aural transcription. All this led to what Steven Rings might call a “stubborn enchantment”² with Blackwood’s microtonality that lasted for years. His music struck me as a compelling mystery—and I was hell-bent on solving it. I spent years in the analytical weeds, so to speak: counting unit intervals, calculating cent sizes, and reducing the music to a series of

¹ On the role of music in the fashioning/constructing of one’s self-identity, see DeNora, Music in Everyday Life (2000), Chapter 3.

numbers in an attempt to figure out how it all worked. I thought that dissecting the music as if it were a fruit fly would be the key to unlocking it.

Of course, I was wrong. Eventually, I would come to learn that there is no such thing as a truly “objective” claim about music,\(^3\) that the dispassionate and clinical tone prototypical of much music analysis does not preclude the spectral presences of preference and value in its avowedly “neutral” prose, and that such specters are inextricably intertwined with issues of race, gender, class, (dis)ability, and the like.\(^4\) I would come to realize that to hide behind a veneer of objectivity is to take refuge in a “folk-psychological”\(^5\) house of cards that only makes one’s subjectivity—and with it, one’s tacit prejudices—more loudly apparent. And I would learn, finally, that to “focus on the music itself,” as it were, is not an necessarily act of elucidation. It can also be a willful act of ignorance.

For many years, I was as ignorant as they came. One could say that my own “stubborn enchantment” with Blackwood’s music rendered me unable—unwilling, even—to take a more

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\(^3\) See in particular Guck, “Analytical Fictions” (1994) and Monahan, “Action and Agency Revisited” (2013) for two accounts that work to unmask the inherently subjective nature of such allegedly “objective” claims.

\(^4\) These latter issues are front and center at the groundbreaking plenary session of the 2019 Annual Meeting of the Society for Music Theory in Columbus, OH (entitled “Reframing Music Theory”). A recording of this session is available at https://www.youtube.com/watch?v=ZSOFPwDIZCA (from 2:07:15 onwards).

\(^5\) The term “folk psychology” is taken from Jerome Bruner’s Acts of Meaning (1990), p.35, and it has been subsequently applied to music theory and analysis by a few notable commentators. See for example Cross, “Music Analysis and Music Perception” (1998), p.5, and Pearce and Wiggins, “Auditory Expectation: The Information Dynamics of Perception and Cognition” (2012), who argue that music theory is “arguably the most formally developed example of a folk psychology currently extant, being based on extensive and careful study of the aural constructs used in a particular musical culture (Western art music), and their associated semiotic connotations, in terms of their usage in that culture” (645).
critical look at the historical, political, and ideological factors that formed the conditions of possibility for its creation (and that still constellate to influence its reception). In particular, I spent many years disinterested in the kind of person that Blackwood was. After all, I had grown up believing that even while music can tell us a great deal about the philosophies, psychologies, and ideological commitments of its creators, to focus one’s inquiry on these areas is to adopt a limiting approach that can only go so far and accomplish so much. Keen to set my sights on something “bigger” than Blackwood the person, I never really thought twice about digging deep into the recesses of his mind.

That is, until the whispers started coming. A couple years ago, someone who knew Blackwood personally approached me with some words of warning: that Blackwood harbored some controversial views that made him somewhat of an outsider in the University of Chicago Department of Music (with which he has been associated since his initial appointment in 1958). This sent me down a multi-year detective trail to try and piece together more information about who Blackwood was as a person. What I found would ultimately alter the trajectory of this project—and this chapter is the story of how it all happened.

What follows can be considered a simultaneous zooming-in and zooming-out. On the one hand, it is a close look at Blackwood himself: his personal archive, his unusual personality, and the ways that his distinctive worldview colors his scholarly activity, compositional

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6 Blackwood transferred to Emeritus status in 1997 and continued to teach courses at the University until the mid-2010s, when his health began to precipitously decline. He is still listed as Professor Emeritus on the University of Chicago Department of Music website (https://music.uchicago.edu/people/faculty-lecturers), though he is the only person listed without an email address (likely due to his very limited computer literacy; he refused to learn computer basics until the early 2000s, and even then he regularly employed other people to act as his “tech crutch”), and his associated phone number is that of the music-departmental main office.
philosophy, and interpersonal interactions. On the other hand, it is a turn away from the musical specifics of his microtonal compositions and towards a consideration of their broader political and ideological contexts—both in terms of Blackwood’s own life and in terms of music theory’s longstanding hegemonic whiteness and maleness. Viewed through one lens, it is an account of how I responded when I realized I had chosen to study the music of a “monstrous man.” Viewed through another, however, it is an allegory for music theory’s history of exclusionary practices, a cautionary tale about its valorization of reclusive white-male “geniuses,” and a critical reflection on how the discipline can only move forward in the future if it first reckons head-on with its problematic past and present.

Blackwood the Person

Finding out more information about Blackwood was not an easy task. For as I quickly came to learn, he has always been an extremely private person with few (if any) people in his inner circle—friends, family, or otherwise. I started my investigation by trying to directly contact Blackwood himself, but upon calling the number listed on his departmental website, I got a member of the office staff who told me that Blackwood was recently put in a nursing home. No

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8 This calls to mind the following quote from James Baldwin that Philip Ewell has recently used as an epigraph in his critical-race scholarship on music theory: “Not everything that is faced can be changed; but nothing can be changed until it is faced.” [Baldwin, “As Much Truth as One Can Bear” (1962), qtd. in Ewell, “Music Theory’s White Racial Frame” (2019) and “Music Theory and the White Racial Frame” (2020a).]
one seemed to know the name of this home. Instead, I was given the name of a recent caretaker who was supposed to have a better idea about his current condition and whereabouts. I tried getting in touch with this person, but I never ended up receiving a response. I started to believe that speaking directly with Blackwood might turn out to be a lost cause.

My plan was to make the best of this apparent dead end by visiting the Hanna Holborn Gray Special Collections Research Center at the University of Chicago Library to consult Blackwood’s recently inventoried archive of personal papers. All the while, I would continue to speak with those people—at Yale, at the University of Chicago, and beyond—who overlapped with Blackwood in some way and could give me some more insight into his enigmatic persona. Those at Yale and beyond adopted more of a cautionary tone, telling me that Blackwood had become the subject of an underground whisper network alleging his racism, sexism, homophobia, and even sexual harassment towards some of his students and advisees. Those at the University of Chicago, on the other hand, were more measured and careful in their appraisals, noting that Blackwood always had a small and dedicated circle of student acolytes at the University, but that he had basically no personal friends on the faculty who could speak to his behavior in more informal, private settings. He could not be faulted for being a poor

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9 This timing was fortuitous; a large stockpile of his materials had just arrived at the facility a few months prior to my visit. As it turned out, many of the documents contained within were extremely important to my research—and according to library staff, I was the first visiting scholar to see them in this form.

10 I prefer to protect the identities of those who passed along this information to me; therefore, I will only cite personal correspondence with others in those cases that I have expressly obtained permission to do so.
colleague on paper, always showing up on time to faculty meetings, participating on those committees to which he had been elected, and fulfilling all of his in-writing duties as a tenured professor. But he frequently held views that conflicted with those of the rest of the department, and he was not shy about making them known—often doing so in a way that was couched in overly formal bureaucratic language. No one I met at the University of Chicago said anything about the more unsavory aspects of Blackwood’s personality about which I had been warned; perhaps there exists some sort of tacit agreement on campus to remain silent on such matters while Blackwood is still living (and particularly while he is in his current state of rapid physical/mental decline). But everyone who overlapped with him, in Chicago or elsewhere, essentially told me a version of the same basic story: that the reclusive Blackwood always seemed to exist in his own mental world, and that no one—not even his longest-tenured departmental colleagues—ever truly got to know what this world was like.

For a week in the summer of 2019, I entered this world. Sitting in a small, overly air-conditioned room in the University of Chicago’s Joseph Regenstein Library, I spent multiple consecutive nine-to-fives poring through the only publicly accessible trove of Blackwood’s personal papers. As I discuss in Chapter 1, I was able to read through his two most substantial unpublished works, a 1992 manuscript entitled *A Practical Musician’s Guide to Tonal Harmony* and three folders of research notes (spanning 1979–81 and totaling over six hundred pages) that catalogue the major findings and takeaways of his NEH-funded foray into microtonal

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11 Blackwood has been suffering from Parkinson’s disease and Guillain-Barré Syndrome throughout the last decade or so, according to his personal diaries. [The Easley Blackwood Papers, Box 20 (in “Spiral Notepad, 2008–2014”).] This has gotten especially acute since his relocation to the nursing home a few years ago.
composition. But the most revealing documents, as regards Blackwood the person, were the ones that had nothing to do with microtonality, tonal harmony, or music theory. Particularly after he transferred to Emeritus status in 1997, Blackwood got into the habit of meticulously documenting every single aspect of his travels in spiral notebook diaries. He would spare no detail: recording exact departure and arrival times to the minute, listing precise dollar-and-cent totals of every meal and drink he purchased, noting any conversations he had with people he met along the way (in addition to other conversations on which he eavesdropped), spelling words wrong intentionally to mimic regional dialects he encountered (e.g., “ice” as “aahss,” “wine” as “waan,” and “eggs” as “aigs”), and even using his perfect pitch to transcribe those sounds that impeded his restful sleep or otherwise annoyed him (from incessantly barking dogs to crying infants on airplanes). These diaries portray Blackwood as quite the eccentric—as someone so sufficiently entertained by his own interior monologue that he never felt much of a need to leave his self-constructed bubble of comfort (even, ironically, when he was traveling).

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12 He always documented his travels in some form, but around the 1990s and after, his preferred method for doing so transformed from sparse bulletpoints into extremely detailed prose. My hypothesis is that Blackwood, who still felt he had the energy to remain Full Professor for many years after 1997, displaced much of this energy into documenting the mundanities of his personal life at a level of detail he had never before achieved on paper. According to Anne Walters Robertson, who helped to negotiate Blackwood’s retirement package/trajectory around that time, Blackwood took quite a good deal of convincing to start phasing out his teaching load and departmental presence, believing that he could basically continue as a full-time employee until the day he died. [Robertson, personal communication, 6/24/2019. For more on the specifics of this retirement negotiation, see The Easley Blackwood Papers, Box 42 (in “Correspondence and Agreements, 1958–2005”).] Having lost an indispensable and previously unchanging part of his world, I contend, Blackwood took special pains to reconstitute his world through his personal diaries, which existed in a private and written form that no one could take from him.

13 See in particular the many spiral notebooks and the single spiral notepad contained within The Easley Blackwood Papers, Box 20.
But while such writings are certainly amusing, and at times even humorous, they ultimately form the tip of a more deeply rooted ideological iceberg that, when considered as a whole, begins not to look so innocuous.

John Donne has famously written that “[n]o man is an island.” Blackwood may be the closest thing there is to an exception to this rule. He never married, had no kids, and does not mention any romantic relationships, even in his most detailed personal diaries. He is an only child, appears not to have been particularly close with his parents, and after their deaths in 1982 (mother) and 1992 (father), had extremely few living family members. The living family member with whom he is nominally closest seems to be his cousin, Walter Russell Trapp, whom Blackwood recently designated as his health care agent and primary beneficiary. Blackwood also had few, if any, personal friends that did not also double as professional contacts; as far as I can tell, the only name of a non–family member and non–music associate that appears in his archive and correspondence with any sort of regularity is a Mike Ervin, who is half Blackwood’s

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14 Donne, “Meditation XVII” from Devotions Upon Emergent Occasions (1624).

15 The Easley Blackwood Papers, Box 28 (in “Notes, n.d.”). Walter’s son (and Blackwood’s nephew), William Andrew Trapp, is also designated as Blackwood’s successor agent. Both Walter and William are based in Florence, Alabama, where they work together as financial advisors at Morgan Stanley (https://advisor.morganstanley.com/the-trapp-group).
age and whose exact relationship to Blackwood is puzzling and unclear.\textsuperscript{16} Blackwood also did not have a habit of befriending his colleagues in the University of Chicago Department of Music, sometimes even drawing their ire with his incessant practicing of atonal modernist music on his office piano.\textsuperscript{17} Simply put, Blackwood was not the sort of person who would ever ask anyone about themselves (or how they were doing), instead preferring to initiate conversation by sharing puzzling observations or making inscrutable remarks, often seemingly out of left field, that reflected the inner workings of his solitary mind.\textsuperscript{18}

\textsuperscript{16} Indeed, there is a good deal of correspondence between the two, and Blackwood writes to/about Ervin with an uncharacteristic warmth that he seems to reserve for very few. Ervin does not appear to have been a former student of Blackwood’s at the University of Chicago, however, and it is never actually specified how they met or why they remained close. He resurfaces as a close confidant of Blackwood’s throughout the latter’s spiral notebooks (see in particular those in The Easley Blackwood Papers, Box 20), and he also seems to have acted as a sometime page-turner (see “Correspondence and Agreements, 1958–2005” in Box 42) and tech crutch (scattered correspondence in Boxes 43 and 44) for Blackwood. Once, Ervin even consulted Blackwood for informal legal advice about an ugly court case in which he had been embroiled during the early and mid-2000s (see “Correspondence, 1979–2002” in Box 43). For more on this case, see https://caselaw.findlaw.com/us-7th-circuit/1448937.html.

\textsuperscript{17} There is a memorable exchange now archived in Box 12 of The Easley Blackwood Papers (in “Correspondence, 1968–1976”) between Blackwood and then-chair of the University of Chicago Department of Music Leonard Meyer regarding Blackwood’s practice habits. Meyer essentially tells Blackwood that his constant and loud practicing (particularly of 20th-century atonal music) is an annoyance and distraction to the other members of the department, hindering their ability to concentrate and get work done in their offices. He directs Blackwood to use the practice rooms designated for students instead, to which Blackwood takes considerable offense, refusing to be subjected to rules meant for students, and vowing retaliation against Meyer’s allegedly condescending order, which he suggests is some form of departmental conspiracy against him. Apparently, Blackwood had already received similar complaints from his neighbors in his nearby Chicago apartment, and he felt that his music-departmental office was a perfectly acceptable space—perhaps the only “safe space” he had—to play his piano.

\textsuperscript{18} Lawrence Zbikowski, personal communication, 7/1/2019.
He brought this approach rather unapologetically to his scholarship. In his only published book, *The Structure of Recognizable Diatonic Tunings*, Blackwood makes no attempt to connect his work to that of any previous music theorists or music historians, and the result is an insular treatise that reads as if it were conceived in an intellectual vacuum. There is no bibliography or reference section (only a self-referential index), and if Blackwood cites any previous work at all, it is almost exclusively mathematical textbooks from the 1920s through 1950s (and these only in footnotes). To do music theory à la Blackwood was not to participate in an ongoing historical dialogue of ideas. Rather, it was to put forth a monologue of one’s own thoughts, and to judge the future work of others based on how well they subscribed to the tenets of that monologue. The only ideas worth considering, for Blackwood, were (the ones that built on) his own. The following brief quote about Ralph Lorenz, who was pursuing his Ph.D. in Music Theory at Indiana University at the time of Blackwood’s writing in 1992, is representative: “He quotes me extensively. He is generally on the right track.”

Blackwood was also a political and ideological outlier in his field, to say the least. He was a staunch lifelong conservative who went to high school with former Senator Richard Lugar (R-IN, served 1977–2013) and later stumped for Ronald Reagan in 1980. In public, he liked

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19 The Easley Blackwood Papers, Box 38 (in “Notes, n.d.”), n.p. Lorenz is currently Senior Associate Dean of the College of Visual and Performing Arts at Syracuse University.

20 Some of their correspondence is archived in The Easley Blackwood Papers, Box 91 (in “Tuning Stuff: Correspondence and Publications, 1982–2011”). Both men were members of the 1950 graduating class of Shortridge High School in Indianapolis, Indiana, and they shared a mutual respect for one another throughout their lives that comes through in their correspondence.

21 More details on this arrangement are available in The Easley Blackwood Papers, Box 37 (in “Memorabilia, 1980–1985”).
to present himself as logical and principled, but in private, he showed shades of ideological extremism. Some of his personal writing argues for an “America-first” isolationist nationalism that would be more at home in today’s alt-right than in the early days of the Cato Institute. Viewing his microtonal output through the ideological prism of these political writings is especially instructive, as it lends further credence to my claim in Chapter 1 that one cannot consider Blackwood’s microtonality without taking stock of exactly what it is, in these compositions, that he is ostensibly taking pains to “preserve.”

Whether one regards Blackwood as a principled conservative or an alt-right extremist, the larger point is that Blackwood had few ideological peers in the music-academic community—and he knew it. He would often speak of Democrats with great contempt, painting them with a broad and monolithic brush and characterizing them as too dependent on emotion (in contrast to the apparent logic and rationality possessed by Republicans). The following quote, from a late-1980s letter to Matthew Kiell (formerly of the Chicago Tribune) in France, is typical in this regard: “Since the vast majority of music theorists and scholars are Democrats, their resistance to my theory can confidently be expected to be both intense and angry.”

Blackwood wrote this letter at a time not only of broad demographic shifts and increasing ideological polarization in America at large, but also of vast disciplinary change within the music-academic community—the time of the budding New Musicology and its increased focus on microtonality.

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22 See in particular Blackwood’s “Essay on Democracy” (n.d.) in The Easley Blackwood Papers, Box 31.

on interdisciplinarity and sociocultural criticism. One must therefore consider Blackwood’s methodologically steadfast approach to doing music theory in this broader context. This entails regarding his scholarly contributions not simply as isolated actions (as they may seem on the surface) but also, more fundamentally, as politically charged reactions to changing times and shifting disciplinary priorities. Viewed in this framework, Blackwood’s consistent reliance on mathematics (and only mathematics, as far as other disciplines are concerned) begins to look more like a defense mechanism—a way to “fix” music theory into place by imbuing it with the permanence and certainty of the equals sign (not to mention a way to perform the control of unknown variables by subsuming them under the ironclad logic of a proof-based approach).  

In short, Blackwood’s approach to scholarship was under siege starting in the 1980s, and while he never phrased the matter explicitly in these terms, his tacit awareness of this fact can be gleaned from his manner of speaking about other scholars—especially those who had the possibility of becoming long-term departmental colleagues. One case in point is his dissenting opinion regarding Rose Subotnik’s tenure case in 1980. By that time, Subotnik had been at the University of Chicago for seven years, where she quickly garnered wide respect (both in the department and beyond) for her pioneering work on Adorno and her firm conviction that music cannot be understood apart from the social, cultural, and political contexts that give rise to it. Of course, much of the musicological community would come to embrace this same conviction over the course of the ensuing decade; Subotnik was thus a

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24 This calls to mind a memorable passage from Khaled Hosseini’s *And The Mountains Echoed* (2013): “There was comfort to be found in the permanence of mathematical truths, in the lack of arbitrariness and the absence of ambiguity. In knowing that the answers may be elusive, but they could be found. They were there, waiting, chalk scribbles away. ‘Nothing like life, in other words,’ he said. ‘There, it’s questions with either no answers or messy ones’” (204).
trailblazing representative of the music-academic “new guard” to come. Something about what she stood for must have threatened Blackwood, whose letter of dissent to her case is not only territorial, but also riddled with sexist overtones. In it, he tries to label Subotnik’s brand of scholarship as a fringe case that will never catch on, and on top of this, he argues in rather condescending fashion that she does not know how to analyze music, nor does she understand Kant.²⁵

In the end, Subotnik did not receive tenure at the University of Chicago, thanks in part to Blackwood’s downvote.²⁶ Nevertheless, she persisted, eventually receiving tenure at Brown University in 1993. Still, she spent most of the 1980s publishing without an institutional affiliation, and it cannot be overstated how her Chicago tenure vote ended up momentarily stalling the trajectory of her otherwise illustrious career. Ultimately, it is not surprising that Blackwood would dissent to her case. What is more surprising, however, is that Blackwood would save the receipt. Indeed, as far as I am aware, his letter opposing Subotnik’s tenure is the only document in the entirety of his archive that has anything to do with a tenure case other

²⁵ The Easley Blackwood Papers, Box 37 (in “Memorabilia, 1980–1985”). Though Blackwood does not cite any specific publications by Subotnik, it is likely that he is referring to her article “Kant, Adorno, and the Self-Critique of Reason: Towards a Model for Music Criticism” (1979). Joseph Kerman, another major figure in the oncoming New Musicology, would later call Subotnik’s work on Kant “a contribution to the history of ideas,” praising the way that it centers “music’s relation to the socio-cultural matrix.” [Kerman, Contemplating Music: Challenges to Musicology (1985), p.171. See also Subotnik, “The Sound of Musicology” (1986), pp.45–46.]

²⁶ Subotnik has previously touched on the politics of her tenure battle in “The Role of Ideology in the Study of Western Music” (1983) and in her 1980 Society for Ethnomusicology paper presentation of the same title—though she does not mention any of her former University of Chicago colleagues by name in them. A brief discussion of Subotnik’s tenure case also appears in Taruskin, Cursed Questions: On Music and Its Social Practices (2020), pp.21–23 and 151–53.
than his own. Why would he keep a copy of this particular document, but not any from the numerous other tenure cases he must have adjudicated throughout his years in the department? Was he proud of the fact that he had a hand in keeping Subotnik out? Regardless of his motive, the document still exists, and it serves as a harrowing reminder that the exclusionary, gatekeeping, and preservationist ideologies that mark Blackwood’s theoretical writings and color his compositional approach are not just things that exist in some sort of detached musical stratosphere—they also trickle down into concrete actions on the ground that can hurt other human beings. There is something more than irony in the fact that Blackwood, as a privileged white male, could claim that his scholarly persona was detached from all things political, while at the same time treating the personal and the political as if they were inseparable in Subotnik’s case (when it was suddenly convenient for him to do so).

Blackwood wrote other music besides his microtonal compositions, of course, and each of these works reveals something, however indirectly, about the fundamental interconnection of his personhood and his politics. But perhaps none does so as explicitly and brazenly as the music he never intended for the general public to see. Consider the following song, for example:

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27 For more on the specifics of Blackwood’s own tenure, see The Easley Blackwood Papers, Box 12 (in “Correspondence, 1969–1979”).
Ex. 6.1: Some of Blackwood’s “music for the drawer” (in The Easley Blackwood Papers, Boxes 84 and 91, Hanna Holborn Gray Special Collections Research Center, University of Chicago Library)

While Blackwood’s antipathy towards Democrats likely comes as no surprise by now, this is still a shocking find—particularly given Blackwood’s penchant for decrying entire genres of music as
too loud and sex-obsessed. Yet here, in this brief ditty penned when he was already well into his fifties, Blackwood appears to be the one who is rather sex-obsessed. Indeed, one of his private hobbies seems to have been writing bawdy limericks, and this represents the only instance I could find in his archive of one of these actually being set to music. On top of the immature, vulgar lyrics and the cloyingly sexist subtitle—which themselves are patently obvious and need no further mention—even the song’s tempo marking is imbued with a sexual subtext (its lower bound, I would bet, is no accident). But perhaps most revealing of all are Blackwood’s performance directions for the song, located in the lower right corner of Ex. 6.1. Two things stand out in particular: [1] Blackwood’s recommendation that the song simply be “played over and over,” and [2] his endorsement of its transposition “into any lower key.” The former advocacy of repetition ad infinitum only doubles down on the song’s blatantly sex-obsessive character; the latter clarification about its acceptable tessitura, meanwhile, confirms something about the song’s intended audience: that this is music by men, for men. I can imagine the song’s taking on an underground life as a popular party trick among a close circle of like-minded males, to be “whipped out” past a certain point of inebriation as a means of collective, obsessive revelry—a sort of sonic phallus that ritualistically aids in the performance of toxic masculinity. But despite these performance directions, I could find no concrete evidence that the song was actually ever performed in a public or semi-private setting (whether at informal departmental gatherings or within the walls of campus frat houses).

28 This is how Blackwood characterizes rock music in private correspondence. [See The Easley Blackwood Papers, Box 42 (in “Correspondence and Agreements, 1958–2005”).]

29 Several of these can be found in The Easley Blackwood Papers, Box 44 (in “Notes, n.d.”).
This is not the only instance of offensive “music for the drawer” in Blackwood’s archive. In addition to this puerile ode to the Clintons, he also penned insensitive “odes” to China and to the American South. The pitch-class content in these last two odes is deliberately complementary: the former uses only the black notes on the piano and is replete with parallel perfect fourths that caricature the pentatonic basis of traditional Chinese music in an egregiously exoticist/Orientalist manner, whereas the latter only uses the white notes on the piano in a not-so-subtle nod to the “whites only” mantra of the postbellum Jim Crow era (which was still in full force when Blackwood arrived in Chicago in 1958). There are also longer-form works by Blackwood that demonstrate his unsettling fascination with racial, ethnic, and sexual difference. One of these, a single-scene satire entitled “Modern Music at the Museum,” was also likely never intended to see the light of day (outside of a few privately circulated copies that Blackwood sent to select friends). On the surface, it is a lamentation of what Blackwood has called the “nihilistic” state of concert music in the third quarter of the 20th century (and the sorts of things that have come to “pass as music” during that period). But it also doubles as an outlet for Blackwood to blow off some reactionary steam about the changing demographic and political landscape of the country at large during this same period.

30 Handwritten scores of these can be found in The Easley Blackwood Papers, Box 91 (curiously buried within a folder labeled “Tuning Stuff: Correspondence and Publications, 1982–2011”).

31 This work appears multiple times in The Easley Blackwood Papers: in Box 18, Box 28, Box 30 (where it is classified as an “opera”), Box 33 (here being a personal copy Blackwood made for Canadian music theorist Paul Rapoport), and Box 38. None of these copies is dated, though I surmise that Blackwood wrote the work sometime in either the 1970s or 1980s, in the midst of his stylistic turn back to neoclassicism.

32 The Easley Blackwood Papers, Box 91 (in “Tuning Stuff: Correspondence and Publications, 1982–2011”).
A few of the play’s characters are notable in this regard. There are two unnamed stagehands, for instance, who Blackwood specifies as being white, but who speak a bastardized version of African-American Vernacular English while chain-smoking joints throughout the scene. There is also a male character in the play who is presumably gay (though this is never stated outright) based on Blackwood’s insensitive stereotypical portrayal of him: as “well-dressed,” effeminate in mannerism, speaking with a high-pitched “nasal” voice, and overly gesticulating.

Taken together, these compositions “for the drawer” present quite the revealing portrait of how Blackwood privately coped with a changing world (and the changing place of Western Euroclassical tonal music—as a proxy for white cis male supremacy—within it). If a person’s character, as the well-worn adage goes, is measured by what they do when no one else is looking (or listening), then Blackwood’s reputation as an eccentric, isolated genius is in need of some serious reconsideration, to say the least. As Philip Ewell writes, one cannot afford to excuse or ignore the “racist misconduct” of white-male “artistic ‘geniuses,’” nor can one continue to subscribe to the prevailing ideology that “geniuses deserve some kind of dispensation for their conduct because of their genius.” Put plainly, Blackwood may be a well-respected composer (and in some circles, a highly revered musical mind), but this does not

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33 One of Blackwood’s former colleagues, it is worth noting, recalls the frequent scent of marijuana coming from inside his office—something that does not exactly square with Blackwood’s reported tendency to frequently (and emphatically) rail against marijuana use in casual conversation, associating the drug with people of color.

34 Blackwood, “Modern Music at the Museum” (n.d.). These are actual explicit stage directions given to the character, usually preceding his speaking lines.

35 Ewell, “Beethoven Was an Above Average Composer—Let’s Leave It at That” (2020b). This is the fourth blog post in a series of six entitled “Music Theory’s White Racial Frame: Confronting Racism and Sexism in American Music Theory.”
give him a free pass to be racist, sexist, and homophobic. These qualities—which are latent in some of his archival materials but blatant in others—cannot be excused as merely “incidental to his music” or simply “a product of his time.” They must be called out for what they are. To do anything otherwise is to perpetuate the pernicious belief that art can be separated from its artist.

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Anita Sullivan has written that “[a] piano is full of suppressed desires, recalcitrance, inhibition, conflict.” Be Becker, “The Power of Inertia” (1995), p.301. Was Blackwood’s world really so different from the instrument that gave it voice? As I left the archive that week, still processing what I had found, I felt the focus of my project shifting under my feet. No longer could it simply be a project about music in the abstract—about unlocking the “mystery” of Blackwood’s microtonal compositions while protectively residing in the ether of abstraction and never making contact with the ground. Instead, it would be a project about the conditioning forces of culture and history, the “powerful inertia” of “art worlds,” and the unavoidable ways that enculturation breeds cognitive (and ideological) bias. It would be a project about fear, anxiety, and insecurity—a far cry from the conventional music-theoretic focus on objectivity, rationality, and coherence. And finally, it would be a project about embracing contradiction, rather than seeking to resolve it. Blackwood’s microtonal music is a fuzzy, messy contradiction in terms, in ways that I have been unraveling over the past few hundred pages. But perhaps the most pointed contradiction of all, and the one that most presently occupied my mind in the wake of my trip to Chicago, is that

despite the outward appearance of equal temperament as an equitable, “democratic” tuning (and despite the outward appearance of microtonal composition as a radical act of musical boundary-expansion), we cannot afford to forget that “[t]he act of tuning is inherently a process of exclusion”\(^{38}\) and that Blackwood’s neoclassical approach to microtonal composition is ultimately a political act that reconstructs and refortifies the very walls he appears to be tearing down. Sure, his music may grab the attention of the musical layperson in a visceral way that most other music does not, but ultimately, this music is also the product of a worldview—and of a broader disciplinary “white racial frame”\(^{39}\)—that continues to keep out more than it lets in.

**Closing Gambit**

I therefore wish to conclude this dissertation in a subversive vein. In what follows, I examine one final, summative musical example that synthesizes many of this project’s major themes and arguments while also lying squarely outside of the “white racial frame” that animates Blackwood’s thoughts and his compositional/aesthetic ideologies. In so doing, I demonstrate that the findings and conclusions of previous chapters are not merely applicable to tonal music conceived in the Euroclassical functional mold; they can also reveal a great deal about tonal music that consciously resists the Euroclassical functional model and deconstructs several of its


\(^{39}\) Of course, there is also a gendered (male) component to this frame that cannot be overlooked, as Ewell discusses in his plenary talk, his subsequent article, and the first two of his intervening blog posts. [See Ewell, “Music Theory’s White Racial Frame” (2019); “Music Theory and the White Racial Frame” (2020a); “The Myth of Race and Gender Neutrality in Music Theory” (2020b); and “Race, Gender, and Their Intersection in Music Theory” (2020b).]
central enabling premises. Indeed, Blackwood would likely bristle at the suggestion that his music might shed new light on something like free jazz. But here goes nothing.

Free jazz denotes a range of Black experimental musics that arose in the late 1950s and 1960s as a reflection of (and reaction to) contemporaneous sociopolitical conditions in America.\textsuperscript{40} It has been referred to by a variety of names, from “avant-garde jazz” to the “New Thing,” but I choose to use the label “free jazz” to highlight the music’s intimate connections with particular notions of freedom that emerged in the era of civil rights and Black nationalism. In contrast to Euro-American ideas of freedom as something only attainable within a predetermined structure of rules and constraints, emergent Afrocentric conceptions of the term merged a freedom from predetermined constraints with a freedom to pursue one’s own path.\textsuperscript{41} Free jazz can be considered a sonic enactment of these Afrocentric ideas of freedom. The music emphasizes collective improvisation, eclecticism, and pluralism while distancing itself from aesthetic euphemisms for hegemonic whiteness such as fixed chord changes, hierarchical metrical templates, and functional tonality. For those trained to regard Western Euroclassical systems of harmony and meter as normative defaults, encountering free jazz can be a jarring experience, to say the least.

\textsuperscript{40} For more on the sociopolitical contexts that gave rise to free jazz, see Kofsky, \textit{Black Nationalism and the Revolution in Music} (1970), Carles and Comolli, \textit{Free Jazz/Black Power} (1971), and Wilmer, \textit{As Serious as Your Life: John Coltrane and Beyond} (1992).

\textsuperscript{41} On this point, see especially Anderson, \textit{This Is Our Music: Free Jazz, the Sixties, and American Culture} (2007), Chapters 2 and 3, and Monson, \textit{Freedom Sounds: Civil Rights Call Out to Jazz and Africa} (2007), Chapter 4.
But free jazz is far from “unstructured chaos.” Its organizational trajectory is simply of a different kind—one that is not always describable by traditional metrics of “governing key,” “ensemble downbeat,” or “global tempo.” Indeed, much free jazz operates in a manner that exposes such alleged musical “facts” as matters of perspectival contingency. Individual ensemble members often approach these referential orienting devices in different ways, but crucially, no one is more “correct” than any other(s). The music thus demonstrates that moments of apparent ambiguity or interpretive plurality need not always be reckoned as instances of conflict (or competition) in which a “winner” must be selected; rather, they can profitably be regarded as instances of vital coexistence (or collaboration) in which the plurality is precisely the point. The remainder of this chapter will focus on one such track—Ornette Coleman’s “All My Life” (1971)—unpacking what I call its “duck-rabbit centricity.” This concept, I argue, can be a useful tool for capturing free jazz’s foundational aesthetic of perspectival contingency and illustrating how music can still sound tonal even when it does not conform to traditional Western conceptions of “being in a key.”

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43 A recording of this track is available at https://www.youtube.com/watch?v=zNtKJNgjq2g. All recording times I cite in the ensuing discussion will be based off this link.
“All My Life” occupies a sort of transitional middleground between Coleman’s early Atlantic recordings and his later releases with Prime Time. A linking element is the use of two drummers at once: Billy Higgins and Ed Blackwell both play simultaneously on this track (as they did on Coleman’s 1961 album Free Jazz), and their interaction ranges from understated and metrically ambiguous (for the first minute or so) to urgent and duple-martial (beginning with singer Asha Puthli’s arrival on the last note of the second vocal strophe at 1:13, which ushers in the instrumental strophe at 1:17). The latter drum feel gradually usurps the former in prominence over the course of the recording, its exigency planing obliquely with the increasingly recitational ethos of the horns and vocals. The composite result is a subtle and gradual musical deconstruction of those temporal concepts that typically serve as shared orienting/anchoring frameworks among performers—such as 4/4 time, the downbeat, metrical regularity/periodicity, and even pulse itself. The recording begins by showcasing what Peter Niklas Wilson calls the “tendency in Coleman’s music to break through regular 4/4 time, to re-group meter—while still maintaining a steady beat—in response to the demands of the melodic line, to move in irregular metrical units.”

44 Coleman remains with Charlie Haden on the double bass, here, not yet having made the conversion of preference to the electric-bass sound that characterizes his Prime Time recordings from the later 1970s and 1980s. Perhaps the more “continuous” (i.e., non-fretted) layout of pitch space on the acoustic bass is a better match for Coleman’s characteristic microtonal inflections and “All My Life” singer Asha Puthli’s remarkable capacity for intonational nuance. Her own vocal part on this recording is enlivened with automatic double-tracking, and the horn section is heaped with reverb almost to the point of timbral anonymity, creating an ethereality never found on the earlier Atlantic sides.

45 Wilson, Ornette Coleman: His Life and Music (1999), p.74. Eric Charry, writing slightly earlier than Wilson, also discusses this same tendency of Coleman’s music to “shatter the barline and eventually break free.” [Charry, “Freedom and Form in Ornette Coleman’s Early Atlantic Recordings” (1997–98), p.261.]
relationship between drummers and horns/vocals sounds more and more like one of structural polytempo,\textsuperscript{46} or in other words, an instance of “dual-track time”\textsuperscript{47} in which the tracks, crucially, do not subscribe to a shared metrical framework.\textsuperscript{48,49} Much of the recording might therefore be regarded as exhibiting an overarching “duck-rabbit meter.”

One of this dissertation’s most important through-lines is that tonal stability and metrical stability exist in a symbiotic relationship, and indeed, the metrical plurality just described in “All My Life” is a principal contributor to the tonal plurality of Puthli’s vocal part. As the below transcription of the first vocal strophe shows, her part can plausibly be heard in either a C-centric (above each system) or a G-centric (below) tonal framework, and since neither hearing is dignified with particularly strong (hyper)metrical support, one could theoretically float back and forth between these two centricities.\textsuperscript{50} This tonal dualism, as I will argue, takes on a new


\textsuperscript{47} This term was coined by Hao Huang and Rachel V. Huang in “Billie Holiday and Tempo Rubato: Understanding Rhythmic Expressivity” (1994–95), p.188.

\textsuperscript{48} This last bit runs counter not only to Huang and Huang’s original conception of the term but also to several subsequent adaptations of the term, including a more recent one by William Bauer to Louis Armstrong’s swing solos. [See Bauer, “Expressiveness in Jazz Performance: Prosody and Rhythm” (2014), p.143.] Bauer (like Huang and Huang before him) regards “dual-track time” in terms of microtiming discrepancies between soloist and accompanist in their articulation of a \textit{shared} metrical frame.

\textsuperscript{49} Bassist Charlie Haden plays a mediating role between both temporal “tracks,” acting as what Jimmy Gomes calls a “pendulum player” in the overall interactional network. [Gomes, qtd. in Prögler, “Searching for Swing: Participatory Discrepancies in the Jazz Rhythm Section” (1995), p.47.]

\textsuperscript{50} Though, of course, as I discuss in previous chapters, one cannot hear in both tonal frameworks simultaneously.
significance during the upcoming instrumental strophe—a moment that can be productively illuminated by putting ordered-triple scale-degree notation in conversation with Coleman's original philosophy of “harmolodics.”

Ex. 6.2: A metrically underdetermined vocal melody that seems to straddle the line between C- and G-centricness; excerpt begins at 0:00 of https://www.youtube.com/watch?v=ZNtKJNgjqlg

One can regard the scale-degree annotations above as furnishing a “choose your own adventure” interpretational gameboard of sorts, meant to correspond to the several
conceivable tonal/modal frameworks in which Puthli’s vocal melody can be heard. The range of colors in Ex. 6.2—which includes all but the characteristic violet of locrian—demonstrates that while this passage is undeniably tonal (in the fuzzy heptatonic diatonic sense) regardless of how one hears it, it is also infused with a veritable rainbow of affective potential energy, seemingly possessing the ability to float among multiple modalities of tonality. To that end, whenever ordered triples are positioned directly on top of one another in Ex. 6.2 (whether on the same side of a given system or spanning both sides of it), this denotes multiple plausible modally situated intervallic interpretations of a given pitch. While this palette may look overwhelming at first, there is a purposive pattern to its layout. As stated previously, C-centric interpretations are always located above each system, and G-centric interpretations below. Furthermore, any vertically aligned modal interpretations for a given pitch within each centricity all share the same x (such as the (5, mi, 7) and (5, sol, 7) that both appear above the lyric “here” in m.6 as plausible C-centric interpretations). And likewise, any vertically aligned modal interpretations for a given pitch between centricities are arranged in a mirror-image format on either side of each system; these pairs all share the same y (such as the (5, mi, 7) and (1, mi, 7)—in addition to the (5, sol, 7) and (1, sol, 7)—that appear both above and below that same lyric in

51 It should be noted here that my metrical interpretation in Ex. 6.2 is by no means the only possible hearing of this passage—nor is it free from my own personal biases and implicit “preference rules” for metrical representation. Indeed, from m.7 onwards, my time signature shifts are chosen such that the agogic accents in Puthli’s melody (i.e., her longest-held notes) can occur on downbeats. While this is done to maximize the readability of Ex. 6.2, it goes without saying that divergent metrical interpretations are absolutely possible; indeed, in much free jazz, there is rarely such thing as a universally agreed-upon meter.

52 Traditional scale-degree notation, forged as it is in the crucible of ionian bias, would simply not be able to capture this range of commingling modal colors without necessarily distorting it in some way.
m.6). My contention is that such a layout, while perhaps confusing at first in its seeming plurality for plurality’s sake, effectively captures something fundamental about what it is like to experience tonal/modal ambiguity. Whether switching among vertically aligned hearings on the same side of a system (i.e., a “parallel” shift) or switching among vertically aligned hearings in a mirror-image relationship on either side of a system (i.e., a “relative” shift), some aspect of scale-degree hearing is always preserved—x in the former case, y in the latter case (and of course, z in both cases). These linkages are the phenomenological bread and butter of tonal/modal plurality, indicating exactly which aspects of scale-degree experience might be staying the same across potential hearings of the passage (and thereby unmasking the very conditions that create the sense of plurality in the first place).

While it is theoretically possible to flip between any two hearings on the same side of a given system—or between any two hearings that are mirror images on either side of a given system—simply by performing the requisite “mental ‘gymnastics,’” there is not always a practical payoff for doing so. Indeed, while I have thus far been considering Puthli’s vocal part on its own, it by no means exists in a vacuum that is void of other pitched material. Charlie Haden’s bass, the interactional “glue” of the ensemble, is crucially also present—and it is time to bring his heretofore ignored part into the discussion. Haden’s bass part, I argue, functions as

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53 In principle, it is also possible to flip between two hearings on either side of a given system that are not mirror images of one another—for instance, between C ionian and G phrygian during the lyrics “I knew you long ago” (mm.10–11). But such shifts preserve neither x nor y for any given z, and thus, because of the extra cognitive “work” they require to execute, they are arguably less plausible transformations than the x-preserving and y-preserving ones just mentioned in the main text.

an understated “influencer” that suggests certain hearings of Puthli’s vocal line, at certain
points, to be more plausible than others. Generally speaking, his playing helps to clarify which
parts of Puthli’s vocal line sound more C-centric, and which sound more G-centric. But because
of Haden’s deliberate sparseness, coupled with the initial absence of other pitched instruments
that could provide more precise macroharmonic cues, his bass playing does not necessarily tip
the interpretational scales conclusively towards any one specific governing C-centric or G-
centric modal collection. This preserves and accentuates the vocal line’s baked-in ambiguity,
suggesting that the song’s centricity may be an open question by design.

Haden’s playing suggests a gradual shift from C-centricness in the first system of Ex. 6.2
(punctuated by his phrase-ending Cs in mm.6–7) to G-centricness in the third system—a shift
that is accomplished during the “pivoting” second system (which begins as more C-centric but
ends as more G-centric, thanks to Haden’s prolonged dwelling on octave-separated Gs in
[most of] m.10 and [all of] m.11). This suggestion of a tonal transition by fifth is dignified by
Puthli’s vocal line during the third system of Ex. 6.2, which is basically an exact fifth
transposition of her part in the first system. Such a method of implying an alternate tonal
center, Ekkehard Jost writes, is a hallmark of Coleman’s compositional style: “The[se] shifts do
not arise from functional harmonic changes but from motivic chain-association, and are thus
independent of any time-order.”55 Indeed, while certain abstractions of harmonic-functional
behavior do emerge as a result of Haden’s bass part—such as the implication of falling-fifth
motion in the outer systems, or the quasi–dominant pedal in m.16 that consolidates the G-

centric conclusion of the strophe—it is noteworthy that, in general, “All My Life” manages to sound tonal without containing anything like traditional harmonies or harmonic functions. In other words, while scale-degree qualia appear to be a sine qua non for tonal hearing, regardless of idiom, harmonic function is not. Indeed, harmonic function seems to be a peculiar feature of musics derived from Western Euroclassical idioms (including some Western popular musics), whereas in other idioms (such as free jazz), it need not be present in order for tonal sensations to be possible. As Ewell writes, “function” (as in “functional’ tonality”) is a “euphemism for white and whiteness in music theory’s white racial frame”; the conscious eschewal of this regulative system in Black free jazz is no coincidence. It is a political act of resistance, a vindication of Jost’s remark that “[f]ree jazz shows precisely how tight the links between social and musical factors are, and how the one cannot be completely grasped without the other.”

Because “All My Life” is strophic, the story of its tonal trajectory is not so simple as positing a linear, directional shift from initial C-centrism to eventual G-centrism. Such

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56 That Ex. 6.2 comes out to a neat sixteen bars is merely a coincidence of my transcription; “All My Life” is still a prime example of the following remark from Jost about modal jazz since the 1960s: “With vertical chordal movement reduced to a minimum, there was room for freedom in a horizontal direction, for the abolition of functional harmony made a schematic division into eight, twelve, or sixteen-bar patterns unnecessary.” [Jost, Free Jazz (1974), p.19.]

57 Ewell, “Beethoven Was an Above Average Composer—Let’s Leave It at That” (2020b). Ronald Radano has also characterized harmony as a metaphor for white cultural dominance, writing that “[h]armony was a sonic reconstruction of the chains that had bridled blacks, of the rationalism that had stifled African spiritualism.” [Radano, “Jazzin’ the Classics: The AACM’s Challenge to Mainstream Aesthetics” (1992), p.90.]

teleological determinacy runs counter to free-jazz aesthetics, and indeed, the combination of progressive musical accumulation playing out over a circular form only intensifies the tonal dualism of Puthli’s vocal melody in the ensuing strophes. The G-leaning atmosphere that concludes the first strophe, for example, does not simply evaporate when the second strophe begins (0:34). Rather, it persists in a manner that challenges the original C-leaning nature of the strophe’s opening material (even despite the fact that Haden’s bass accompaniment to this portion essentially does not change between strophes). But one centricity never conclusively overtakes the other; even for those listeners who are inertially inclined to remain in a G-centric framework for the start of the second strophe, Haden’s emphatic phrase-punctuating Cs from 0:45–0:48 (referentially corresponding to those in mm.6–7, but now in octaves) momentarily tip the scales back to C-centrism, before the remainder of the strophe ventures once again in the direction of G. This push and pull, though it may engender some pointed cognitive dissonance in those listeners who are accustomed to one tonal area’s “winning out” in the end, is deliberate—and the ensuing instrumental strophe beginning at 1:17 demonstrates rather poetically that tonal plurality is something that is aesthetically and ideologically built into this music on the most foundational level.

The opening line of this instrumental strophe—essentially a superimposition of Puthli’s vocal melody in mm.1–3 and mm.12–14 of Ex. 6.2—is transcribed below:
As is the case in Ex. 6.2, the C-centric interpretation is located above the staff, and the G-centric interpretation is located below the staff. But unlike Ex. 6.2, I have chosen to represent the strophe’s melody as unmoored from any governing metrical framework, since it is here that the sense of “dual-track time” is most pointed, with the horns recitationally floating above the emergent duple meter of the drums, refusing to capitulate to their proposition of strictly isochronous phrasing. As a result, the horns sound “out of time,” and the rhythmic values in my transcription are meant to be loose approximations of “long” and “short” durations, not

[Lydian]: (3,la,4) (2, sol,2) (1, fa,0) (7, mi,11) (1, fa,0) (5, do,7) (7, mi,11) (6, re,9)

(G ionian): (6, la,4) (5, sol,2) (4, fa,0) (3, mi,11) (4, fa,0) (1, do,7) (3, mi,11) (1, re,9)

Ex. 6.3: Partial treble clef transcription of the instrumental strophe of “All My Life”; excerpt spans from 1:17 to 1:26 of https://www.youtube.com/watch?v=zNtKJNgjq2g

59 Here, however, within each of these two interpretations, vertically aligned ordered triples denote upper and lower voices in each of the passage’s dyads.

60 The horn part here might be regarded as freely expressing what Justin London has memorably called the “inner value of the notes.” [London, Hearing in Time (2012), p.174.]

61 I am reminded here of Charles Keil’s famous provocation that “[m]usic, to be personally involving and socially valuable, must be ‘out of time’ and ‘out of tune.’” [Keil, “Participatory Discrepancies and the Power of Music” (1987), p.275.] Certainly, “All My Life” can be said to display elements of both.

62 Of course, this label is a Eurocentric misnomer, and that is why I place it in scare quotes. The recitational sensibility of the horns might instead be regarded as deconstructing the idea that there must be a notionally isochronous beat level that is shared by all performers in an ensemble—as if to expose this latter manner of musical organization as just one among many equally valid ways to play “in time.”
rhythmically exact lengths. Once again, the lack of clear metrical support for this melody contributes to its ability to float between C-centric and G-centric anchorings.

I want to frame this instrumental strophe as a sonic encapsulation of Coleman’s philosophy of “harmolodics,” which is part musicking approach, part compositional method, and part cultural ideology. Harmolodic philosophy, which Coleman developed during the US civil rights movement, is rooted in the idea of human equality and mobilized through music that enacts this fundamental equality—concretely, among performers and instruments in an ensemble, and more abstractly, among musical domains. It is marked by an “egalitarian spirit” in which no one thing dominates over any other; its end goal is to create a musical space “in which the partners [in a] dialogue can articulate their own worldview without any pressure to compromise.” As Stephen Rush notes, “It makes complete sense that this approach to music would emerge […] in parallel with the Civil Rights Movement,” since harmolodics is not just about respecting each and every voice “within [an] ensemble” (so as not to create “a

\[\text{63 This transcriptional strategy matches the one found in Frink, “An Analysis of the Compositional Practices of Ornette Coleman as Demonstrated in His Small Group Recordings During the 1970s” (2012), p.77 (specifically Fig. 12), and later in Frink, “Dancing in His Head: The Evolution of Ornette Coleman’s Music and Compositional Philosophy” (2016), p.111 (specifically Fig. 7).}

\[\text{64 Haden’s playing during this section, moreover, continues to subtly nudge the interpretational scales without tipping them wholesale—closely mirroring the approach he takes in the preceding vocal strophes.}

\[\text{65 The most detailed and sensitive treatment of this notoriously hard-to-define philosophy is given in Rush, Free Jazz, Harmolodics, and Ornette Coleman (2017), which includes a lengthy interview with Coleman and makes a point of centering his own words and thoughts on the concept. Previous discussions of harmolodics can be found in Morris, Perpetual Frontier: The Properties of Free Music (2012), Kelley, “New Monastery: Monk and the Jazz Avant-Garde” (1999), and Wilson, Ornette Coleman: His Life and Music (1999), among other sources.}

\[\text{66 Wilson, Ornette Coleman: His Life and Music (1999), pp.68 and 70.}
preference or elevated function for any one instrument”), but also about empowering each and
every human voice “more broadly, within society.” Discussions of harmolodic philosophy that
focus on its musical particulars tend to note its theoretical commitment to giving “equal value
in importance to harmony, movement (rhythm), and melody.” Achieving this balance in
practice, however, actually entails more focus on certain musical parameters than others—
specifically, on melody as the ultimate musical wellspring, the source from which all else
derives. By conceiving of melody as harmony (and as movement), harmolodic practitioners
sought to break free from “[euphemistically ‘white’ conceptions of] harmony had on Jazz by the end of the 1950s.”

One distinctive feature of Coleman’s harmolodic philosophy is his expansive concept of
“unison,” which explicitly “reject[s] the hierarchical notion of ‘concert pitch.’” He would often
write out a melody and instruct each musician to play it as if it were written in the clef they were
accustomed to reading. The result would be a unique kind of parallel motion that seemingly
merges the qualities of polytonality and heterophony, as if suggesting multiple potential
referential centricities while simultaneously acting as a unified elaboration of one basic,
fundamental melodic line.

The instrumental strophe partially transcribed in Ex. 6.3 above can be conceived as a
textbook example of Coleman’s “harmolodic unison.” Consider the opening B-E dyad, for


70 Harbert, American Music Documentary: Five Case Studies of Ciné-Ethnomusicology (2018),
p.149.
instance. Even though it sounds as two separate notes, its constituent elements—a concert-pitch B played by Dewey Redman on tenor saxophone and the concert-pitch E a fourth above played by Coleman on alto saxophone—would both read as the same C# on Coleman’s harmolodic clef.\textsuperscript{71,72} Since most of the ensuing instrumental strophe proceeds similarly, in parallel perfect fourths, this offers a clue that Coleman may have conceived of it as a single, unison melody in harmolodic terms. The transcription below reconstructs how Ex. 6.3 might have originally looked to the players in Coleman’s ensemble, written on his harmolodic clef.\textsuperscript{73}

Ex. 6.4: Partial harmolodic clef transcription of the instrumental strophe of “All My Life”; excerpt spans from 1:17 to 1:26 of https://www.youtube.com/watch?v=zNtKJNgjq2g


\textsuperscript{72} There may also be two trumpets playing this melodic line—as Carmine Fornarotto and Gerard Schwarz are listed as playing trumpet on this track in the liner notes—but the heavy reverb makes it difficult to distinguish their parts from the more timbrally prominent saxophones. In any case, if the lower voice in each P4 dyad were played by a Bb trumpet, and/or the upper voice by an Eb trumpet, then the “harmolodic unison” hypothesis would hold.

\textsuperscript{73} This clef was apparently shaped like a figure eight. In Ex. 6.4, it is meant to be read as a treble clef, since this is the clef that alto saxophonists, tenor saxophonists, and trumpeters alike (i.e., all the horn players on the recording) are accustomed to reading. The literal sounding dyads in the instrumental strophe therefore result not from intra-group differences in referential clef, but from the fact that these horns are transposing instruments—and not all of the same type.
A few key differences from Ex. 6.3 are worth pointing out, over and above the change in clef. First, Ex. 6.4 is not color-coded, and no longer do my annotations above the staff correspond to a C-centric hearing and those below the staff to a G-centric hearing. Instead, these annotations now correspond to register: those above the staff represent the upper voice in the dyadic instrumental strophe, and those below the staff represent the lower voice. Notice that such annotations consist only of scale-degree $y$-components. This is intentional; my aim is to focus on the elements that unite the C-centric and G-centric potential hearings laid out previously in Ex. 6.3, not to focus on the elements that separate such hearings. For example, whether one chooses to hear the opening (literal) B-E dyad as $7^\#-3^\#$ in C lydian or $3^\#-6^\#$ in G ionian, both hearings correspond to a lower-voice $mi$ and an upper-voice $la$. Ex. 6.4 therefore makes no claims about governing/competing centricities, nor does it feature any information about $x$. Instead, it showcases the fact that regardless of how one tonally situates the instrumental strophe, the associated $y$-component string always remains the same. Ordered-triple notation thus captures exactly what makes this line feel so “unison” (outside of its monophonic appearance on the harmolodic clef): a fundamental qualitative equivalency that is the case not in spite of the line’s tonal multivalence, but precisely because of this very multivalence. In sum, the instrumental strophe (and with it, “All My Life” as a whole) is a musical microcosm of the central harmolodic credo: to always “respect and celebrate
differences within unity.” To pigeonhole this music into the either/or confines of C-centrism versus G-centrism, put plainly, is to miss its point.

To be abundantly clear, I am not arguing that “All My Life” can be heard in both a C-centric framework and a G-centric framework at the same time, by the same listener. But what I am arguing, simply, is that it is contrary to the spirit of harmolodics to force a choice between two tonal areas, to regard them as “competing,” and to feel the need to select an absolute “winner.” Instead, I have been framing the tonal multivalence of “All My Life” in collaborative terms, as furnishing a set of equally viable perspectival “hats” that a listener can try on for size, discarding one and switching to another at their own pace, in order to experience the same music in a variety of immersive modalities and affective frameworks. This aesthetic of complementarity is deeply rooted in the music’s performance. While a single listener can only hear one operative tonal center at a time, different musicians in an ensemble need not subscribe to the same shared referential orienting centricity. This is part and parcel of the deconstructive modus operandi of free jazz, in which the idea of a shared set of universally

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75 Indeed, this subtle tonal interpenetration continues until the very end of the recording, never settling definitively into C-centrism or G-centrism. In fact, just when a conclusive, final arrival in G seems imminent (hear especially Puthli’s rhetorically charged quasi-“cadential dominant” beginning at 3:44), Haden’s bowed bass moves deceptively from D to E (3:47), and the promise of an ultimate, satisfying tonal resolution is devastatingly thwarted at the last possible moment.
agreed-upon musical “facts” is often supplanted in favor of a “multidominant”\textsuperscript{76} array of radically contingent perspectives. The way this aesthetic sensibility trickles down to affect harmolodic scale-degree consciousness is perhaps best described by Coleman’s longtime trumpeter Don Cherry: “If I play a C and have it in mind as the tonic, that’s what it will become. If I want it to be a minor third or a major seventh that has the tendency to resolve upward, then the quality of the note will change.”\textsuperscript{77} Simply put, harmolodic playing, to bastardize a quote from Gandhi, is about being the qualia you wish to feel in the world. That certain musicians may approach the same material from different qualitative perspectives, or from divergent angles of orientation, is not a bug in the system—it is an essential feature of the music (and of the aesthetic/ideological philosophy that empowers the music). Free jazz is fundamentally about choosing one’s own path. There is no such thing as an \textit{a priori} wrong turn.

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Blackwood’s microtonal music and Coleman’s free jazz certainly make for strange bedfellows on the surface. But are they really as different as they may seem at first glance? Both are frequently described as “dissonant” for reasons that boil down to their flouting of culturally conditioned expectations about how music typically sounds. Both demonstrate, in their own idiosyncratic ways, how metrical stability and tonal stability are codependent.

\textsuperscript{76} The idea of “multidominance” originates with Robert L. Douglas, whose notion of “multidominant elements” forms a central part of his formalized “African-American aesthetic.” [Douglas, “Formalizing an African-American Aesthetic” (1991), \textit{passim}.] In Douglas’s words, the term refers to “the multiple use of colors in intense degrees, or the multiple use of textures, design patterns, or shapes” (18); this, he argues, is a defining feature of African-American art. For an application of this concept to free jazz, see Lewis, “Purposive Patterning: Jeff Donaldson, Muhal Richard Abrams, and the Multidominance of Consciousness” (2009).

phenomena, and how the loss or gain of one implies the loss or gain of the other. Both challenge the music-theoretically privileged qualities of fit, fixity, and exactitude through their foregrounding of sonic liminalities—those “micro-“elements that sound either colloquially “out of tune,” colloquially “out of time,” or both. Both are fundamentally tonal musics, despite all that seems not to fit. Both contain moments of ambiguity, in-betweenness, and puzzlement that can be illuminated by leveraging a scale-degree concept that separates generic scalar position from specific modal character (and that does not discriminate among the many viable modalities of fuzzy heptatonic diatonic tonality). And finally, though both musics could perhaps not be more different in the worldviews they articulate and the politics that motivate their creation, they serve as equally potent reminders that musical aesthetics are musical ideologies, full stop. In the words of Amiri Baraka, “The song and the people is the same.”78

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