Towards a Global Music Theory

Practical Concepts and Methods for the Analysis of Music Across Human Cultures

Mark Hijleh

ASHGATE

ASHGATE e-BOOK

TOWARDS A GLOBAL MUSIC THEORY

To Kelley, Hannah and Noah
S.D.G.

Towards a Global Music Theory

Practical Concepts and Methods for the Analysis of Music Across Human Cultures

MARK HIJLEH
Houghton College, New York, USA

ASHGATE

Published by
Ashgate Publishing Limited
Wey Court East
Union Road
Farnham
Surrey, GU9 7PT
England

Ashgate Publishing Company
Suite 420
101 Cherry Street
Burlington
VT 05401-4405
USA

www.ashgate.com

British Library Cataloguing in Publication Data
Hijleh, Mark.
Towards a global music theory : practical concepts and methods for the analysis of music across human cultures.
1. World music – Analysis, Appreciation. 2. Music theory – History – 20th century. 3. Music theory – History – 21st century. 4. Music and globalization.
I. Title
781'.0905-dc23

Library of Congress Cataloging-in-Publication Data
Hijleh, Mark.
Towards a global music theory : practical concepts and methods for the analysis of music across human cultures / Mark Hijleh.
p. cm.
Includes bibliographical references and index.
ISBN 978-1-4094-2336-2 (hardcover)—ISBN 978-1-4094-2337-9 (ebook)
1. Musical analysis. 2. World music—Analysis, appreciation. 3. Music—Cross-cultural studies. 4. Music theory. I. Title.
MT90.H55 2012
781—dc23

2012001260

ISBN 9781409423362 (hbk)
ISBN 9781409423379 (ebk)

III

MIX
Paper from responsible sources
FSC® C018575
www.fsc.org

Printed and bound in Great Britain by the MPG Books Group, UK.

Bach musicological font developed by © Yo Tomita.

Contents

This page has been left blank intentionally

List of Figures

This page has been left blank intentionally

List of Music Examples

This page has been left blank intentionally

Acknowledgements

My sincere thanks go first to Jeremy Begbie, without whom I might not have had the temerity to write this book, and whose warm friendship and professional encouragement I continue to cherish so deeply. Certainly, this book could not have been written without the teaching, wisdom, and encouragement of my professors at the University of Sheffield: Jonathan Stock, Andrew Killick, and Kathleen Noss Vanburen. Further thanks go to Michael Tenzer for his trailblazing work in the field of world music theory and his willingness to engage in dialogue with me, and to Kendra Rutgers for believing in and enthusiastically speaking out about the need for more culturally inclusive music theory curricula. I am indebted to those who graciously read drafts and conversed with me as these ideas developed: Frank Felice, Andy Sauerwein, Bill Vollinger, Matt Hoch, Vicky V. Johnson, and especially David Davies, my former student and now colleague, who provided commentary on this project over several years, and who has begun fearlessly and generously delving into teaching some of it to a new generation. Thanks also to friends, students, and colleagues at Houghton College, who allowed me the professional space to explore the ideas in this book, despite the inconvenience it caused. I owe an inestimable debt of gratitude to Heidi Bishop at Ashgate for taking a chance on advancing the discussion of this important topic, and for taking even more of a chance on me; also to Laura Macy, who stepped in to oversee the final editing. And, finally, I am deeply grateful to my family, especially my wife Kelley and my mother Sondra, for the many years of selfless encouragement and understanding they have given.

Mark Hijleh, Houghton
New York

This page has been left blank intentionally

Chapter 1
Global Music Theory: Issues, Possibilities, and Fundamental Concepts

Global Musicianship: Imperative and Dilemma

This book does not purport to constitute a theory for all music. It is not a work of ethnomusicology. Nor is it a study in natural science or mathematics, though it does draw on basic ideas from those disciplines, especially from acoustics and human perceptual theory. Those looking for validation of the concepts and methods in this book by means of formal proofs will likely be disappointed. Rather, this is a book by a musician for musicians, one that attempts to address an increasingly pressing problem in an age of what might be called "global musicianship": how to offer a practical approach to analytical understanding that might be useful for a very wide variety of musics, and which is at the same time manageable for the purposes of music education, especially at the collegiate level.

In the remarkable introduction to his book *Analytical Studies in World Music*, composer, theorist and ethnomusicologist Michael Tenzer astutely notes that:

> In coming years it is conceivable that we will want a *world music theory* … [and] it would have to be an umbrella set of practical concepts for teaching … The purpose of such a theory would be in the first place to start making sense of our complex cross-cultural musical selves and perceptions. We are often told of the world's vast and rapid changes but rarely advised on how to make sense of them as musicians. A world music theory would be a response to economic and cultural transformation making it desirable for musicians to acquire competence not just passively hearing, but contemplating and integrating any music. The well-established ethnomusicological model of bi- or tri-musicality is inadequate to describe us anymore; we are approaching multi- or a virtual pan-musicality. For many this is already a fact of life, and not just for composers: trumpet players do salsa, Corelli, free jazz, and mariachi all in the same week, and the iPod shuffle mode compresses infinite musics, cultures, eras, and locales for listening with consummate effortlessness. (2006a:33–4)

Tenzer goes on to frame a large and critical question, one that is especially relevant to the purposes of this study:

> Yet real musicality actually comes from prolonged exposure to deep details which we learn to experience cognitively and feel bodily. That takes years of

> focused study. To suggest world music theory implies a comparative perspective so diffuse that it would seem to preclude such closeness … Could such a course coexist with the need for students to master particular instruments and traditions? How could the unwieldy breadth of world music theory not stretch it too thin? And who would have the mastery to teach it? The questions are discouraging, yet the problem remains. Music theory in Europe and North America, oriented so heavily toward Western art music, fails to address the needs, selves, and likely life trajectories of more and more musicians. (2006a:34)

The tension between these two concepts, the global musicianship imperative and the global musicianship dilemma, is palpable, and it is in fact what has motivated the writing of this book. We cannot afford any longer to be experts in only one music, yet we cannot possibly become experts in all musics. In fact, this dilemma requires a rethinking of what music theory really is, especially from a pedagogical standpoint. If we have only so much time and capacity for thinking about and teaching how music works, how are our limited resources best spent?

One way through this dilemma is to pinpoint one of the most profound ways the musical world in which we live is different from any of those that spawned the concepts and methods by which most musicians continue to be formally trained. World music education expert Huib Schippers notes that the reality of our globalized musical world:

> has major implications for the way musical skills and knowledge are perpetuated and for the formal organization of music learning and teaching, much of which was designed for the musical realities of the nineteenth century. Many of the key factors we take for granted in our contemporary musical experience did not emerge until the twentieth century. (2010:xv)

Indeed, over the last 120 years or so, the cross-pollenization of global musical materials and practices has accelerated precipitously, due in large part to advances in higher-speed communication and travel. As Kwame Anthony Appiah has recently noted, “A world in which communities are neatly hived off from one another seems no longer a serious option, if it ever was one” (2006:xx). The upshot of this is that we can no more go back to a world of truly discrete musical cultures than we can to one without mobile telephones. All music is to some degree now world music, and world music is the music of synthesis. Thus, Schippers’s definition of world music is a very apt one: “the phenomenon of musical concepts, repertoires, genres, styles, and instruments traveling, establishing themselves, or mixing in new cultural environments” (2010:27). The time is now right for students, teachers, and researchers in music theory to begin shaping and sharing analytical concepts and methods applicable to a wide range of human musics, not least the hybrid musics that influence (and increasingly define) more and more of the world’s musical practices.

In short, given our limited capacities in a virtually unlimited musical world, *we need first to become experts in the analysis of musical synthesis*: music as a synergism of eclectic influences, as an integration of interrelated and overlapping elements of time, pitch, timbre, and process. We need a music theory—and, eventually, a music theory curriculum—that fosters in musicians both the abilities and the sensibilities for a life of musical freedom and flexibility in the context of a musical world that now has conceptually limitless creative possibilities. We need a music theory that encourages understanding of synthesis rather than one that focuses on the rigid preservation of cultural difference, category, boundary, and hierarchy, not because we would seek to erase difference (as if that were possible) but simply because global fusion—to one degree or another and of one kind or another—is what now most clearly defines and enlivens the activities and products of our musical world. Some understanding of difference is necessary in such a milieu; in fact, thinking integratively actually helps one understand what makes musics different from one another. But it also helps one understand how different musics operate as syntheses of other syntheses, and so on, which is why it is the most appropriate paradigm on which to base a twenty-first-century music theory.

As Appiah (2006) might put it, a "cosmopolitan" theory of music is now in order, a theory that acknowledges that we are (or ought to be) citizens of a much broader musical world. But, since we cannot be full citizens of every musical culture, we must instead become musicians who more readily apprehend musical universals as they are manifested in musical localities. That is, we must focus on learning how musical elements are woven together to create various unique styles and practices. To be sure, this is itself a type of analysis deeply informed by Western contributions, but also one that might be applicable to a wider range of musics precisely because it is more susceptible to a kind of flexibility that Kofi Agawu suggests could "facilitate a more even-handed traffic in intellectual capital between musical cultures"; a method by which "Eurocentric cross-culturalism [could be] replaced by a dense network of exchanges in which origins and destinations change regularly and swiftly and are accessible to, and at the same time enriching for, all actors" (2003:188). In short, we need to ground ourselves and our students in a music theory that allows us to operate effectively in the complex web of globalized musics that defines our time, of which the ongoing traditions of the West are certainly an important part, but not the totality.

Moreover, though analytical studies focused on illuminating the music of each discrete culture have obvious value, a global music theory is ultimately needed to help us understand the accelerating process of synthesis that is surrounding and transforming those same cultures year by year. Along with Tenzer and Agawu, John Blacking (1973:xi, 31, 108) and others have suggested implicitly the value of such an enterprise, and Bruno Nettl (2005:42–9, 58–9) has noted its potential sensibility (along with its challenges). Further still, such a music theory needs to be developed and implemented in ways that do not preclude subsequent immersion in the deep details of one or more specific musics, but that are not at the same time paralyzed by legitimate yet too often overwrought concerns about cultural "authenticity." Schippers goes so far as to speak of "the myth of authentic traditions in context," especially as it relates to music education, and lauds Janet Mills for saying that "'no music stands still in time, even without the involvement of schools. It would be inauthentic to view any music as a museum piece …'" (2010:41, 50).

"Global" musical analysis, then, might productively focus on description of the dynamic interaction between musical elements, with quantification of detail sufficient to provide the data from which descriptive meaning can arise. However, this sort of differentiation ought not to be aimed in any sense at demonstrating the intrinsic superiority of any musical culture, system, or style over any other, but rather at discovering and celebrating similarities along with differences, both as a good in itself and as an aid to understanding the stylistic syntheses that surround us. The concepts and methods of a global music theory might illuminate many aspects of 12-tone serial music, African music, or Mozart, but they will not necessarily reveal the same things as theories designed specifically from or for those musics. Nevertheless, such a theory could reveal much of unique value about the disposition of any or all of these musics in relation to one another in an intercultural musical world where they are in perpetual dialogue. Again, "disposition" is not here meant to suggest any sort of stylistic hierarchy, but rather the dynamic interaction of characteristics.

To be sure, theories that have sprung indigenously from specific musics they seek to illuminate remain worthwhile due to the special insights they give to their respective musics. Indeed, it is hoped that the theories put forward here might remain in fruitful dialogue with more culturally focused theories, for surely each would inform the other. What is at stake, however, is the question of whether we might move beyond specialization and distinction as the only arbiters of music theory, and toward the notion that much of value might be gained by uncovering certain similarities between musics. The risk of loss is real in such an enterprise, for the temptation to reduce and consolidate beyond what is healthy (or even accurate) is ever with us.

The difficult question, then, is whether the potential rewards of theories more applicable to the global musical syntheses that continue to accelerate around us are worth such risk. This study is certainly not the first attempt at such a theory; as will become apparent, some of its bases lie along well-established acoustical and psycho-acoustical lines, along with much other prior research. Proponents of pitch class set theory have recently claimed, implicitly or explicitly, that it may offer a high level of useful universality with regard to pitch. As an example, Robert Gauldin's examination of what set theory may reveal about the development and nature of world pentatonicism and diatonicism (1983) is especially fascinating. But there are many aspects of pitch that this approach does not take into account, and it does not even claim to address other critical musical elements such as rhythm and texture. Thus, set theory may in the end be another example of a highly useful but more narrowly targeted system. And so the dilemma remains: just as it is not practical for twenty-first-century musicians to become experts in all musics, so we are faced with the need to limit the number of theories of music with which we are familiar. There appears to be room to put forward a sufficiently robust foundational approach to music theory that serves the overall needs of a global era, while keeping the dialogue open at a more detailed and/or culturally informed level. That is the purpose of the present study.

Moreover, the global musicianship imperative suggested herein applies not just to theorists, but to all musicians, since the act of music-making and sharing nearly always requires the conveyance of musical concepts between persons. In some cases, theoretical studies and concepts have seemed designed to be opaque to those who might want to use them as aids to musical creation or re-creation. In other cases, theories have proven to be largely irrelevant to actual musical lives. Without a music theory that is applicable to a wide variety of musics, and most importantly to globally integrated musics, there is a real danger that efforts to educate both listeners and music-makers will become increasingly ineffective in our time.

So, to return to Tenzer's exhortation, a set of well-integrated, elegant, and practical conceptual tools could assist us in making sense of diverse musics and their interaction. This book proposes a number of such concepts and methods under a concise and unified theory: *for practical analytical purposes across human cultures, musical elements, structures, and processes can be fundamentally understood and expressed as complex webs of relationships operating around the interaction of "twos" and "threes": as durational groupings of twos and threes at various hierarchical levels; and as pitch relations organized around acoustical ratios of 3:2 and 2:1*.

What follows is an exploration of how this theory is manifested in various interrelated aspects of music, including time and pitch (that is, rhythm, melody, and harmony); consideration of how such elements interact to form texture and other processes; and, finally, suggestions for how such concepts and methods might be applied effectively to the creation, re-creation, learning, and sharing of music in a variety of contexts in ways that invite further investigation, critique, and application. Before delving into these matters, however, a more detailed discussion of the nature of our globalized world, and some of its musical implications, is in order.

Music and Globalization: Similarity, Difference, and Fusion

Sociologist Jan Nederveen Pieterse provides three basic paradigms of globalization and culture (2004:41–58), each of which is helpful to thinking about global music. The first of these, "Clash of Civilizations" (after Samuel Huntington) essentially divides the world into "West" and "non-West," and suggests that a period of dominance for the former is waning, though not without a fight. This view is extremely relevant to academic music theory in that the current system remains heavily focused on deep understanding, preservation, and dissemination of

Western European "Common Practice" repertoire originating in the seventeenth, eighteenth, and nineteenth centuries. The paradigm relies on a monolithic view of culture that Pieterse rejects, noting that "culture refers as much to commonality as to diversity," that "human experience … is fluid and open-ended," and that too keen a focus on differentiation ignores "the interplay between the local and the global" that characterizes human behavior (2004:46–7).

Pieterse colorfully names a second paradigm of globalization the "McDonaldization" of culture (2004:49). In the arts, the fear is that valuable differences between cultures are receding in favor of something universal that is too quick and easy, perhaps something like American popular music conventions and styles. One irony here is that American pop music is in fact itself a very sophisticated hybrid of European and African (and, increasingly, Asian) elements, and that it mixes further with whatever local culture to which it is exported. Consider, for example, the complex interplay between American-style and Asian contributions to the development of modern Japanese popular music, as outlined well by Yano and Shūhei (2008). Economist Tyler Cowan, writing about the "creative destruction" (after Joseph Schumpeter) that accompanies historical change in societies, asserts that in this age of globalization:

> World musics are healthier and more diverse than ever before. Rather than being swamped by output from the multinational conglomerates, musicians around the world have adapted international influences towards their own ends … Most world music styles are of more recent origin than is commonly believed, even in supposedly "traditional" genres … [T]he notable creators are active, searching artists, drawing on many sources to produce the sought-after aesthetic effect. These points do not denigrate non-Western artists or imply that they "owe it all to the West." It is the contrary emphasis on monoculture that insults, by portraying non-Western artists as unchanging and static craftworkers, unable to transcend their initial styles for synthetic improvements. (2002:8–9)

Pieterse, echoing Cowan, finally suggests that the most healthy and accurate paradigm of globalization is simply "Hybridization," in which there is an "increase in the available modes of organization: transnational, international, macroregional, national, microregional, municipal, local" (2004:65–6). Schippers helpfully characterizes the musics arising from such a milieu as each falling somewhere along a continuum that includes monocultural, multicultural, intercultural, and transcultural points (2010:31). The result is that musical possibilities are increased exponentially, and few, if any, are precluded. Cowan suggests that some local expressions do in fact die away in such a milieu, but that these are replaced by musics that are at least as robust if not more so (2002:53, 55–9).

This perspective sees all musical styles and cultures as constantly in flux, and acknowledges that the main issue is not change itself but rather the nature, subtlety, and rate of change. As noted earlier, the twentieth and twenty-first centuries have seen a much greater rate of noticeable musical change, largely because of quantum leaps in technology. Yet even the most venerable musical traditions have been marked by inevitable change, since no culture is ever fully separated from all others. Bruno Nettl put this in perspective by suggesting that if Western musical purists could travel back in time to the Vienna of the 1780s, they might be "scandalized that Mozart, evidently a member of the eighteenth-century world music movement, claimed to be able to write Italian, French, German music, old and new, mixing in Bohemian and Hungarian and 'Turkish' styles" (2000b:24–5). But even this understates the number of world traditions that have contributed over the centuries to what is now called "Western music." Schippers, quoting Henrice Vonck, refers to another and even more venerable case quite succinctly: "Balinese music is an uninterrupted tradition, but it changes constantly" (2010:153), and this is confirmed by Tenzer's description of *gamelan gong kebyar*, one of the most popular and influential Balinese musics, as "a notable part of the past century's global cultural legacy" while noting that "Balinese music and musicians have already had considerable and prolonged contact with their counterparts from abroad" (2000:4–5).

Admittedly, there are differences between evolution within distinct traditions and full-fledged musical fusion between disparate styles. Nevertheless, the term "fusion" is particularly helpful here in a musical sense, since it captures the dynamic meshing of elements within each music itself while at the same time acknowledging perceivable differences between musics. Though perhaps most commonly used to describe the particular welding of stylistic elements from jazz and rock, the term thus offers much broader possibilities. This in turn relates to the use of a second term, "global," which may address some of the same issues, that is, may be understood as reflecting a sense of comprehensive (though sometimes subtle) integration of any number of world musical sounds, styles, elements, or processes.[1] An important question in this context concerns the point at which fusion ceases and something new is created in which boundaries are so crossed that the origins of distinctive elements are lost. Such lines, like so many others, are often both fluid and blurred in real musical situations. Yet without some clearly identifiable differences between the stylistic elements (or references) in a piece of music, the concept of fusion seems to fade if not disappear. Musical fusion thus requires the retention of difference on one level, but also an openness to the possibilities of operational or foundational similarities among styles. A global music theory must therefore have enough flexibility to address such questions of operational balance.

But the championing of difference has too often obscured the vital role of similarity and the natural evolutionary role of fusion in the making of music. That is, any attempt to call attention to sounds, patterns, or principles that appear similar between musics is too often met with a resistance that seems borne out of a fear

---

[1] As an example, one work by Lakshminarayana Subramaniam that attempts to bring all these meanings into play is simply titled *Global Fusion*, portions of which are featured in Chapter 6 of this study.

that vital distinctions (not to mention whole products) might be lost. At the same time, this championing of difference has also too often been used to make deeply problematic and frankly parochial musical judgments that seem to stem from cultural bias. This is why music theory is perhaps best kept away from the realm of cultural comment. In that sense, a global music theory is not a search for musical “meaning,” but rather for operational principles that transcend particular contexts. At the same time, a global music theory allows for meaningful dialogue about those principles within any particular context. And since discussion of musical similarity and difference leads inevitably to the thorny (and ultimately overstated) question of “musical universals,” that topic becomes central to addressing the larger question of whether any kind of global music theory is possible.

Practical Theory and the World of Qualified Universals

Thus it is that boundaries must be staked out: *a practical global theory of music is one that includes analytical concepts and methods applicable to human music-making in the world in which we now live*. The notion that a musical universal must be valid in every possible human or non-human music (such as bird and insect song, patterns of wind and water, and so on) is therefore rejected here, though Rahn (1983:12–13) and a number of bio-ethnomusicologists think such inclusiveness is necessary (see Wallin et al. 2000). Such insistence is the first step down a slippery slope of paralyzing absolutism from which no recovery is possible, as it moves beyond the musics we can hear and participate in now into the realm of musics we may have never heard, past, present, or future.

But even within the realm of human activity, what is music? Though Jean-Jacques Nattiez asserts that “[by] all accounts there is no *single* and *intercultural* universal concept defining what music might be” (1990:55), Varèse’s famously succinct definition of music as “organized sound” (see Goldman 1961:133–4), perhaps tempered by John Blacking’s addition of “humanly” (1973:3), may do as well as any other. The larger question is one of whether anything can be “human” that is not also “cultural.” Here, the implicit relationship between “humanly organized sound” and “soundly organized humanity” put forth so eloquently by Blacking (1973:89) perhaps offers reconciliatory hope. And, for example, for Nattiez it is the *meaning* that is socially constructed, rather than the sound itself or even its “compositional” organization (1990:46).

A far more useful answer to the dilemma of musical universals, therefore, is simply that a human-oriented theory should comport with both physical and psychological characteristics, concepts, and associations that seem to apply to the vast majority of human beings and their musical practices. As Lerdahl and Jackendoff put it, “[a] formal theory of musical idioms will make possible substantial hypotheses about those aspects of musical understanding that are innate; the innate aspects will reveal themselves as ‘universal’ principles of musical grammar” (1983:4). Such issues will be explored later in this study. In a more general sense, the views on musical universals expressed by Bruno Nettl (2005:42–9) provide a reasonable way forward for this discussion. Nettl notes that there are four ways to conceive of musical universals, each a bit less restrictive than its predecessor: “anything present in every instant of music” (44), “anything that is present in every musical utterance” (45), “anything that is found in each musical system” (46), or “features shared not by all but by a healthy majority of musics” (48). It is this last category, which Nettl labels “statistical universals” but which may be subsumed under the even more general heading of “qualified universals,” that offers hope for reasonable criteria with which to judge the value of a global music theory.

Qualified musical universals, then, are those concepts that illuminate the features of a vast array of human musics, and for which reasonable arguments can be made as to their origins in human physiology, human understanding of the physical world, the psychology of human perception, and/or the actual practice of known human musical systems.

Objections to this line of examination are, however, rather strenuous and come from well-respected quarters. Theorist Leonard Meyer, for example, labels the search for musical universals as one of the three errors that have “plagued music theory,” reserving special vitriol for “the time-honored search for a physical, quasi-acoustical explanation of musical experience—the attempt, that is, to account for musical communication in terms of vibrations, ratios of intervals, and the like,” and singling out for criticism music psychologists who hold “the belief that the responses obtained by experiment or otherwise are universal, natural and necessary” (1956:5). Meanwhile, Nettl asserts that the “demands of human physiology and anatomy do not provide a very convincing argument” (2005:48) for why some characteristics seem applicable to many or most musics.

Such attitudes are puzzling, since, for example, Meyer grounds his implicitly universalist theory of musical meaning entirely on psychological theory and experimental results (which cannot, by his definition, be universally reliable), and does so in an explicitly multicultural context. Both Meyer and Nettl insist that any musical discoveries must be carefully contextualized (in Gestalt theory for Meyer, and culturally for Nettl), but at the same time they embrace selective acceptance of parameters that suit their aims. In fact, Meyer’s critique above is not relevant to the aims of this study, since a theory of music that “explains” musical “communication” or “meaning” is not being suggested herein. Nettl offers no explanation for why anatomy does not provide any “convincing” support, even as he acknowledges that musical universals are likely (2005:49; 2000a:472). Meanwhile, François-Bernard Mâche sums up the biases of both ethnomusicology and theory by noting that:

> Extreme cultural relativism, through its excessive focus on the specificity of every musical culture, tends to present the common aspects as pure misunderstanding. It claims that no culture has any right to superimpose its categories on any other. Doing so, it tends to favor a kind of reverse racism by isolating every culture

> from all others, while the ubiquitous blending of musical practice becomes unintelligible. (2000:474)

This study affirms, then, that there are universal human physical characteristics, and, since music-making is a physical process, that these are relevant to human musicianship. To be sure, the relationship of human beings to the physical universe extends far beyond organic embodiment, to a conceptual world in which we attempt to understand and even explain that which we experience. This conceptual world, however, is still largely "physical" in the sense that it ultimately deals with real things that we can (or could) see, hear, and touch. Thus, this study will at various points return to the notion of "physicality" and it relationship to qualified musical universals in a global theory.

Fundamental Elements and Concepts

The question of which symbolic and conceptual language might be most appropriate for presenting a global music theory is a complex one, and will not be examined at length here. Yet some means must be utilized to efficiently and effectively convey concepts and methods, and this presents a challenge that leads ultimately to some practical compromises. It should be noted, for example, that this study assumes that the reader can understand Western musical notation. This is not meant to be presumptuous, but rather merely convenient. It seems quite plausible that the examples given herein could be translated into other notational conventions, or even understood in non-notational contexts, since many of them were not originally conceived notationally. However, to omit notation would reduce the clarity of method by which these theories are applied to musical examples. On the other hand, some musics do seem better suited to freer adaptations of Western notation, and when that is the case an attempt at such adjustments is made herein. One might also envision useful further manifestations of these theories that are exclusively aural/oral in nature, but working out the details of such a manifestation is beyond the scope of this project. Moreover, this study builds on a great deal of very useful previous work in acoustics, psycho-acoustics, and other related disciplines. Reference will therefore be made consistently to a number of traditional Western conventions of music scholarship, while at the same time attention will be devoted when possible to moving toward less stylistically-bound terms and explanations. That is, this book contains a good bit of reimagining, but also attempts to assist the reader by relating ideas to established expressions when these seem convenient. In this way, it is hoped that this study may serve to some extent as a transitional, rather than a revolutionary, move towards a global music theory.

As a conceptual framework upon which to build a pedagogy of global musicianship, Jan LaRue's *Guidelines for Style Analysis* (1970) may serve well. Proceeding from the very useful observation that music is a process of synthesis ("growth," as he would call it), LaRue rightly notes that rhythm, melody, harmony, and what he calls "sound" (primarily timbre, dynamics, and texture) are the essential, overlapping, interactive elements that contribute to the syntheses that constitute musical processes and products. Though his specific examples and orientations are all Western (and most from the Common Practice era), LaRue nevertheless supplies not only a practical method for approaching any music, but also a pedagogical framework on which to construct a more comprehensive and flexible theory curriculum.

LaRue builds his model around these five categories of musical elements in a particular order that he feels is appropriate to the nature of Western music: Sound (an intriguing collection of items that are sometimes ignored or treated peripherally in traditional Western analysis), Harmony, Melody, Rhythm, and Growth. Each of these will be considered in due course (most in separate chapters), though in an interactive model that is more conducive to a global music theory. Moreover, the order will be reconsidered based on the level of importance and ubiquity of each element in the global musical milieu. Because of this reconsideration, and because a number of interrelated concepts are built upon sequentially from the start, the order in which the chapters of this book are presented is very important.

The first and most elemental of the analytical categories is Rhythm, which seems essential to a practical working definition of music since music flows out over time (unlike, for example, visual art). Clearly, music can exist without pitch, and even without timbral or dynamic distinctions, but it cannot exist without rhythm. However, as LaRue makes clear, any analytical treatment of rhythm requires careful consideration of other musical elements that may accompany it. Indeed, many of the main issues associated with a global music theory quickly come to the fore when attempting a discussion of rhythm precisely because rhythmic grouping so often relies on pitch, timbral, textural, and other characteristics.

It is therefore useful as a starting point to attempt to define just what is meant by "rhythm" per se. Among the multitude of answers spawned by this question (see, for example, Creston 1961:iv–v), three concepts deserve special attention in the context of this study. The first of these is that rhythm relates in some complex fashion to broader conceptions of time. Lewis Rowell points out, for example, that cultures with a circular view of time tend to conceive of musical rhythm very differently from those with a linear view, and further suggests that "musical time" attempts to reconcile conceptions of time as "being" versus time as "becoming" (1979:98). At the same time, needed balance is offered by a second important concept, articulated in different ways by Jay Rahn (1983:29), Meki Nzewi (1997:32–42), Cooper and Meyer (1960:1) and others: that "rhythm" should not be about "time" or "duration" *only*, divorced from other musical elements, especially pitch. However, to realize Rahn's analytical goal of "establishing the greatest number of similarities among the values and relationships by which the observables are interpreted [while employing] the smallest number of primitive concepts" (1983:51), that is, showing similarities of organization in pitch, rhythm, and form at various hierarchical levels, one must in fact be able to examine pitch, rhythm, and form with some degree of separation first; otherwise, one would have nothing to compare.[2] Moreover, other theorists (Lester 1986:5; London 2001:278) have suggested that the study of "duration" as a valid musical element in its own right is appropriate. Finally, the enormous question of what constitutes "music" has significant implications for any definition of musical rhythm. This has much to do with the "qualified universals" that will be considered further in due course, but for now it is important to assert that a practical definition of music will ultimately focus on the music-making of human beings. For the purposes of this study, then, a working definition of "rhythm" may therefore be reasonably and substantially informed and limited by the element of human intentionality (see Arom 2000:27).

Taking into account these three ideas, rhythm may be appropriately defined as *the management of time in human musical processes*. A practical approach to rhythm, then, will seek to illuminate how such management is accomplished, in ways that elucidate relationships between time, organization, and perception, and it will be applicable to a very wide range of musics in the "qualified universal" sense explored above. Chapter 2 will explore the details of a system for understanding rhythm within such a set of contexts, while the idea of time management in music will also play a role in examining larger musical processes in Chapter 5.

After the management of time (that is, rhythm), the management of pitch seems to play the next most critical role in what human beings generally think of as music. Pitch may here be usefully defined as *the human perception of audible fundamental frequencies and their relationships*, the details of which will be discussed in Chapter 3. The related concepts of tuning and timbre (part of what LaRue would call "Sound") also play a complex and critical role in the operation of pitch in music, and thus will be considered in those discussions.

Meanwhile, LaRue helpfully distinguishes Melody (sequential pitch) from Harmony (simultaneous pitch). Indeed, after rhythm, melody is the most ubiquitous element in human music-making; far more musical cultures seem melodically focused than harmonically focused. In some cases, harmony is present, but appears to be more incidentally than intentionally so. Moreover, the whole concept of pitch in music can be successfully conceived of as primarily linear, a notion that a number of theorists have embraced.[3] Chapter 4 of this study attempts to address not only harmonic simultaneities and functions, but also the effect of how individual chord pitches flow from one to the next. Not surprisingly, these arise largely from the same principles devoted to melody in Chapter 3.

---

[2] Rahn attempts to solve this problem by suggesting concepts that can be applied analogously to pitch, rhythm, form, and other musical elements, aiding direct comparison. However, he does so at a level of abstraction that proves very difficult to reconcile with the practicalities of important and very real musical distinctions.

[3] For a good short summary of this topic in the context of Western music, and an interesting take on its possibilities, see Morris (1998). Meanwhile, Stock (1993) contemplates the possibilities of structural linearity for non-Western musics as well.

One large issue inherent in any discussion of music is that of tension and release. In the context of pitch (and, in this study, of rhythm as well), the terms "dissonance" and "consonance" have historically been fraught with difficulty. The use of these terms in music theory, as proxies for "tension" and "release" respectively, ought not to refer to anything intrinsically positive or negative, but rather to the necessary and desirable dynamic interaction without which there is no music. Sadly, such terms have too often been used to serve the agenda of some who would make value judgments about musical styles (see, for example, Tenney 1988:1–5). Nevertheless, to avoid too much descriptive ambiguity, this study utilizes all four of them freely, with the explicit understanding that they are meant to work in tandem as a way of (imperfectly) describing musical *expression*. That is, the building of musical tension (dissonance) is just as positive as its release (consonance), and both are necessary for expression, though the balance between them may be quite subtle and may vary widely. One of the difficulties of making such references, however, stems from lack of clear definitions. In one sense, consonance and dissonance are relative rather than absolute descriptors, since each musical style tends to include a "floor" of the former and a "ceiling" of the latter; that is, a range (wide or subtle) within which that particular music operates. At the same time, this study will explore definitions that may be understood to extend from clearer acoustic and/or psycho-acoustic principles. These are also, in some respects, related to the level of process complexity that listeners might perceive in any given musical moment.

In a very real sense, understanding the management of time (rhythm) and pitch constitutes the bulk of what a music theory seeks to accomplish. However, as LaRue is careful to point out, there are a number of other considerations that contribute to musical style (and therefore to musical effect). Among these aspects that LaRue considers to be in a broader category labeled "Sound," two that are very closely related—timbre and tuning—and another one that is especially elemental—texture—will receive closer attention in this study, the former in the context of pitch (as noted above) and the latter as an important subcategory of "process" in music (Chapter 5). Some of the other elements that LaRue places in the Sound category are here dealt with in the context of other, larger concerns. For example, though LaRue spends a fair amount of effort on the related subcategories of "accent" and "dynamics," much of the discussion of their musical effect may be conveniently subsumed in an examination of musical grouping, a concept that is in turn key to understanding process at various levels.

As William Sethares shows (2005, especially 25–32), tuning and timbre are intertwined, since the balance between the specific frequencies (that determine the perceived pitch) and amplitudes (that affect perceived loudness) of individual partials within the composite sound wave determines much of the distinguishing character of its aural effect. Sethares approaches this issue from the perspective of how "consonant" a musical sound is, defined as the extent to which the timbre-determining spectra (frequencies and amplitudes) of the individual partials within the sound match the frequency relationships in the tuning system being used

(2005:2–3). Sethares is also very interested in the difference between "harmonic" sounds (defined as those in which the overtones or partials appear exclusively at integer multiples of the base or fundamental frequency; 2005:3) and "inharmonic" sounds, or aspects of both sometimes combined, since pitch seems much harder to determine in the latter, an issue that will be considered again later in this study. The larger point, however, is that pitch collections and tuning systems seem to arise as much from the design of the instruments and singing techniques as from anything else. That is, pitch material cannot be divorced from the instruments and/or voices (and thus the timbres) used to perform the music. The question, then, is whether a reasonably limited "master set" of pitches within a world of qualified musical universals can be identified that sufficiently encompasses these concerns for the practical purposes of analysis, and the extent to which such a collection can be shown to be grounded in established perceptual and conceptual realities. This study, however, stops short of attempting to classify sounds timbrally, and instead asserts that some combination of pitch and timbral distinctions is sufficient for comparative analytical purposes. Useful for such purposes are four broad, traditional, and culturally neutral categories of instrumental design: aerophones (sounds produced by a vibrating column of air), chordophones (sound produced by the vibration of a stretched string), idiophones (sound produced by the vibration of the body of the instrument), and membranophones (sound produced by the vibration of a stretched skin), though the timbral varieties within each of these is vast. Sethares also provides a helpful reminder that the modification of vocal vowel sounds has timbral effect, and further notes that contemporary technology now allows musicians to create sounds in any timbral/tuning combination (2005:30).

A second major subcategory, texture, includes timbre among its components. As will be discussed in Chapter 5, it is the independence of simultaneous rhythmic, pitch, and timbral "streams" that helps distinguish textures and, by extension, perceived musical complexity, all of which contributes further to the sense of musical tension and release. In this study, an attempt is made to move beyond the basic traditional categories of music texture (monophony, homophony, polyphony, and heterophony) into a realm of textural consideration that has many more combinatorial possibilities.

How these foundational elements and concepts related to rhythm, pitch, timbre/tuning, and texture ultimately work together is the subject of the next and final introductory section.

Musical Synthesis and Synergy

It should be clear by this point that the notion of dynamic interactivity of elements is essential to understanding music analytically. Again, this is the real genius of LaRue's original study. However, in broadening this concept into something useful for a global music theory, a rearrangement of priorities and relationships is in order. To reiterate, rhythm is the most ubiquitous and necessary component of music, since music must flow through time. When pitch is present, the evidence from a wide swatch of world musics indicates that melodic (linear) pitch is a more common focus than harmonic (simultaneous) pitch, though the latter is obviously central to many styles. Intertwined with these, or in dialogue with them, are a number of broader "sound" elements, the most important and distinctive of which are tuning, timbre, and texture,[4] the latter of which actually rises beyond the category of "element" into the realm of "process."

Process, or the interactive unfolding of the musical materials within and between these elemental categories, can in some ways be thought of as synonymous with the notion of "synthesis" with which this chapter began. Synthetic musical process tends to be synergistic (greater than the sum of the parts), and also leads to an identifiable musical "product." This product may be intentionally and/or actually either momentary or lasting. It may be large or small, simple or complex, subtle or overt. It may stay within or freely cross boundaries between the categories of "composition," "improvisation," and "performance." Thus it is that synthesis, synergy, process, and product are all intertwined in music. Moreover, as will be explored in Chapters 5 and 6, the concepts of exposition, repetition, variation, and contrast, and their contributions to the process of musical perception and balance in and across musics, are essential. LaRue, as noted earlier, uses the term "growth" (1970:115) in an attempt to capture these dynamics, and it is a term far preferable to the more traditional label "form," which implies a fixedness that is rather alien to the nature of music; even the many established "forms" in the musics of the world display a degree of openness to varying processes at both micro and macro levels.

LaRue thus arrives at the anagram "SHMeRG," (1970:7) which, as also noted above, belies a distinct orientation toward Western music in its order of elements: Sound, Harmony, Melody, Rhythm, and Growth. Even if one were to reorder these so as to more accurately reflect the importance placed on each in the global composite—Sound, Rhythm, Melody, Harmony, and Growth, perhaps—the critical sense of interdependent dynamism would not be captured. Thus a more graphically complex model is useful:

$$\left.\begin{array}{c} \mathrm{S(ttt)} \\ \swarrow\!\!\!\!\nearrow \;\; \updownarrow \;\; \nwarrow\!\!\!\!\searrow \\ \mathrm{RMeH} \end{array}\right\}\mathrm{P}$$

Figure 1.1 A dynamic model of musical process

---

[4] The definition of "texture" is too complex to state succinctly here, but will be explored more fully in Chapter 5.

Here, rhythm, melody, and harmony (in that order) all interact with the other elements that make up the broad "Sound" category, especially with regard to the musical grouping that in turn helps articulate process relationships. As noted earlier, tuning, timbre, and texture (the three "ts" in parentheses) are among the most prominent of these other elements. Finally, the totality of these dynamic interactions constitute the growth of the music as it flows out over time. However, since even the term "growth" implies certain biases, the respective operative term used throughout this study will instead be "process," represented graphically as "P" above, which also serves as a further reminder that music is both a process and a "product."

This study ends, in Chapter 7, with further consideration of some of the implications for composition, improvisation, performance, and music education inherent in the theories put forward. In the end, a global music theory should be useful for understanding the things associated with real music-making by real human beings in the actual musical world in which we live. It ought to consist of a few simple concepts, rooted in fundamental human perceptual and conceptual experience, that can at the same time allow for expanded exploration of implications at a variety of deeper levels and in a variety of cultural contexts. And it must of course be applicable to a wide range of musics, both in and out of the Western tradition, especially musics that reflect the global hybridity now at the forefront of cultural development. In short, for the sake of the global musicianship imperative, a twenty-first-century music theory needs to move towards being both more conceptually accessible and more globally and experientially relevant. This book aims to take a clear, firm step in that direction.

Chapter 2
Global Rhythm

Music, Time, and Embodiment

As suggested in Chapter 1, the idea of rhythm is in many ways the most foundational to music. Moreover, a number of ideas related to music as something both time-bound and embodied may be applied beyond the strict confines of rhythm per se, though they will be discussed in this chapter largely in terms of their most direct implications for rhythm. Among these foundational ideas are physicality, the primacy of prime numbers, and certain aspects of perceptual psychology.

Physicality

It is worth noting here that the term "physicality" is a better one than "physiology" for describing phenomena applicable to rhythmic theory, because such phenomena are more broadly concerned with how human beings relate to the physical realm. The two categories most relevant to this study are characteristics of the human body and mathematically expressed characteristics of space and/or time, along with their implications for the psychology of human musical perception.

In a characteristically straightforward statement, Blacking notes that "Many, if not all, of music's essential processes may be found in the constitution of the human body" (1973:x). Peter Fletcher (2001:19, 49) is one among many who assert that heartbeat is foundational to human rhythmic orientation. One might also include respiration as a human bio-musical universal, and, as an example, ways in which the breath orientation of Japanese *shakuhachi* music could be related to rhythm will explored briefly later in this chapter. Of more general importance may be the bilaterality of the human brain and body that seems to correspond to a preference for symmetry, balance, and evenness (see, for example, Bochner 1973, especially 348, and Voloshinov 1996). The venerable Curt Sachs (1952:391–2) suggests that musical rhythms are closely related to the binary act of walking, but implies that this is largely a Western phenomenon rather than a universal one, a view echoed by Hannon and Trehub (2005) on the basis of one controlled experiment. However, in another study Bergeson and Trehub (2006) reaffirm an innate predilection for binary rhythmic patterns in infants, while Eric Clarke (1999:474), citing the extensive work of Paul Fraisse, also connects anatomical bilaterality with a preference for binary ("isochronous or pendular") rhythms. Moreover, Kofi Agawu (2003:74) implies that common rhythmic patterns in African music are largely based on evenly divisible groups of beats that conform to two-footed dancing, and criticizes the efforts of Sachs and others to "represent"

African rhythms as “Other” in this regard. At the same time, in discussing Indian music, Martin Clayton (2000:37–41) seeks a definition of meter that can allow for uneven groupings, a point explored further by Mohammed Azadehfar (2006:19–46) in his study of Iranian music.

What emerges from such conflicting analyses, however, is a clear need to distinguish biologically based human rhythmic preferences from what actually occurs in music at various levels of time organization (a point more or less acknowledged by Agawu, Clayton, and Azadehfar). In fact, it is precisely the tension created by even and uneven groups of durations that seems to give rise to perceivable rhythmic affect. Nevertheless, it is important at this stage to affirm that binary groupings seem to be the most closely connected to “natural” human physiology.

Primacy of Primes

As noted above, however, it is also important to stress principles by which human beings may seek to understand and interact with the larger physical world. Here the concept of prime numbers comes to the fore. It is not overstating the case to assert that, with regard to mathematical representations of the world, the properties and implications of prime numbers can be said to be a fundamental way of expressing natural phenomena. The literature on this subject is vast and complex, but mathematician Marcus du Sautoy perhaps sums it up best:

> Prime numbers are the very atoms of arithmetic … Their importance to mathematics comes from their power to build all other numbers. Every molecule in the physical world can be built out of atoms in the periodic table of chemical elements. A list of the primes is the mathematician’s own periodic table. The prime numbers 2, 3 and 5 are the hydrogen, helium and lithium in the mathematician’s laboratory … [Yet it] seems paradoxical that the fundamental objects on which we build our order-filled world of mathematics should behave so wildly and unpredictably. (2003:5, 45)

This tension between the simplicity and foundational nature of prime numbers and the quasi-random complexity of their qualities and implications has a parallel in the essential nature of musical rhythm that, it is hoped, will be illuminated in the theory proposed in this study.

Closely related to the concept of primes as a way to describe the universe is the original Pythagorean theory of the Tetractys, which demonstrates that the numbers one, two, three, and four together can be said to illustrate basic spatial realities: one being a single point in space (location), two points defining the first dimension (linearity), three points constituting the second dimension (planarity, a flat triangle), and four points describing the third dimension (solidity, a three-sided pyramid on a flat triangular base) (Boyer 1991:53). Until the nineteenth century, one was considered to be prime by most mathematicians but has since been categorized as a "unity" with special properties rather than a quantity per se (Gowers 2002:118); for the purposes of a theory of rhythm, one is not particularly useful since at least two events must occur in time for there to be duration between them. (Nevertheless, for good measure, the possibility of a "group of one" will be examined briefly later.) And four is simply the square of two, which further pares down the essentials to the undisputed primes two and three. Of these, three is harder to analogize musically; its primary rhythmic function seems to lie in introducing a kind of elemental unevenness that operates interactively in contrast with the preferred evenness of bilaterality.

Euclid's Fundamental Theorem of Arithmetic states that every integer can be written as a product of primes in an essentially unique way, but in fact every integer greater than one can also be generated by some combination of summation or multiplication from these two smallest and most fundamental prime numbers, two and three. Another form of the Pythagorean Tetractys (shown below in Figure 2.1) consists, with the exception of a single one at the apex, exclusively of multiplications of twos and threes:

$$\begin{array}{rl} & \!\!\!\!1 \\ 2 & 3 \\ 2\text{x}2 & 3\text{x}3 \\ 2\text{x}2\text{x}2 & 3\text{x}3\text{x}3 \end{array}$$

Figure 2.1 Pythagorean Tetractys

Here, in a fashion similar to the other Tetractys noted earlier, one represents a single point in space, two and three represent linear distances (or durations), 2 × 2 and 3 × 3 represent two dimensions, and 2 × 2 × 2 and 3 × 3 × 3 represent three dimensions. Both two and three are used as the basic units precisely because they are not further divisible (other than by one), and because every greater number may be reduced to some combination of them.

Perceptual Psychology

The question of how human beings perceive rhythm has spawned countless studies, papers, and books; as such, any attempt at a comprehensive look herein would be well beyond a reasonable scope. However, a summary of several well-established and relevant issues and findings is manageable and will prove sufficient to move the discussion forward.

The first of these is the apparently unique ability of human beings to synchronize perception and movement to a steady beat or pulse ("entrainment"), which allows dancing of a kind not exhibited by other animals (Patel 2006:101; Fitch 2006). This ability appears to extend to at least two stages of perception, the first being a "clock model" in which the brain analyzes and chooses a best time unit ("clock") against which to compare the given pulse, and a second stage in which the time spans are subdivided further into equal and/or unequal sub-groups, the former of which are easier to process than the latter (Povel and Essens 1985). This also comports with the theories of Gestalt hearing and auditory "chunking" discussed below. But the basic human ability to entrain to a steady beat, against which rhythmic content is then judged, remains most foundational.

As will become apparent later in this study, most theories of rhythm rely on documented human predilections for the grouping of temporal (and other) events. This tendency to organize rhythmic phenomena into groups appears to operate in two ways. On the one hand, human beings have limited ability to remember series of discrete objects or events, as a rather famous study by Harvard's George Miller demonstrated (1956:92); the optimal number seems to be about seven items or events. As a result, people tend to find more success in grouping long series of items into smaller "chunks," which are then remembered as sub-groups. Telephone numbers are an obvious application of this principle; in the United States, for example, the required 10 digits are always presented and remembered in chunks of 3+3+4 (area code + prefix + suffix), and in practice the final four digits are often further sub-divided into two groups of two. Additional research shows that this same strategy is applied to motor learning as well, which ties the concept more closely to physicalized rhythmic concerns (see Sakai et al., 2003).

But the human listener also combines clusters of seemingly random auditory events into larger wholes, or Gestalts, in an attempt to make sense of what is heard (Neuhaus and Knösche 2006). This may best be considered a "higher level" strategy, in that it is more likely to take place at "higher" (temporally slower) levels of rhythmic organization, whereas "chunking" is invoked more at the immediate sequential ("lower" or closer to the rhythmic "surface") levels.

Together, these two grouping strategies enable the listener to organize and remember rhythmic content at a variety of hierarchical levels, an ability that will prove important to the theory put forth in this study.

Yet another interesting phenomenon, only recently explored in a controlled systematic fashion but commonly invoked by experienced musicians, is the complex interpretive place afforded to silences in musical situations. As researcher Elizabeth Margulis puts it:

> The same acoustic silence, embedded in two different excerpts, can be perceived dramatically differently. Impressions of the music that preceded the silence seep into the gap, as do expectations about what may follow. These impressions and expectations can cause two identical acoustic silences to seem like they occupy different lengths of time, or carry different amounts of musical tension, or function differently in other ways … Overall, [this study] provides additional evidence that the time course of musical engagement is complex; elements from the past (e.g., preceding musical context) impact significantly on the experience of the present (e.g., a presently sounding silence), such that a silence within one

> context is not really experienced as the same event as that silence in another context. (2007:485, 501)

This concept is important to rhythmic theory, since it implies that the role each rest plays in temporal groupings cannot be delineated by the measurement of its duration nor its placement alone; rather, some rests are perceived as part of rhythmic groups and others as mere separators between groups.

Finally, it is worth reiterating that human preference for binary groupings is both a biological and a psychological phenomenon.

A Practical Global Theory of Rhythm

Human beings appear to be musically unique. At the very least, researchers seem to agree that humans alone are able to coordinate their perceptions and movements to a steady pulse of time units. The obvious implication for rhythmic theory of this is that humans tend to compare rhythmic gestures to this perceived regular "beat" in musical situations. The steady pulse acts as a background against which other rhythmic phenomena are assessed. Secondly, the tendency both to break down longer streams of durational material into smaller more manageable units and to combine disparate elements into Gestalts can be described more simply as a tendency to organize the rhythmic gestures with which humans are confronted (or which they create) in music. The first part of this tendency, combined with an innate predilection for prime groups of two and three, leads to a kind of usefully limited atomization ("chunking"). At the same time, the second part of the organizational tendency leads us to organize rhythmic content at a variety of durational levels or time streams. Finally, the element of silence plays a variable role in rhythmic design; sometimes unsounded pulses are included in our conception of gestural organization as group members, and sometimes they are interpreted as group separators.

Taken together, these elements lead to a surprisingly simple theory of rhythm that can be applied to the "qualified universe" of human musics: *for the practical purposes of analysis, rhythm in human music-making can be understood and expressed as a complex web of relationships arising from durational groupings of two and three at various hierarchical levels*.

An exploration of some of the details, implications, and applied principles of this theory is now in order. To begin with, the reader is reminded of the qualified definition of rhythm already presented: *the management of time in human musical processes*. This definition implies intentionality, but at the same time leaves room for management processes that may be intuitive. Moreover, sometimes the management of which the definition speaks refers to interpretive concerns. Even when it is the case, such as in improvisation, that the "composer(s)" and "performer(s)" are the same, this further implies that the act of interpretation may require a different mindset. That is to say, the processes of musical conception and musical conveyance may differ in the ways that intuition, analysis, and execution are applied to the task of managing musical time in each. These distinctions are important, since a practical theory of world rhythm must be useful not only for the creation of music, but also for its exploration and conveyance in many senses: analysis, education, entertainment, communication, edification, and the like. In order to do so, the "theory" must also to some degree be a "method" that can be applied interpretively. The next several sections explore the concepts and principles of such a theoretical method.

However, two additional elemental terms in the statement of the theory itself must be defined before they can be unpacked. "Groupings" here mean identifiable sets of durational elements. Such groupings flow naturally in certain ways from human tendencies when listeners are confronted with rhythmic information in musical processes (that is, "chunking" on one level and creating Gestalts on other levels). Whether or not these groups are identified by music creators, performers, or listeners during the musical moment itself, they must surely be identifiable at some point in order to illustrate the organizational management of duration in the music. The theory asserts that all such groups may be successfully reduced to and expressed as groups of two or three durational elements. In this chapter, a considerable amount of discussion will be devoted to how these durational groups are "identified."

But the groups also exist and interact at various "hierarchical levels," meaning that there are various rates at which durational groupings unfold in musical processes. The term "rates" is correct here because rhythmic groups at what will be called "higher" levels unfold more slowly over time than those at "lower" levels. The latter are those levels that are closer to the "surface" of the music, that is, closer to the durations that are actually sounded as opposed to those that are implied by grouping at "higher" levels. Thus the term "durational" must be broadly and contextually construed. How such hierarchies are laid out constitutes another large portion of this chapter.

Finally, durational groups at various hierarchical levels interact in various ways to produce "a complex web of relationships" that is at the heart of what constitutes the rhythmic content of the music. Interpreting this relational web thus becomes a primary aim of the theory/method. Several aspects of this interpretive process will be dealt with in detail, but it is sufficient for now simply to mention that some of the key relationships flow from simultaneity and others do not. That is, some rely on linearity—memory and anticipation—and others rely more on a kind of selective switching of attention back and forth between various hierarchical levels. The apprehension and interpretation (and in some scenarios, the construction) of the "web" thus constitutes the most complex aspect of rhythmic "management," in contrast to the relative simplicity of how the groups and their hierarchies are formed.

Grouping

Before proceeding with a detailed discussion of rhythmic grouping theory, some attention needs to be given first to the traditional concepts sometimes known as "divisive" and "additive," since these are often used both to characterize and to explain underlying principles of grouping (and hierarchy), and to distinguish Western rhythmic ideas from those of other cultures. Agawu essentially argues that such a distinction, as it pertains to African music, is a fabrication born of significant misunderstanding of African music on the part of Western scholars (2003:55–95). As noted earlier, Agawu instead asserts that African rhythm is mainly about dancing, and as such must usually be understood in the context of how two-footed human beings move; that is, in essentially even (most often binary) groupings. Clayton acknowledges that there are uneven ("irregular") groupings in some Indian music, which often cause it to be labeled "additive" (2000:37), but likewise insists that the key to understanding lies not in the divisive/additive distinction, but rather in how "meter" is defined (37–42). Azadehfar agrees with this assessment in regard to Iranian music (2006:19–36), and Habib Touma (1996:48–54) notes that Arabic rhythmic patterns simply are what they are; they are not distinguished by whether they have even or odd numbers of beats or subdivisions, though like Indian *tāḷas* they do seem to be based on stringing groups of beats together into larger wholes. Some genres of Indian, Arabic, and Japanese music are ostensibly "non-pulsed," which would seem to preclude the concept of even versus odd groups of "beats." Others (some Native North American music, for example) have very steady and clear beats which are usually not interrupted by (though they interact dynamically with) the accents necessary to delineate metrical groupings.

Agawu's point that the distinction made between "additive" and "divisive" rhythms is essentially a mechanism for separating Western from non-Western music is a strong one, and as such it is not an especially useful distinction in an inclusive theory of world rhythm. Likewise Clayton's point that the main issue is how rhythms are grouped seems sound. When the "rhythms" in question are steady "pulses" or "beats," it becomes clear that any regular, recurring groupings of these would fall into the category of "meter."

Here it is also useful to clarify further the distinction between groupings of "beats" and groupings of "events." It is in fact the latter that forms the perceivable musical patterns that will herein be called "rhythms." In that sense, beats are theoretical place-markers in the temporal flow; though some events are certainly linked to underlying beats, every beat need not be considered an event for the purposes of grouping—otherwise "meter" would become equivalent to "rhythm."

And indeed meter is only one sort of grouping, albeit an important one. Lerdahl and Jackendoff note that:

> The principles of grouping structure are more universal than those of metrical structure. In fact, though all music groups into units of various kinds, some music does not have metrical structure at all, in the specific sense that the listener

> is unable to extrapolate from the musical signal a hierarchy of beats. Examples that come immediately to mind are Gregorian chant, the alap (opening section) of North Indian raga, and much contemporary [Western] music (regardless of whether the notation is "spatial" or conventional). At the opposite extreme, the music of many cultures has a more complicated metrical organization than that of tonal music (1983:18).

For the purposes of this study, in fact, the concept of meter is absorbed into a larger and more flexible array of hierarchical levels, as will be discussed below. What remains, then, is to explore how groupings (that might include metrical groupings) are determined.

Much useful work has been done in this regard by both Rahn (1983) and Lerdahl and Jackendoff (1983). Rahn's explicit intent to formulate "a theory for all music" makes his study of particular interest in considering a rhythmic theory that might be applicable to a wide variety of world musics. Lerdahl and Jackendoff limit their postulations to Western tonal music, but their observations about rhythm and grouping are still salient for the purposes of this study. Jonathan D. Kramer's (1988) exploration of similar concepts includes extended consideration of another key element, the "accents" that are often necessary to audibly delineate groups. Despite the use of various terminologies, the shared goal of these analysts remains describing what constitutes the boundaries of a rhythmic group, and each suggests a number of strategies for making such a determination.

Lerdahl and Jackendoff speak of "well-formedness" and "preference" rules (1983:37, 43), emphasizing the important point that the formation of groups is a matter of interpretation within reasonable boundaries rather than something that can be absolutely systematized. Rahn concurs; by giving considerable attention to discussing principles of "adjacency," "endpoints," and "endpoint relations" (1983:52–5), he rightly implies that group boundaries may be contextually complex, and may even overlap in various ways. Lerdahl and Jackendoff explore the same issues in the context of "proximity and similarity" as well as "overlap and elision" (1983:40–62). It is also clear that other musical elements, especially pitch, timbre, and dynamics (amplitudes), play a large role in rhythmic group formation (Rahn 1983:29; Lerdahl and Jackendoff 1983:13; Cooper and Meyer 1960:1).

Clarke (1999:480–81) offers two important additional supporting ideas, namely that perceivable groupings seem to be an acoustical feature and not only a notational one, and that listeners seem able to distinguish between structural rhythmic groupings and variations in expressive performance timing (489–91). Such confirmations are especially important in validating that a theory may be applicable to a wide variety of aural/oral and notated musics.

Since principles of grouping rely in some instances on hierarchical conceptions, their listing will be delayed until after the next section of this chapter. It is worth noting, however, that many grouping concerns are greatly simplified when groups are limited to two or three durational elements. And it is useful in this context to reiterate and extend a series of thoughts introduced earlier in this study. Rhythmic patterns are heard, whenever possible, in the context of binary regularity (even groupings of beats). This is in keeping with a universal human association of musical pulse with binary movement, as in stepping back and forth from one foot to the other (marching, dancing). Thus the underlying beat of a rhythmic occurrence is generally perceived as even pulses in groups of two, a “metrical” backdrop. Even apparently undifferentiated, evenly-spaced pulses are perceived this way, with artificially imposed groupings of two (see Clarke 1999:485, in addition to earlier references). Groups of four, which seem quite natural and even common in various musics, are thus best understood both as subdivisions of a larger group of two and as the product of two consecutive lower-level groups of two, based on tendencies noted earlier. Groups of three, though, are heard as indivisible, and thus irregular, unless pattern repetition overrides the expectation of binary groupings (that is, in meters of three beats or compound meters; see Clarke 1999:483). In cases where such pattern repetition does not operate, if a larger group of two is explicit or implicit, irregular groupings at the next lower level will be heard as syncopated (for example, groupings of three eighth notes against a binary meter of quarter notes). However, this analysis is not helpful in developing the performance of a given rhythm, in which the musician must be prepared to negotiate between the actual rhythmic pattern and his or her natural binary tendencies in order to render the pattern accurately (as opposed to merely reacting to the pattern contextually after the fact, as listeners do). Therefore, a practical theory of rhythm must provide a way of analyzing and organizing patterns into easily manageable groups, to aid in such negotiation. These groups, then, are twos and threes, the most basic and generative prime numbers. All other longer groups at the various hierarchical levels of division may be broken down into composite sums of twos and threes, and are thus best seen as such composites. In the perceptual world of musical time as it flows out, attention is focused on all levels of hierarchical groupings, but the tendency to break longer groupings into smaller sub-groups is strong. Miller’s 1956 study (noted earlier) of how humans manage to remember sequences of elements makes this quite clear: subjects were most accurately able to reproduce sequences of unrepeated pitches of four or less. Miller also notes that the distinctive features of phonemes in human speech “are usually binary, or at most ternary, in nature. For example, a binary distinction is made between vowels and consonants, a binary decision is made between oral and nasal consonants, a ternary decision is made among front, middle, and back phonemes, etc.” (Miller 1956:88). Patel (2006:99–100) summarizes a number of previous studies by noting that “Grouping in music and speech shows many similarities,” but also emphasizes that the relationship between musical meter (regular groupings of pulses) and language has not been shown. This distinction is important, since it further supports the idea that, while humans do prefer to hear musical rhythms in the context of regular (normally binary) metrical groupings, we may also be attuned to hearing rhythms in irregular, non-metrical contexts.

The "emic" perspectives of various cultures with regard to such conceptualizations seem generally to support the foregoing analysis.[1] As a cautionary note, Agawu (2003:88–9) observes that counting out rhythmic groups of twos and threes accurately in real time in the Ghanaian languages of Ewe, Twi and Siwu using the words "one," "two," and "three" in those languages is not possible since the words in question are multi-syllabic; Agawu thus warns that conceiving of African rhythms in atomized groups of twos and threes does not make sense conceptually in the context of teaching or learning African music in the normally verbal manner. However, Locke, who studied Ewe drumming extensively in indigenous contexts, makes clear throughout his explication of *Drum Gahu* (1998) that strings of monosyllables such as "ko-ko-ko-ko-ko," "pa-ti-pa-ti-pa-ti-pa-pa," and "ki-di-gi-gi," rather than the indigenous words for "one-two-three," are used to vocalize various percussion parts during the learning process. Furthermore, it is clear that Indian *tāḷas* and Arabic *īqā'āt* are composed of syllabified patterns of beats that are either in or can be reduced to groups of two and three. The basic Carnatic (South Indian) *jāti* groupings are four (ta-ka-di-mi), three (ta-ki-ta), seven (3+4, ta-ki-ta ta-ka-di-mi), five (2+3, ta-ka ta-ki-ta), and nine (4+2+3, ta-ka-di-mi ta-ka ta-ki-ta) (Viswanathan and Allen 2004:35–6); Hindustani (North Indian) *tāḷas* use a conceptually similar system (Ruckert 2004:42–4). It is important to note in this context that in *tāḷas* that have groupings of four or larger, such as Dhamār (5+2+3+4) or Ādi (4+2+2), the larger groupings are important theoretically but are nevertheless probably perceived in actual practice as broken into the smaller "chunks" of two and/or three. In the case of Dhamār specifically, the *bols* of the basic *thekā* pattern seem to bear this out: the first group of five falls into 3+2 with "kat-dhe-te dhe-te," whereas the final group of four divides neatly into 2+2 with "te-te ta-(rest)." Likewise, Indonesian *gamelan* music, while traditionally conceived of in groups of 4 × 4 (with the last pulse of each group and subgroup being accented rather than the first), operates entirely on the basis of divisions that are twice as fast at each new level, suggesting that twos are the dominant rhythmic concern. Arabic *īqā'āt* (or *wazn*) have only two syllables ("dum" and "tak") that are based on the sounds of two main hand drum strokes, and which, with subdivisions, are used to articulate at least 100 different patterns (Touma 1996:48–54). Such systems are not based on numerical words. Thus, there need not necessarily be conceptual or cultural barriers to groupings of two or three; musicians might very well perceive such groupings mentally or intuitively, even if such groupings are not conveniently embedded in the counting structures of the native language, or even in the theoretical constructs of the musical traditions.

Moreover, there are a large number of well-documented world musics that embrace the concept of twos and threes outright: Wade mentions the Japanese *yatara byōshi* (2005:38), and Toussaint lists several *aksak* patterns from Eastern

[1] While some of the non-Western musical terms introduced here will be revisited contextually in subsequent sections, the reader is likely to benefit from separate exploration of the details of each using the sources supplied in the bibliography.

Europe, India, Africa, the Middle East, and North and South America (n.d.:12–13), for example. Even the character of Western European rhythms has largely centered on the interaction of twos and threes at both the metrical and "surface" levels. Prominent and interesting examples range from the alternating duple-triple meter of many Renaissance motets and dance suites to the significant "two-against-three" patterns in much of Brahms's music.

It seems reasonable, then, to affirm that a number of useful commonalities in human rhythmic expression may be traced back to conceptual groupings of two and three. What distinguishes various musical cultures and individual musical expressions is precisely how these elemental groupings interact, and at what levels.

Hierarchies

Grosvenor Cooper and Leonard Meyer are to be commended for very usefully suggesting that musical rhythm is best viewed as a series of relationships at various hierarchical levels, which they term "architectonic levels" (1960:2). This concept is further embraced by Lerdahl and Jackendoff and Rahn, and plays a large role in the theory proposed herein.

At its simplest, a given hierarchical level in rhythm is limited to groupings at a fixed durational level (for example, sixteenth notes or eighth notes). Of these fixed levels, the most fundamental is that of the basic pulse or beat of the music. In notated music, this pulse level is often clearly indicated by the metrical structure and/or time signature, and in all musics it is perceptually determined by tempo. Change of tempo is not usually relevant to hierarchical level determinations in preceding or subsequent sections, since listeners appear able to tolerate a degree of tempo fluctuation without losing the ability to hear underlying rhythmic relationships (Epstein 1985; Clarke 1999:489–91). However, the initial tempo of any given section may very well affect beat/meter perception. For the purposes of the proposed theory, there are actually two pulse-level hierarchies that could be present, one that reflects pulse/beat groupings indicated by notated or implied meters, and one that reflects groupings of the same durations that are different from meter.

It is perhaps useful in this context to mention that a wide range of ideas about "meter" have been suggested elsewhere in relation to various musics. In a way, much confusion can be avoided simply by noting that meter (when it occurs) is a particular type of grouping, one applied to regular pulses (when they occur). Kolinski comes close to this in asserting that meter is "organized pulsation functioning as a frame-work for rhythmic design" (1973:499). Azadehfar (2006:15–31) and Clayton (2000:28–42) both summarize the available literature on the relationship between beat, meter, and accent quite well. What essentially emerges is an ongoing discussion about whether accent is required to delineate meter, and if so what constitutes an "accent." Kramer (1988:86), for example, asserts that there are stress accents, metric accents, and rhythmic accents, implying that not all accents delineate meter, not least artificial "stress" or "dynamic" accents that are added to confound the established meter. Clayton also discusses confusion between grouping and meter (2000:29–30). Again, such problems can be absorbed into a larger discussion of grouping in which meter is only one stream of groupings interacting with others.

For the purposes of clarity, the two basic hierarchical levels may be labeled as the "indicated metrical level" and the "pulse level." Even though these levels are fundamental to most music, they are not essential. This is demonstrated, for example, by Indian improvisatory ālāp/ālāpana sections and the effectively non-pulsed nature of some *shakuhachi* literature and other Japanese musics. Clayton spends a great deal of time discussing this issue in relation to Indian music, suggesting that "non-pulsed" Indian music may not in fact exist (2000:95–103, and following). But Touma (1996:47) and Wade (2005:39–40, 54–5) assume that non-isochronous durational organization does operate in Arabic and Japanese music respectively. This author also has observed such to be the case in live performances of the Young San Ceremony by Korean Buddhist monks. Later in this study an attempt will be made to apply the proposed theory to the more "pulse-flexible" music of *shakuhachi honkyoku*, where duration is organized more by breath length.

In any case, there almost always exists at least one "surface level" (and usually more than one), which corresponds to the "rhythm" that unfolds against any beat/meter as suggested above. These surface levels may also sometimes be referred to as "gestural," since it is at these levels that rhythmic motives often appear most perceivably (that is, on the "surface" of the music). If for example the pulse and/or metrical levels are articulated by quarter notes, there may very well be surface levels of eighth notes, sixteenth notes, or even faster durations. It is clear, then, that any surface levels operate at faster durations than the pulse/metrical levels. In identifying these surface levels, the fastest prevailing duration should be considered the lowest level. But what constitutes the "fastest prevailing duration" is obviously open to interpretation, and may change in context within a selection. In any case, the first surface level, if needed, consists of durations one-half those of the pulse/metrical levels, the second surface level consists of durations one-half those of the first surface level, and so on, down to the "lowest" (fastest) structural level.

At the other end of the hierarchy is what will here be called the "phrase" level, though it may not necessarily correspond to "phrases" in the traditional Western sense. Rather, this level is the highest organizational level relevant to the music being analyzed. As such, the phrase level normally consists of "hyper-groupings" of smaller groups at lower levels. In that sense, the phrase level often shows groups of gestures rather than simple durations. Here Cooper and Meyer go much further and suggest that the highest "architectonic level" should consist of one very large (slow) gesture that defines the rhythmic shape of an entire piece (see 1960:203, for example). However, Clarke (1999:476–8) argues that the apprehension of such larger structures ("form" as opposed to "rhythm") seems to proceed in a fashion rather different from the "perceptual present," making it apparently unlikely that real-time durational comparisons can be made between such disparate time frames. Though the possibility of even higher-level hearing should not be eliminated, analytical emphasis is best placed on more perceivable relationships between durational levels that are closer together as the music unfolds over time. It is also important to note that in some analyses the “highest” (“phrase”) level may need to be broken out into two or more sub-levels in order to demonstrate the full extent of the structural content.

Principles of Group and Hierarchy Identification and Analysis

For the purposes of the rhythmic theory proposed in this study, the following are basic principles suggested for identifying groups. Many of these are borrowed from the immediately above-named sources, others are extensions of the same, and still others are based on ideas outlined earlier. Though an absolute hierarchy of these principles probably cannot be successfully formulated, the following is an attempt to present them in an order from most fundamental to most overarching:

1. Groups must be contiguous. That is, a group cannot be formed from elements that are separated by other non-group elements.
2. Sometimes rests are to be analyzed as part of rhythmic groups and other times they are to be viewed as group separators. Such interpretation must be entirely contextual. This is true with regard to the function of a rest on each hierarchical level; the same rest may be part of a group at one level and not part at another. However, perception of metric structure also shapes rest interpretation, so the rests in identical patterns might be interpreted differently in the context of different meters.
3. Groups must consist of either two or three elements.

A Since duration requires a minimum of two events, apparently isolated aural singularities (“groups of one”) are not useful in explicating rhythmic relationships and are thus to be viewed as part of a group including elements immediately previous to or following. This is especially clear when the singularity is *preceded* by a duration of equal or greater value; it may be more ambiguous if the singularity is *followed* by a duration of equal or greater value. While the preference is normally to attach the singularity to the previous group (because musical anticipation normally flows from musical memory; see Longuet-Higgins and Lee 1982, for example), context may dictate other interpretations, especially if (1) repeated rhythmic motivic patterns are clearly and proximally delineated; and/or (2) the passage is clearly compound (subdivided into regular recurring sub-groupings of three at the metric level). Incidentally, this would seem to hold true even for “end-oriented” musical cultures such as the Javanese, who place more emphasis on the last event of a group than the first; this conceptually accented note thus attaches to the previous events in terms of its grouping (and in any case is not normally aurally isolated anyway).

B Apparent groups larger than two or three must be subdivided according to these group-identification principles. However, clearly undifferentiated groups (that is, containing no internal characteristics by which subdivisions can be made) are ambiguous, and may be interpreted contextually (for example, a group of five undifferentiated durations may be seen as 2+3 or 3+2 based on other factors in the analysis).

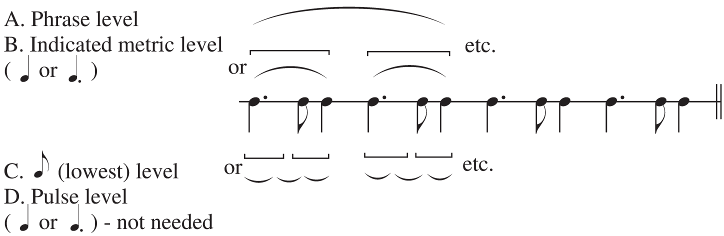
4. Groups are normally formed from the same durational units within a single hierarchical level. However, it is possible and even desirable on occasion to identify group constructions on a "hybrid level," that is, where some of the durations belong to one level and some to another. Usually, these mixed elements are on immediately adjacent levels, but may also be "between" levels, such as when a triplet occurs in the context of eighth notes. In such cases, the groupings involving mixed durations must be identified interpretively within the context of the entire analysis.
5. Noticeable changes in various non-rhythmic elements, including pitch register, dynamics, articulation patterns, note lengths, and timbre, may be useful and even essential in determining group boundaries (Lerdahl and Jackendoff 1983:45–7).
6. The proximity of durations may be a useful guide: all other factors being equal, the further apart in time two events are, the less likely they are to be perceived as being grouped together (even though they are adjacent).
7. Periodicity and motivic development should be carefully considered, but are not necessarily the final arbiters of group identification.
8. An important goal is to seek or demonstrate coherence by identifying prevailing patterns and their permutations that operate at one or more levels (see next section); this goal may legitimately influence group identification.
9. Groups may overlap or elide, but only if identifying them as so illuminates important relationships.

It is this last principle especially that hints at the overriding concern of grouping strategy: to show useful relationships among groups of two and three at various hierarchical levels as a way of illuminating the rhythmic nature of the music. It is in the interaction of these groups that rhythmic vitality exists, an idea that will be explored more fully as this chapter proceeds.

In the meantime, the five examples of group identification that follow may be useful in illuminating some of the issues raised by these principles. Here graphical analytical symbols useful in demonstrating the theory are introduced: slurs for groups of two and brackets for groups of three at each level.

Since meter (if present) is an important hierarchical level, it is useful to consider it while also remaining open to non-metrical groupings. In the example below, the meter is not indicated. But the most identifiable characteristic is the periodicity of dotted quarter-eighth-quarter. It may be said that the fastest value triggers a kind of "subdivision clock," which in this case would be eighth notes. Each periodic unit has six of these sub-divided pulses, which further suggests a meter that is simple

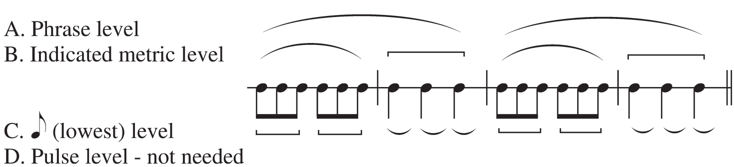
Ex.2.1 Ambiguous periodicity



triple (three periodic groups of two) or compound duple (two periodic groups of three). The idea that shorter isolated single events tend to be heard as belonging to the previous larger group (see principle 3A above) reinforces a simple triple interpretation. However, the idea of proximity may reinforce a compound duple interpretation, since the longest durational "break" in event onset occurs between the dotted quarter and the eighth note (putting the eighth note and quarter note closer together as events), and because, if heard that way, the pattern establishes itself through repetition. Pitch, dynamics, articulations, timbre, and motivic considerations might push the determination one direction or the other, but these are absent. The lesson from this example, then, is not that there is necessarily one grouping approach that is superior to another. Rather, it is that the rhythmic interest of this example is produced precisely because of the interactive tension between groups of two and groups of three.

A similar, though slightly less ambiguous, dynamic can be seen in the traditional *sesquiáltera* rhythm common throughout Latin America:

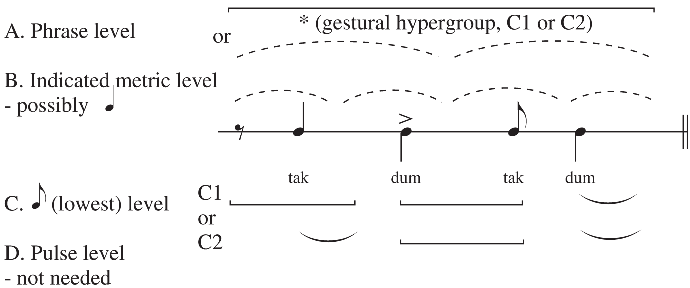
Ex.2.2 Latin American *sesquiáltera*



Here the alternation of metrical groupings provides clearer delineation at the B level, though in dynamic interaction with the C level, while also being "resolved" into evenness at the A level.

In the next example, the Arabic *wazn yamānī* pattern (as presented in Touma 1996:108 and Azadehfar 2006: 32–3), the question of what role a rest should play becomes critical. In discussing this particular issue, Azadehfar notes that Kramer's (1988) claim that the "downbeat" of a pattern is always a stressed (strong) pulse thus comes into question with this example, because the musicians who would perform this music in cultural context do not think in such terms. Including the rest gives the pattern eight eighth notes, while excluding it yields only seven. The theory proposed here suggests that either analysis would be reasonable in this particular scenario, as shown below:

Ex.2.3 Arabic *Wazn Yamānī*



Including the rest emphasizes the idea that only the last quarter note coincides with a metrical pulse, thus creating more "surface rhythmic tension." (If the metrical/pulse level is actually the eighth note, however, this level becomes meaningless.) On the other hand, one finds a tendency in retrospect to want to "feel" the accent of the rest as the pattern continues to repeat, reinforcing Kramer's claim; even Azadehfar acknowledges that the musicians shake their bodies on this rest and then clap the remainder of the pattern. The element of timbre is an additional important factor in this grouping assessment: the "taks" are higher in pitch and considered weaker than the lower-pitched "dums." The accent on the first "dum" adds to its strength as the beginning of a group boundary. Again, the present theory allows for rhythmic vitality through ambiguity. However, regardless of whether the rest is included, at the phrase level there seems to be a strong indication that showing a group of three "gestures" (3+3+2 or 2+3+2) is more in keeping with the actual sound of the pattern than showing two groups of two "imaginary" beats.

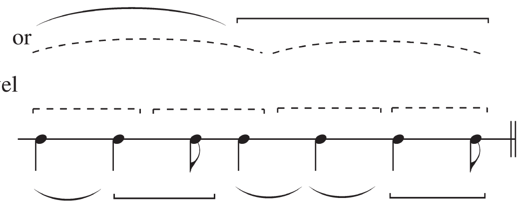
The following common "timeline" pattern from West Africa (as presented in Agawu 2003:74–5 and Nketia 1974:135) further illustrates the tensions between metrical considerations and group identification. Agawu insists that this pattern is to be interpreted rhythmically within the context of a steady beat—compound quadruple meter, four beats of dotted quarter notes—on the basis that the pattern is for accompanying dancing. Such an analysis certainly demonstrates a great deal of dynamism (tension, or dissonance) between the metrical pulse and the surface rhythms, since rhythmic articulations would occur only on the first and last "beats." However, additional illumination arises from showing mixed groups of two and three at the lowest level, especially with regard to how these then form larger groups at the phrase level: the pattern of 2+3 that begins and ends the surface grouping is reflected at the higher level. The surface-level grouping uses principle 3A above to assign each isolated eighth note to the previous group; principle 6 (proximity) does not apply in this case, since the eighth note is equidistant from the

Ex.2.4 Ewe “timeline”

A. Phrase level

B. Indicated metric level
- possibly ♩.

C. ♪ (lowest) level
D. Pulse level
- not needed



quarter notes on either side. Once again, the point is not to argue for one overriding interpretation, but rather to provide a way of understanding and demonstrating the rhythmic vitality within this music— vitality that flows from both conjunction and disjunction of groups of two and three at various levels.

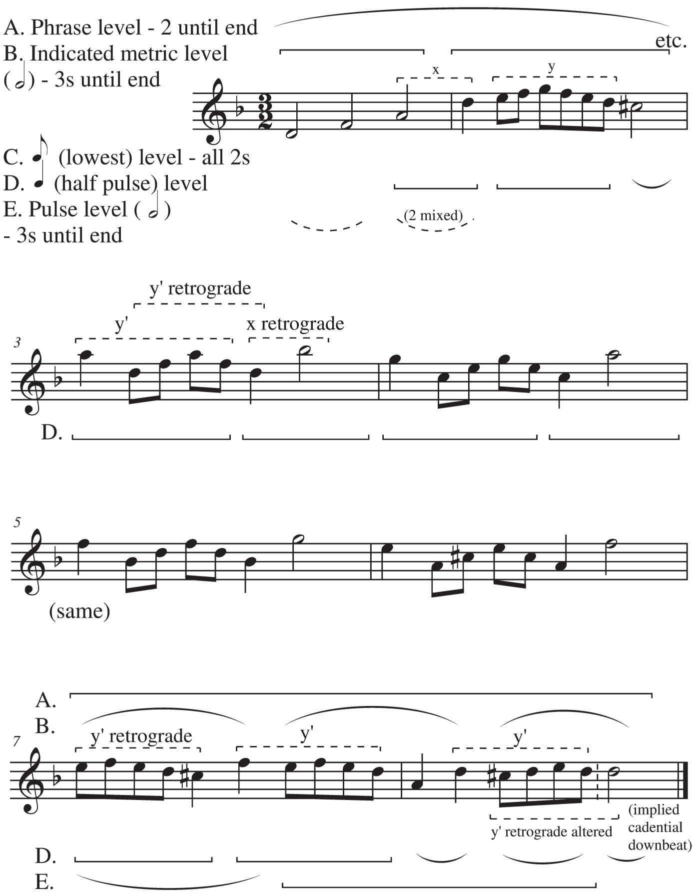
The last example in this section includes pitch and illustrates concomitant issues surrounding motivic and cadential considerations in grouping. Here a number of concepts from Western European theory are referenced in passing, as is appropriate to this particular piece; more globally-oriented examinations of similar issues will be made starting in Chapter 3.

This melody, made famous in the twentieth century by Benjamin Britten in his *Young Person’s Guide to the Orchestra*, is on the one hand rather rhythmically simple, with a straightforward triple meter and evenly divided beats. However, an examination of the analysis below shows groups of twos and threes interacting in a significant manner, especially at the beginning and end of the excerpt. Because motivic development plays such a large role in determining the musical surface and its groupings, rhythmic motives have been labeled. Several comments are in order. The very beginning is fraught with ambiguity, with the rising triad delineating two groups of two notes each, the last two being reinforced by the dominant-tonic pitch relation.[2] Though the last note in the opening figure is but a quarter note, it is only heard as belonging to the next bar (the larger metrical group of three) retrospectively, and in fact functions simultaneously both in a group of two and a group of three at the same lower level. The eighth notes that follow represent a significant temporal and textural change (conjunct pitch motion after the disjunct opening figure), suggesting yet another new group. This last becomes a motive “y” that is developed throughout, and thus influences subsequent grouping decisions, as does the “x” motive of half note and quarter note. These contribute to the four bars in the middle being somewhat more stable rhythmically than material at the beginning and end of the example, since the metrical level groupings of three correspond to the motivic groupings at the half-pulse level. Though the reversed “x” motive as it appears in bars 4–6 does have a large internal leap, this potentially

---

2 This extremely important pitch relationship will, incidentally, be recast in a more global light in Chapter 3.

Ex.2.5 Henry Purcell (1659–1695), Rondeau from *Abdelazar*, bars 1–8



boundary-producing feature is overridden by the drastic slowing from eighth notes through the quarter note and into the half note. A similar argument can be made about the implied harmonic change right in the middle of the reversed "x" motive here; in the end it is precisely such "conflicts" of rhythmic grouping and melodic/harmonic "rhythm" that contribute to a forward-moving effect. The last two bars (plus one beat) prove remarkably complex. The traditional Western term "hemiola" (discussed below) applies to the groupings of two against the meter of three, but the motivic grouping considerations established earlier add another layer of interest, as does the ambiguity of the final cadence on a "weak" beat.

Interactions

Hopefully, it is clear from the previous section that the interaction of groups and levels is the key to understanding rhythm in the context of the present theory. The process of group and level identification itself flows back and forth within a search for meaningful relationships: an interpretation of the "web" referred to earlier. As such, a discussion of some of the most important principles involved in that process is now in order, preceded by a few additional preliminaries.

As noted earlier, a main goal is to show rhythmic character as elegantly as possible. One element of this is the reduction of clutter, both visually and conceptually, giving rise to the following additional principles:

1. A hierarchical level is not interesting (and not worthy of continuous indication) when it consists of several repetitions of the same grouping. Thus, not all levels need be shown at all times in an analysis.
2. As a parallel to principle 4 above, it is sometimes necessary to allow unequal groups at one level to be interpreted as "balanced" at a higher level. This is especially true in very complex musics that have many unequal durational values mixed together. For example, at one level a group of two eighth notes might be followed by a group of three eighth notes, but at the next higher level this pair of groups is most likely to be indicated as a larger group of two, even though each does not add up to a single quarter note. Rahn (1983:68–71) calls this concept "bisection," noting that without such allowances many obvious musical grouping hierarchies would be impossible to describe. This principle is perhaps reflected most clearly in the "hyper-grouping" that tends to occurs at the phrase level, but it also operates as needed at lower levels.

It is at this point appropriate to review and reinterpret some rhythmic terminology in light of the proposed theory; a few of these have already been alluded to above, but now deserve more direct treatment. For example, "syncopation" in this theory results from dissonance[3] between surface levels and adjacent metrical or pulse levels. The analytical method of the theory shows graphically how and where potential syncopation occurs. On a higher temporal plane, structural rhythmic dissonance occurs when grouping patterns at the lowest levels do not match those at higher levels.

---

[3] As suggested in Chapter 1, the intention in borrowing the terms "consonance" and "dissonance" from harmonic analytical vocabulary is to conceive of "dissonance" along the lines of "more dynamic interaction" and "consonance" along the lines of "more stable interaction." Thus neither term is meant intrinsically positively or negatively, but rather as together constituting tension and release of the kind that is foundational to music. Furthermore, it is hoped that having parallel terminology between rhythm and harmony might contribute coherence to the broader global music theory.

Oppositely, rhythmic consonance occurs when these level interactions coincide. Other terms commonly used to describe these phenomena in specific instances include:

1. "Hemiola"—"The opposition of three groups of two played against two groups of three" (Cooper and Meyer 1960:4). Though it could be noted that such "opposed" groupings are sometimes alternating rather than simultaneous, the point here lies in the focus on interactive twos and threes creating dissonance.
2. "Polyrhythm" and "polymeter"—Though these two terms are often confused with one another, the most useful definitions are suggested by the composer and theorist Thomas Benjamin (1998:174): polyrhythm occurs when simultaneous rhythmic figures have different divisions of the pulse (such as a quintuplet opposite a septuplet), whereas polymeter occurs when simultaneous rhythmic figures have the same division of the pulse but different start and end points in their periodicities (that is, what would be the bar lines in each do not line up). Thus each is dissonant in a different way, but the basis for each still resides in how durations are grouped.[4]

In an effort to simplify, a consolidation of all these concepts into the more inclusive terms "surface rhythmic dissonance/consonance" and "structural rhythmic dissonance/consonance" might prove fruitful. Like harmonic consonance and dissonance, these phenomena are relative to the specific situations in which they occur; there is no absolute "rhythmic dissonance," for example. And, as suggested earlier, there is a vast array of terms used to describe various types of meter. Rhythmic consonance and dissonance may (or may not) involve interactions with or within a metrical level (if it is present). As a result, the use of the proposed terms might also eliminate many confusing nomenclatures and shift the balance toward a broader concept of meter (and away from a specifically Western one).[5]

Some musics have a high degree of surface rhythmic dissonance (syncopation) while maintaining a high degree of structural rhythmic consonance. An example of this is ragtime, a hybrid African-American music from around the turn of the twentieth century (Ex.2.6).

The absolute regularity of the phrase level, the metrical level, and the left-hand eighth-note level serves as a backdrop for the highly dissonant right hand. The same characteristics apply to many other genres of twentieth-century popular music, perhaps because of the rootedness of such musics in dance—a steady beat is necessary, but surface rhythmic dissonance adds welcome interest. (Such an observation comports with Agawu's assertion (2003:74) that African rhythm always has an underlying steady dance beat, since it is clear that most contemporary

---

4 Incidentally, both Agawu (2003:71–96) and Nzewi (1997:32–41) insist that these terms, often employed (and perhaps even "invented") to describe African music, are meaningless at best and destructive at worst with regard to African music.

5 A notion endorsed by Clayton (2000:41–2), for example.

Ex.2.6 Scott Joplin (1867–1917), *Pine Apple Rag*, bars 5–12

popular musics are heavily African-influenced.) It is interesting to note here that the surface dissonance ceases at the ends of the sub-phrases (bars 4 and 8 of the excerpt), perhaps providing key strategic confirmations of sure-footedness.

Prevalent Patterns and Permutations

These preliminaries established, two specific concepts that arise from the interpretation of group relationships at various levels may now be considered. The first of these is the idea that a musical selection might display one or more "prevalent patterns" of grouping that are manifested structurally in important ways. Analogies from Schenkarian or set theory analysis may be useful in this regard: for the former it is the Urlinie, or basic linear scalar progression of a tonal piece, and for the latter it is the most prevalent set(s) of intervallic relationships. These may be likened to rhythmic grouping patterns that seem particularly prevalent in a musical selection. Like the flexibility of pitch sets (but unlike the Urlinie), such patterns can consist of any combination of twos and/or threes, although patterns that consist only of twos or only of threes do not reveal much about the rhythmic dynamic of the music in question.

As suggested earlier, a significant goal of analysis in this theory is to illuminate a rich web of relationships. Conceptually echoing Rahn (1983:50–51), it may be said that a combination of variety and coherence of rhythmic organization at various levels in a piece of music can be a significant contributor to effectiveness. However, such coherence need not center on structural rhythmic consonance; it may in fact be manifested as a kind of consistent arrangement of particular structural rhythmic dissonances. In such a case, one or more prevalent patterns might operate in consistent dissonant opposition to one another. At the same time, a piece that had nothing but groupings of two at all levels would be very coherent, but not very rhythmically interesting. Thus coherence is but one factor, albeit normally an important one, and it is certainly something that can be enhanced by the interaction of prevalent patterns.

A second concept that applies to but is not limited to prevalent patterns is that of permutation. Here again, ideas may be borrowed from serialism and set theory in saying that a given rhythmic pattern has several categories of related permutations which might be considered, three of which are most relevant. The rather globally ubiquitous pattern of 3+3+2 may serve as an example. Below are its relevant permutations, presented in order from most to least closely related:

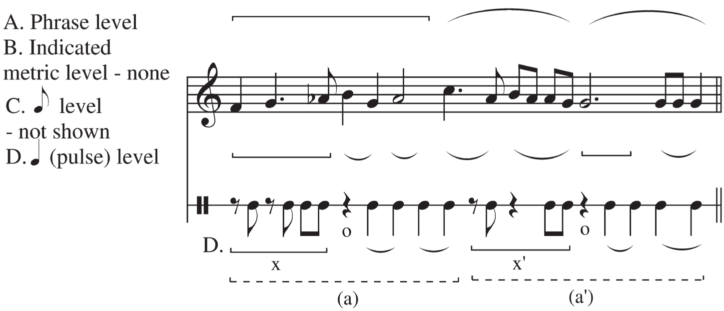
- Retrograde: 2+3+3
- Rhythmic inversion (that is, complete switching of the twos and threes): 2+2+3
- Retrograde inversion: 3+2+2

And, of course, the pattern and its permutations may appear at slower (higher) or faster (lower) hierarchical levels, producing what are commonly called "augmentation" and "diminution" respectively. There is only one retrograde, only one exact inversion and only one retrograde inversion of any given pattern, since patterns are limited to groups of twos and threes.

The order of strength in such relationships must be emphasized: the further down the above list one goes, the weaker the relationship to the original pattern. If sensitivity to this hierarchy is not shown, analyses produced may quickly deteriorate into meaningless comparisons of distantly related (or effectively unrelated) patterns. On the other hand, the three categories of relationships noted above are at least as likely to be perceived by listeners as the complex pitch relations in Schenkerian or set theory analysis are (and probably much more so).

Finally, the more closely related a permutation is to its original, the more rhythmic consonance is produced, and the less closely related it is, the more dissonance is produced. The most consonance, therefore, comes from exact replications of a pattern, while the most dissonance comes from the juxtaposition or superimposition of completely unrelated patterns. As noted above, coherence comes from the organized (and creative) management of groups and patterns in consonance and dissonance across various levels.

Ex.2.7 Excerpt from the *mkhūlfī* section of an Arabic *funūn al-baḥr* song



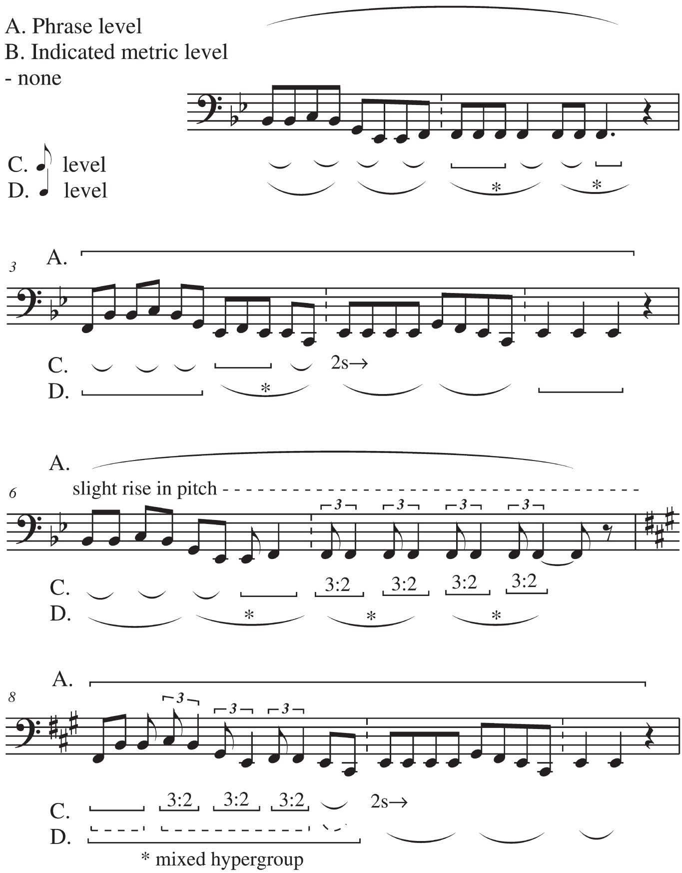
Two brief examples may serve to illustrate some of these concepts. The graphical arrangement of the first, part of the *mkhūlfī* section of an Arabic *funūn al-baḥr* song (adapted from material as presented by Touma 1996:95), is altered slightly to show the same hierarchical level in two different parts, with some relevant motivic ideas labeled. (For the sake of clarity, some levels are not indicated at all.) In this analysis some of the rests in the accompanying percussion part (a reduction of three instruments) are included and others not, for reasons of motivic construction: the two quarter rests marked with an "o" are group separators, while the eighth rests and one quarter rest are part of motivic structures reinforced by periodicity. Additional support for such decisions comes from the discovery of a prevalent pattern of 3+2+2 at two levels. Note that this pattern unfolds differently in the melody than in the percussion, which introduces some structural dissonance into the rhythmic arrangement; this dissonance is resolved to some degree at the end of the sequence, where both parts have a simultaneous group of two at the same level. Furthermore, the retrograde permutation of the prevalent pattern (2+2+3) forms part of the melody starting with the dotted quarter note C. This example displays a high degree of rhythmic coherence via its prevalent pattern, while also including some creative rhythmic dissonance in the layout and development of the pattern between parts.

A second example, part of an Inuit solo song (Stock 1996:88), presents by contrast a rather complicated state of affairs.[6] Here there is no consistent prevalent pattern among levels, and considerable additional surface rhythmic dissonance occurs due to the triplet figure (indicated by the proportional 3:2 analysis; that is,

---

[6] From transcription by Jonathan Stock in *World Sound Matters*. Copyright © 1996 Schott Music Ltd, London. All Rights Reserved. Used by Permission of European American Music Distributors LLC, sole U.S. and Canadian agent for Schott Music Ltd, London.

Ex.2.8 Excerpt from an Inuit solo song



three notes in the same rhythmic "space" of two)[7]. The groupings marked with asterisks contain the most ambiguities or dissonances, though each for different reasons. One might be able to stretch the prevalent pattern idea as follows: each of the first three gestures (bars 1–2, 3–5, and 6–7, based on Stock's very reasonably deduced measuring scheme) begins at the C level with multiple groups of two followed by a group of three and then by additional multiple groups of two (or the triplets in the third gesture). This same pattern is loosely reflected twice at the D level (bars 1–4 and 6–10), but only if a very creative hyper-group of three is imagined in bar 8 and the group of three in bar 5 is ignored. Such an analysis may represent the outer boundaries at which coherence may be perceived. Still,

---

[7] Note that this rhythmic use of "3:2" should not be confused with the same symbol denoting a frequency ratio (pitch interval) of three to two, as will be discussed in Chapter 3.

both the various types of dissonance and the repeated 2+3 pattern at the A level (here directly reflective of phrases created by cadential rests) are revealed by the method, demonstrating why and how the selection contains a balance of dynamism and comparative stability. It should also be noted that these complexities seem to arise from the patterns of the sung text (omitted here), raising questions about the relationship of musical rhythm to language rhythm. Such a topic is beyond the scope of this study, but remains a relevant one among ethnomusicologists and theorists (see Patel 2006, for example).

Initial Summary

The proposed method of global rhythmic analysis, then, includes these elements, each of which informs the others:

1. Acknowledgement that groupings of twos and threes are the best way to delineate rhythmic content in a wide variety of human musics, regardless of the cultural origin of the music in question (though the interpretive meaning of such groupings may vary considerably from culture to culture).
2. Understanding that rhythmic group identification/formation is informed by various established principles and affected by other musical elements. Among these principles are contiguousness, proximity, similarity, coherence, periodicity, and the flexible role of silence.
3. Realization that time in music unfolds at various temporal levels, that meter (if present) is only one of these levels, and that arrangement of patterns of twos and threes within and between levels produces a web of relationships and interactions that defines the dynamic rhythmic character of the music. Such relationships include rhythmic consonance, dissonance, and coherence.

Four Analytical Examples

This section demonstrates application of the proposed rhythmic theory in somewhat more substantial contexts from four different cultures, though these examples are still preparatory to the more comprehensive analyses combining rhythm and pitch that will occur in later chapters. It must be emphasized at this point that, as is ultimately true for all music theory methods, the analyses offered here are interpretations rather than absolute empiricisms. That is, there are as many possible interpretations as there are interpreters, and it is hoped that the methods in this chapter and throughout this book might become useful to performers, composers, and theorists as a tool both for giving shape to what they perceive intuitively as musicians and for uncovering elements that might assist them in drawing additional musical value from the pieces with which they engage. No assertion is being made that the interpretations that follow are necessarily the best ones. Rather, these analyses are invitations to richer musical contemplation. Moreover, the main goal of this chapter is to provide evidence that the proposed theory could work within the realm of "qualified universals" noted earlier, rather than to provide any sort of exhaustive application.

Because no complete examples of extended length are represented here, potential implications of rhythmic hyper-groups beyond the "phrase" level are not thoroughly addressed at this stage. These highest levels, furthermore, need to be considered somewhat separately due to their temporal distance from surface rhythmic levels, and some attempt will be made in Chapters 5 and 6 to explore certain implications of such questions.[8] Finally, in an effort to reduce visual clutter, and because they tend to be ubiquitous, indication of hyper-groups with asterisks will be eliminated from this point forward.

Palestinian Mu'annā

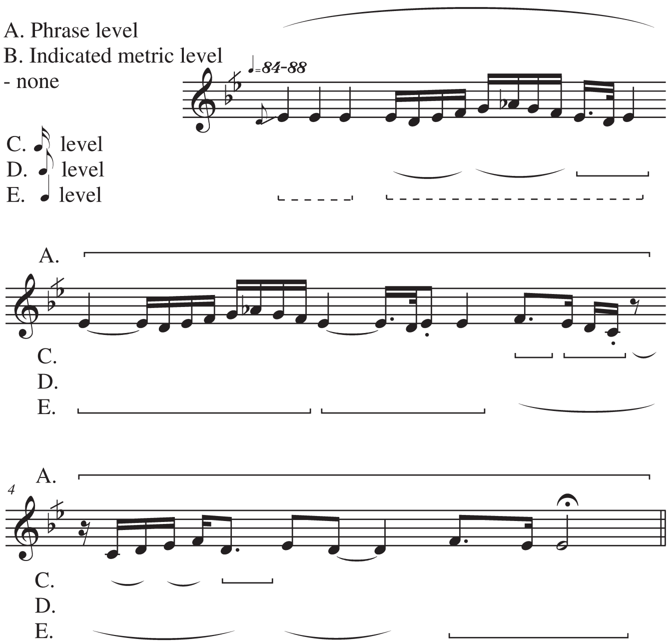
The first example in this section consists of excerpts from the first verse and refrain of a Palestinian *Mu'annā* (transcribed by the author from 'Abdel-Qāder n.d.). These two excerpts are interesting because of the mix of both less and more metered rhythm they display.

In order to render the transcriptions below more usable for the purposes of this study, a large number of ornamental elements were removed. The basic rhythmic shapes remain intact, however. Analysis is made at the phrase level as well as the quarter-note, eighth-note and sixteenth-note levels; any faster durations are ornamental. Once again, many groupings are omitted to avoid unnecessary clutter; patterns are shown only when they are distinct from those around them, and/or when the particular level in which they occur is the focus of gestural activity. It is useful in the context of this example to recall that changes of tempo (and thus pulse orientation) in clearly defined sections do not unduly affect perceptions of rhythmic groups at various levels. On the other hand, the level on which the listener focuses at any given time in this piece may very well change, as in, for example, the first two bars of Ex.2.9b and similar instances (here and throughout the whole piece) where both tempo and the prevailing divisions of beat change.

It is clear upon examination that the improvisatory nature of this piece renders both a transcription and an analysis of significant complexity. Here, more so than in some other pieces, the role of rests takes on a dual nature. The decisions concerning whether to include a rest in a particular group and at a particular level is in this analysis are driven largely by gestural and pattern considerations. In several cases, moreover, gestural groupings override particular pulse division levels, and this is acceptable precisely because there is no consistent pulse, meter, or tempo until the Refrain (last line of Ex.2.9b). There is plenty of dissonance both structurally and on the surface throughout, including one rare example of group overlap, which can be observed at the C level in the second line of Ex.2.9b; other examples of dissonance

[8] For an intriguing and refreshingly broad look into this topic, see Temperley 2001.

Ex.2.9a Palestinian *Mu'annā*, opening excerpt



include the C level against the E level in the second and third lines of Ex.2.9a and the C, D, and E levels in combination with the metric (B) level in the Refrain.

Yet there is a good deal of coherence here as well. The opening sequence (Ex.2.9a), which is separated from the rest of the piece by the longest of many pauses, offers an intriguing puzzle as to what the most prevalent pattern might be: both 3+3+2 and 2+2+3 are presented as clear candidates. The retrograde of 3+3+2 appears at the A level of both excerpts, though it should be noted that an extra A-level group of three (not shown here) follows to end the Refrain. Yet 2+2+3 (or its retrograde) also appears at the C, D, and E levels consistently.

The Refrain, which continues the patterns introduced at the beginning of Ex.2.9b, brings the most rhythmic stability to the piece. In particular, the E-level grouping in the Refrain, 3+2+2+3, in a way reflects the second of the prevalent patterns noted above in that it is an overlapping palindrome that begins with 3+2+2 and ends with 2+2+3. The other pattern (3+3+2) is simultaneously and more clearly present at the lower levels. It is also worth saying that 2+2+3 and 3+3+2 are inversions of each other, thus further establishing a reasonably close relationship. The analysis thus reveals possibilities for how and why a complex piece of music with much temporal dissonance somehow forms a satisfying rhythmic whole.[9]

---

[9] The pitch material from a portion of this same example is analyzed in Chapter 3.

Ex.2.9b Palestinian *Mu'annā*, excerpts from first verse and Refrain

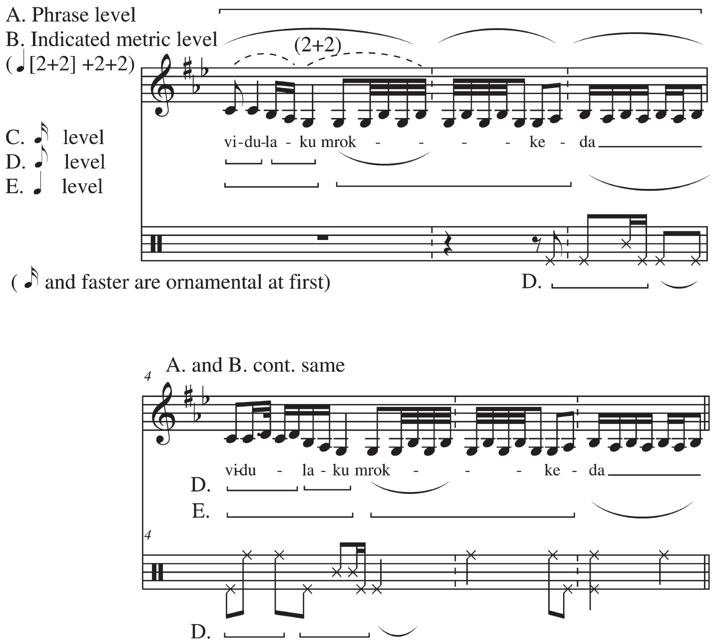
Carnatic Kriti

The next example, consisting of three excerpts from the *kriti Vidulaku Mrokkeda* by the Indian composer Tyagaraja (1767–1847) (transcribed from Tamil notation by the author with reference to Subbulakshmi 1970)[10], offers an opportunity to explore the interaction of two simultaneous parts, shows application of the theory to a non-Western metrical system (*tāḷa*), and includes a few other unusual elements. The text has been included because of its importance in the E-level grouping decisions.

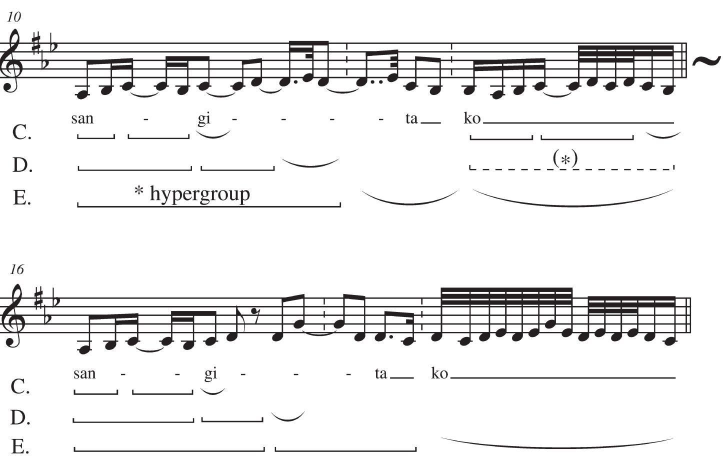
The *tāḷa* pattern here (Ādi) is 4+2+2, which according to the proposed grouping principles is reconceived as (2+2)+2+2, but as the piece begins the pulse level grouping of 3+3+2 is actually dissonant to the metrical *tāḷa*. This pattern also seems to be a prevalent pattern in these representative excerpts from the *pallavi* (opening) and *anupallavi* (second) sections of the work. The structural dissonance of the 3+3+2 pattern against the *tāḷa* provides the main rhythmic dynamic of the music, though there is also some surface dissonance built into the very first gesture in the vocal part: the first grouping of three at the E level could also be seen as a hyper-group of two based on the two groups of three at the D level

10 *Vidulaku Mrokkeda (kriti)*, as performed by M.S. Subbulakshmi. Copyright © 1970. Published by Saregama India, Ltd. All Rights Reserved. Used by Permission.

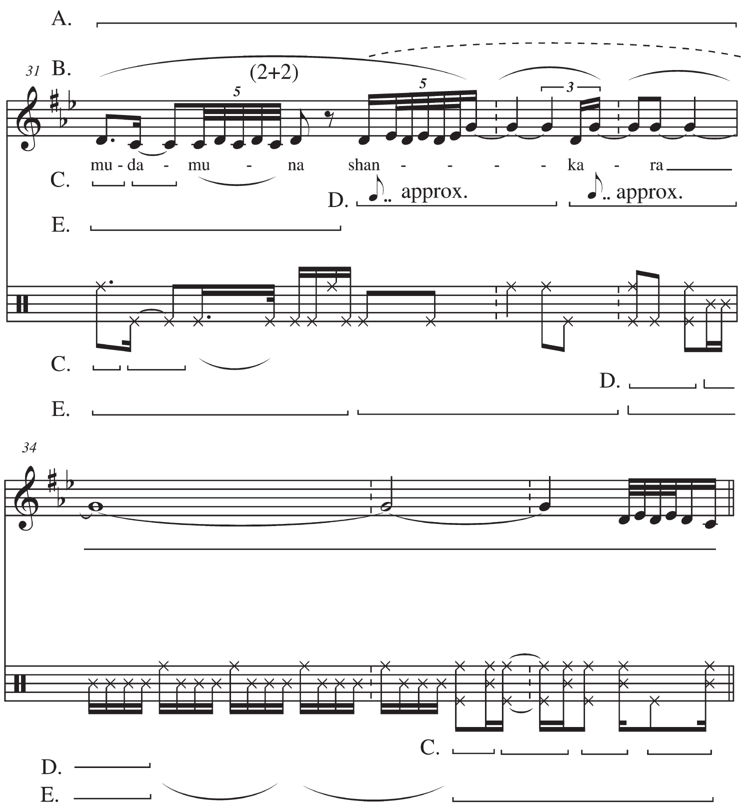
Ex.2.10a *Vidulaku Mrokkeda*, bars 1–6



Ex.2.10b *Vidulaku*, bars 10–12 and 16–18



simultaneously. The entrance of the *mrindaṅgam* (drum) reinforces this surface dissonance. Structurally, the *tāḷa* layout ensures that the phrase level will always be a group of three; one could insist that there are actually four groups of two, Ex.2.10c *Vidulaku*, bars 31–6



making each phrase one larger group of two, but showing the level as consistent groups of three reinforces the intent of the *tāḷa* as three sub-groups (4+2+2). In a different way, such an analysis also reflects the text/melody layout that is shown explicitly at the E level.

The text and music change in bar 10 (Ex.2.10b), but the 3+3+2 pattern remains prevalent. Bar ten is also a focal point in the piece because the C level there becomes rhythmically active rather than merely ornamental. A comparison of bars 10–11 with bars 16–17 yields interesting results. Ironically, though the C and D levels remain the same in these parallel passages, the surface details vary enough to produce a different grouping at the E level. The eighth rest in bar 17 plays a large part in this difference, since it provides a sonically clear sense of group division that is absent in bar 11, and overrides the tendency to hear the E-level hyper-group indicated in bar 10. This is true even though the duration of the rest is part of the grouping. The fact that the recorded singer emphasizes this break in the middle of a word syllable provides evidence that she realizes the rhythmic impact of the change. That the new grouping in bars 16–18 brings the E level into consonance with nearby figures in the C and D levels, by reinforcing the 3+3+2 prevalent pattern in the music, adds further weight to such an analysis. This is contrasted by the less hierarchically consonant 3+2+2 E-level pattern in bars 10–12.

Bars 31–6 (Ex.2.10c) represent the beginning of the *anupallavi*, in which the prevalent pattern of the *pallavi* (3+3+2) reasserts itself strongly at the C level in both the voice and *mrindaṅgam* parts, but is quickly drowned out in a sea of very complex dissonance. The melodic leap of a "perfect fourth" down and back in bar 32 proves to be a strong sonic group separator, leaving the analyst struggling with how to measure durations. The two groups of three at the D level are essentially a sextuplet against five quarter-note beats, and are shown here in a way that emphasizes the groupings of three at other levels. Over the held vocal note, the *mrindaṅgam* continues to fall into threes, a characteristic reinforced by the C-level *mrindaṅgam* groups at the end of the excerpt. This hierarchical "speeding up" has a profound effect on the rhythmic dynamism as the section proceeds, and must be understood in the context of the ever-present, evenly grouped *tāḷa* itself. Here, as elsewhere in the analysis, the *mrindaṅgam* groupings are based on pitch/timbral contours that are approximated in the transcribed notation.[11]

West African Drum Gahu

Considerable attention is devoted next to the traditional Ghanaian *Drum Gahu* since it serves as a substantial and multi-faceted musical example that is almost exclusively rhythmic in nature. David Locke's (1998) keen insight into the multi-layered nature of this traditional Ewe dance music invites analysis as a series of stages involving the examination of several of the most well defined percussive "voices," both as separate entities and in various combinations.[12]

Drum Gahu: The Time

This analysis commences with the three foundational elements that Locke refers to collectively as "The Time": the *gankogui* (double bell) part, the *axatse* (rattle/shaker) part, and the *kaganu* (smallest drum) part. Together, these three streams provide both the most stable material upon which the music is based and the backdrop against which it unfolds.

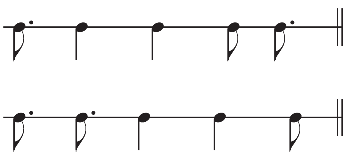
Locke (1998:17–19) rightly insists that the *gankogui* "timeline" be viewed from at least two perspectives in terms of where its pattern begins and ends, both orientations being derived from the *gankogui* linear position in relation to other *Gahu* "voices." Here, and throughout the *Gahu* examples, each pattern is to be understood as an ongoing periodicity:

---

[11] Portions of the pitch material from this same example are analyzed in Chapter 3.

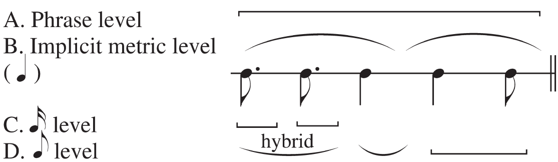
[12] The transcriptions and references in this section are used with the kind personal permission of Professor Locke, whose direct experience of *Drum Gahu* in the field offers enormous benefit.

Ex.2.11a *Gankogui* pattern, two perspectives on beginning and ending points



These two abstract states present different groupings at the fastest level (sixteenth note), the first as 3+(2+2)+(2+2)+2+3 and the second as 3+3+(2+2)+(2+2)+2. The latter of these is much easier to understand against the steady pulsation of quarter notes that defines the dance this music accompanies, though Locke cautions against the assigning of the stresses based on Western 4/4 meter (1998:19). The second *gankogui* arrangement therefore warrants further examination with regard to inherent hierarchical levels:

Ex.2.11b *Gankogui* analysis

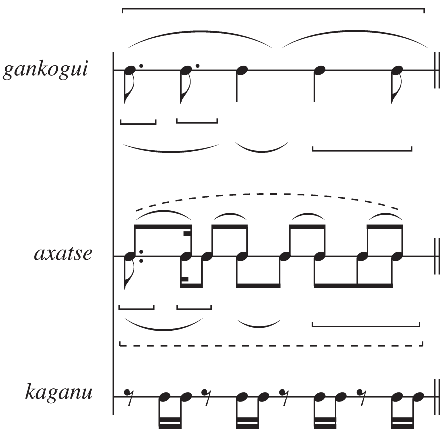


The dissonant interactions of twos and threes are rich in several aspects, especially because of the ambiguous hybridization between the C and D levels. The phrase-level choice of a three reflects level D (2+3+2), and all the groupings are in dissonance with the implicit evenness of the duple dance stepping (level B). Such complexities distinguish the *gankogui* part from the other two in the "time" group (*axatse* and the *kaganu*), both of which are most readily perceived in steady groupings of twos (see Locke 1998:36). Against such symmetry, the asymmetry of the *gankogui* part produces the primary rhythmic interest.

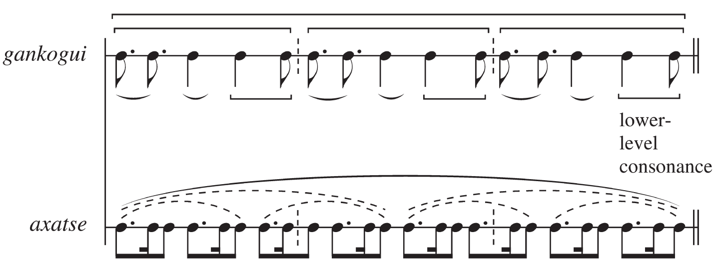
At the same time, having established such an interpretation, it is also appropriate to demonstrate a dual dynamic between the *axatse* and the *gankogui* parts in combination. While the *axatse* part is most likely to be heard as all twos and thus dissonant with the *gankogui*, Locke (1998:267–) points out that, like the *gankogui*, the *axatse* may be heard two different ways, each of which suggests a different relationship between the parts. These, along with the unambiguous *kaganu* part, are shown below.

Thus, for the listener, the simultaneous *gankogui* and *axatse* patterns may move in and out of alignment with each other and with the underlying metric dance pulse, producing a paradoxical tension between rhythmic consonance and dissonance within the exact same arrangement of durations. While the *kaganu* pattern simply repeats groups of two separated by rests, its most important function may be to draw listeners' attention to the sixteenth-note level, highlighting the groupings that occur there in the other parts.

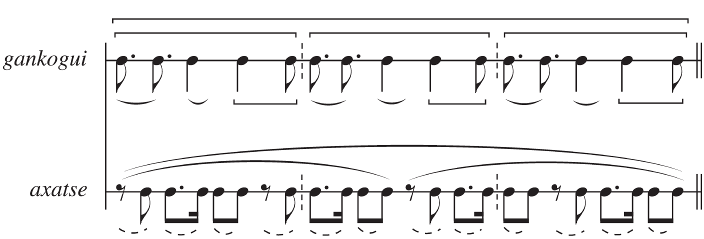
Ex.2.11c *Gankogui* and *axatse* relationship, with *kaganu*



Ex.2.11d Analysis of *axatse* variation one



Ex.2.11e Analysis of *axatse* variation two



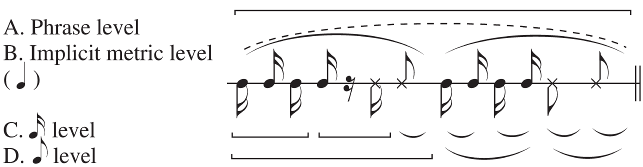
Finally, Locke also notes that the basic *axatse* part often gives way to more sophisticated improvisation (1998:289–). By way of example, two of the possibilities he notes offer interesting perspectives in the context of the basic analysis given above. In the first variation (Ex.2.11d), the high level of dissonance between the parts is mitigated somewhat by a lower-level moment of consonance at the end of the sequence. In the second variation, all consonance is absent.

Even the basic "time" of the *Drum Gahu*, then, offers several sophisticated rhythmic characteristics that are revealed by the method proposed here.

Drum Gahu: The Response

Among the additional basic patterns present in the *Gahu* ensemble texture, it is that of the *kidi* (medium-sized drum) that offers the most interest. In the notation below (based on Lock 1998:44) drum strokes with alternating hands are shown with a change of stem direction, regular bouncing strokes are shown with regular note heads and the special muted (pressed) strokes are shown with x-shaped note heads:

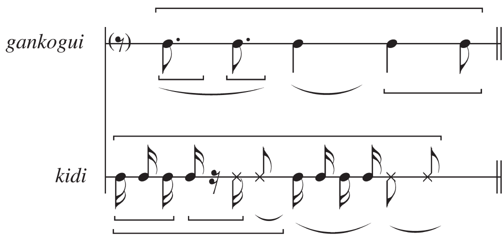
Ex.2.11f *Kidi* analysis



Indeed, because of the changes of stroke and timbre, one is tempted to group the D level as either 2+3+3+2+2+2+2 or 3+2+3+2+2+2+2, or even 2+2 (skip the rest) +3+2+2+2+2, and none of these should be dismissed out of hand. However, grouping principle 3A suggests a preference for attaching the "isolated" first muted stroke to the previous group, which then brings the rest fully into play as a group member. Furthermore, as seen earlier, rests seem to play a consistent rhythmic role rather than act as mere group separators in the context of the whole *Drum Gahu* ensemble. Agawu (2003:77) notes that "silences are an important part of groups in African music … not an absence of sound but an intentional placement of silence as a substitute for sound." In any case, the uneven D-level pattern of the first half becomes clearer aurally upon repetition in comparison to the even configuration of the second half, due to its more dissonant ("syncopated") feeling against the implied metric pulse.

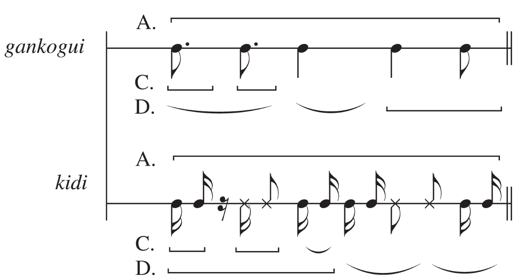
Though this pattern can be heard as having the same lowest-level (sixteenth-note) grouping configuration as that of the *gankogui*, it typically does not appear in that same alignment in the full ensemble context. Rather, the beginning of the *gankogui* pattern is offset by the time of one eighth note, producing a considerable amount of dissonance:

Ex.2.11g *Kidi* and *gankogui* relationship, first analysis (based on Locke 1998:47)



This contextually overlapping placement of the *kidi* part actually suggests a second configuration for it that, surprisingly, consists of the same groupings, but produces rather different interactions with the *gankogui* pattern, including two C-level threes that line up in both parts at the beginning, consonance at the phrase level, and a more perceivable retrograde relationship between the two at the D level. Moreover, the timbral distinctions seem to make just as much sense as before. Locke never mentions this perspective specifically, but implies it in suggesting that the *kidi* phrase can be heard in several configurations against any of the other parts of "the time" and thus contributes significantly to a "positive ambiguity of phrasing" (1998:45–6).

Ex.2.11h *Kidi* and *gankogui* relationship, second analysis

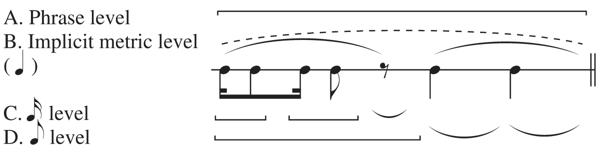


Drum Gahu: The Lead (Call)

"The Call" here refers to "call and response," since the lead drummer on the *boba* (largest drum) not only plays an ever-changing mixture of phrases over the top of "the time" and "the response," but also signals changes of sections, changes of dance moves, and other structural elements of the *Drum Gahu*. For the sake of manageability, two of the five basic phrases used by lead drummers (adapted from Locke 1998:76–106) are explored here. Having discussed the idea above that many *Drum Gahu* "voices" can be understood to start at varying places in relation to the *gankogui*, the two selected lead phrases will initially be conceived of for the purposes of grouping as lining up with the start of the repeating *gankogui* phrase. At the same time, the common practice of introducing modest lead phrase variants provides additional (but manageable) analytical complexity.

Locke (1998:77) calls the first variant the "Ancestral Phrase" or "Phrase One" since it includes much of the material found in the other three phrases not presented here:

Ex.2.11i Basic *Gahu* lead, Phrase One

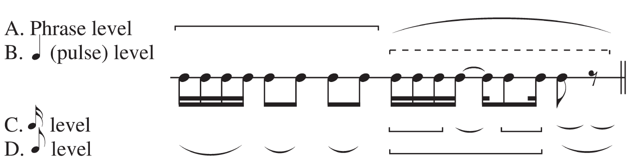


Due to pattern repetition, the "isolated" sixteenth notes here start new groups rather than adhering to previous durations, a possibility indicated in the discussion of grouping principle 3A earlier in this chapter. These contribute to a change from dissonance in the first half to metrically stable consonance in the second half that is especially noteworthy.

The second example consists of segments from which Phrase Five variants are constructed, due to Locke's observation that "Phrase Five 'licks' have variable length and internal structure and can begin on any beat" (1998:97). Locke states that there are three motives in the phrase (the first beat, the second two beats, and the last three beats respectively), but typically presents at least two beats of the first three-beat figure and the final three-beat figure operating together as single units in subsequent examples. The rhythmic interest seems most evident in the final three-beat group with its uneven lower-level groupings; the inclusion of the final rest in the analysis may seem odd, but makes more sense when the figure appears in the ensemble context.

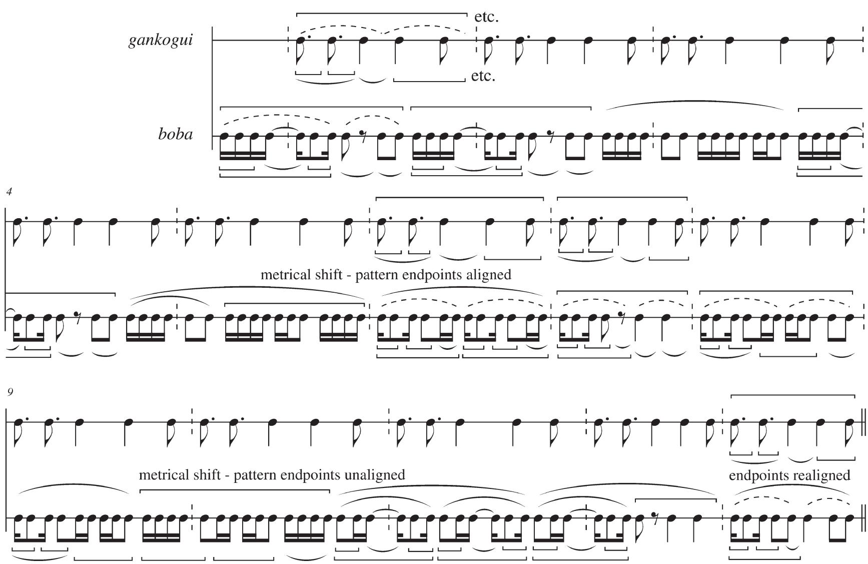
How the two phrases and their variants operate in actual *Drum Gahu* music is far more relevant than their isolated configurations. The excerpt given below (adapted from material as presented by Locke 1998:103–104) is a vast simplification of

Ex.2.11j Basic *Gahu* lead, Phrase Five



what might actually occur, and includes only the lead phrases and the *gankogui* part. Even so, the rhythmic dynamics are complex indeed. For the sake of brevity and clarity, repeated bars (and one nearly identical bar), dynamics, and timbral distinctions have been removed. As before in this section, the phrase level is shown above each staff, while the sixteenth-note and eighth-note levels appear below each staff. The quarter-note level appears directly under the phrase level only in certain instances, sometimes to serve as a reminder of the regular, dance-based evenness against which other rhythms occur (indicated by dotted slurs here), and sometimes to show pulse-level groups that are not in fact in alignment with the implicit meter of four beats per "bar":

Ex.2.11k Analysis of *boba* phrase variants



Though there is one sense in which the beginning of the *gankogui* (3+3) may be generally conceived of as the beginning of each "bar" or periodic repetition, such a concept is in fact quite fluid in the *Drum Gahu*. Locke in several places notes the phenomenon of the phrase "turning around" such that beat and downbeat are shifted (see, for example, 1998:7, 22), and even emphasizes that "phrases in African music rarely start on one!" (1998:10). Thus it is that the "bars" in the above example do not always line up, which in itself creates a significant amount of dissonance. Certainly no one interpretation of grouping, especially in music such as this that relies considerably on flexible improvisatory creativity, is likely to be definitive. What is useful here, rather, is consideration of the interpretive choices that may be discovered using the proposed analytical method.

Nevertheless, it seems essential to the initial rhythmic shaping that the larger grouping of the *boba* part starts with the "upbeat," as in the notation above; if nothing else, the implied group of two sixteenths (shown here as a tie across the bar line) makes little sense otherwise. This in turn suggests that the *boba* "bars" initially begin one beat earlier than those of the *gankogui*. However, a shift of groupings in bars 4–5 brings the two parts into periodic alignment at bar 6. This new level of consonance coincides with another, as both voices then begin with two sixteenth-level groups of three in each of the next four bars. In bar 7, however, the change to Phrase One material creates ambiguity with regard to phrase-level grouping. In bar 9 the metrical groupings again begin to shift over three and one-half bars, finally realigning at bar 13. These features at the higher levels help to create durational shape.

No single pattern seems to dominate the excerpt. The sixteenth-level 3+3+2 that characterizes the beginning of Phrase One (for example, bar 6) is perhaps the most memorable due to its clear and proximate repetitions over several bars. The same pattern is built into the beginning of each *gankogui* repetition as well, though it is extended in each case, and is also an important part of the *kidi* pattern (which, though not shown directly above, does play a prominent role in the ensemble). Also worthy of note is the sixteenth-level 3+2+3 repeated several times at what could be called the rhythmic "climax" of the excerpt in bars 10–11. The inversion of this latter pattern (that is, 2+3+2) does define the sixteenth-note level of the *boba* through most of bars 1–4, just as the inversion of 3+3+2 (that is, 2+2+3) shapes the same level in the *gankogui*, but both of these may be rather tenuous in terms of specific perception; it is more likely that the performer or listener is simply aware of various uneven patterns consisting of three sub-groups.

Drum Gahu: Summary

Though only a few of the common elements in *Drum Gahu* have been presented here, it is clear that not only does each rhythmic "voice" demonstrate multiple grouping possibilities within itself, but that each is also part of a complex web of rhythmic relationships that is likewise ambiguous from moment to moment. No predominant pattern seems to emerge, though 2+2+3, its retrograde 3+2+2, and its inversion 3+3+2 might be the best-related candidates. In any case, seeing even a small portion of this web laid out using a unified system provides insight into what is sometimes called the "kaleidoscopic" effect of this and other African musics.

At the Edges of Rhythmic Effect: Japanese Shakuhachi Honkyoku

As noted earlier, not all rhythm is conceived of from the perspective of strictly recurring pulse. It is therefore fitting, as a conclusion to this chapter devoted to the intricacies of global rhythm, to explore one final challenge with regard to understanding the management of time in human musical processes. Though a number of world musics include approaches to rhythm that are more or less independent of a steady organizing beat, one of the most intriguing genres comes from the ancient Japanese *shakuhachi* (Zen bamboo flute) tradition, a largely breath-based method of durational expression that is highly dependent on the input of the performer. Certainly, such music tests the limits of rhythmic analysis as proposed herein.

This final example consists of the opening of *Koku reibo*, transcribed by the author from traditional Kinko-*ryū* notation, but also reflective of elements from a recorded performance by *shakuhachi* master Teruhisa Fukuda (2003).[13] Smaller notes show ornaments indicated in the Kinko-*ryū* score. Each quarter note of the transcription indicates one second (1000 milliseconds) of duration in the performance, accurate to within 250 milliseconds, which is well within the range of "perceptual indifference"; that is, the typical listener would not be able to perceive difference in duration within such a short time interval (see Clarke 1999:474–5). Thus, each sixteenth note is 250 milliseconds, each eighth note is 500 milliseconds, and so on. Dotted bar lines correspond to breath marks in the Kinko-*ryū* score, while the breaths in the middle of bars 1, 4, and 5 are the additional ones taken by Fukuda. Pitches are approximate, and based on the traditional Japanese collections *miyako-bushi* and *min'yō* that will be discussed in Chapter 3.

Bars 8–9 (not shown) are an extended version of bar 1, and bars 10–12 (also not shown) are nearly identical to bars 2–4. Thus, for local analytical purposes, the first section of the piece can be understood to end with bar 7, as shown here. This creates an interesting shape for the section of two (bars 1–2) + two (bars 3–4, with higher pitch focus) + three (bars 5–7; the periodicity of bar 5 starting similar to bar 1, but then bars 6–7 taking a lower pitch focus).

However, except for the B level in bars 2–3, 2+2+3 does not appear to be a consistent pattern, and indeed no such patterns emerge here. Instead, as the analysis shows, grouping focus in the performed version shifts constantly between hierarchical levels, making larger groups harder to surmise. Nevertheless, with the exception of three undifferentiated durations of five, each musical event can be shown as either a two or three, with what appears to be a strong preference for threes both in the Kinko notation and in the lower levels in performance. Worthy of comment are the three-note ornaments at the beginning of bars 1, 5, and 6, as well as in the middle of bar 5. (The instance at the beginning of bar 6 is comparable musically, though not strictly durationally, to that in the middle of bar 5, and so is analyzed here as a mixed group, overlapping slightly with the E-level group immediately following.) These are not specified as threes in the Kinko score, and it is interesting to ask why they are performed as such by Fukuda.

Also interesting is the fact that what appear to be the two most straightforward consecutive rhythmic shapes, the threes at the B and E levels in bar 3 and the beginning of bar 4, correspond to the highest and most precipitous pitch shapes. These seem also tenuously related to the lower-level shapes in bar 2. At the same

[13] Reference to the recorded performance is made by way of kind personal permission from Mr. Fukuda and the recording producer, Mr. Akira Tamba.

time, bar 4 seems to include the most complex mixture of simultaneous interactions at various levels.

Ex.2.12 *Koku reibo*, opening

The rhythmic discrepancies between score and performance here offer further opportunity for questions and observations. Such discrepancy is perhaps nowhere more apparent than at the start of the very first bar, where what is notated as three equal beats is nonetheless performed as two equal beats followed by a third duration nearly twice as long. This effectively forms an aural grouping of two for the three notes. Likewise, at the beginning of bar 2, what is notated as two beats is effectively performed as a group of three (one note plus a second note of double the duration). Certainly, *shakuhachi honkyoku* notation is considered only a guide to the performer (see Lee 1992), and it seems clear that each note or event is appropriately interpreted with great flexibility by Fukuda. At the same time, score and performance show more confluence in bar 3 and at the ends of bars 4, 5, and 7. It may be, then, that such moments in the music are considered more cadential and therefore more important with regard to durational agreement.

Finally, it is perhaps precisely the unpredictable nature of *shakuhachi honkyoku* performance in comparison to the score that accounts for the rather "mysterious" effect of this piece and others of the same genre. More to the point, were everything to fall into predictable groupings (whether all twos or all threes), much of that effect might be lost. This is also salient with regard to the ever-shifting focus between hierarchical levels; one cannot easily resolve the dissonance of a sixteenth-note group of three followed by an eighth-note group of three followed by a quarter-note group of three. The effect is one of exponential slowing, as well as of three "events" (three groups of three), all of which contributes both to a sense of coherence held in tension with unpredictability. Though *shakuhachi honkyoku* are meant to be learned aurally from a master teacher (with all the nuances encountered here), awareness of this most unusual web of rhythmic relationships at various levels would seem to be valuable to both performers and listeners in apprehending and appreciating the music.

Conclusion

These analyses illustrate the notion (introduced early and repeated throughout this study) that the proposed theory does not in the end erase meaningful differences between musics. Rather, it highlights how "qualified musical universals" (in this case, rhythmic) may be manifested in a myriad of ways without at the same time necessarily denying that such universals may exist. This, then, is a principle to be built upon in subsequent chapters. The "complex web of relationships" present in each example is not reducible to any grand archetype of rhythmic structure. At the same time, it becomes clear that mixed groupings of twos and threes at various levels do indeed characterize the rhythmic dynamism of widely disparate musics, even those that on the surface might seem to be strictly binary in their groupings, though the range of subtlety is almost certainly greater than a limited set of examples can display. The theory further suggests ways in which the rhythmic structure of various musics may be compared to illustrate how prevalent patterns such as 3+3+2, 3+2+3, 2+2+3, and so on, are articulated differently but may nevertheless be at the heart of such dynamism. Further study is needed to determine whether certain such prevalent patterns may underlie a significant number of musics.

But the foregoing analyses also reveal that the proposed theory has significant potential to be more than merely a method for cataloguing rhythmic groups and their relationships, as valuable as such descriptions might be. What is most strikingly revealed in the examples from this chapter is how much the dynamics of musical shape flowing through time stem from elements predicted by the theory. Specifically, it is the control of rhythmic consonance and dissonance within and between various hierarchical levels (as delineated earlier) that most influences the durational shape of the music. Moreover, each piece stands as a notable example within its own tradition, and the analyses reveal that they have something in common that may explain this phenomenon in part: each exhibits an especially interesting and dynamic web of contextual rhythmic relationships. It seems reasonable to assert that because rhythm is so elemental to music it will always play a significant role in musical effect, and to posit, from the evidence herein, that foundational groupings of twos and threes and their interactions are at the heart of rhythm in human musical endeavors. Interpreting such interactions, as noted earlier, allows for both quantitative and qualitative comparison using common terms, a goal to be sought for and applied to other musical elements in subsequent chapters of this study.

Chapter 3
Global Melody

Introduction

As noted in Chapter 1, melody seems to be the second most ubiquitous and defining element among the musics of the world. Music must include rhythmic durations, and most musics also feature melody at various levels of elaborateness. It is important to understand that "melody" here is limited to "monophony" in the strictest sense of the term: linearly sequential arrangements of single pitches.[1] The equally important concepts often labeled "heterophony," "homophony," and "polyphony," as well as harmony, are reserved for later, separate consideration, with the understanding that they are all related to each other and to monophony as well. Because it is rhythm and linear pitch together that most often constitute melodic conceptions, the interaction of the two will be considered in more detail in subsequent chapters. The current chapter, however, serves as an introduction to fundamental ideas about pitch relations, focusing on the dynamics of pitch sequences largely apart from their rhythmic contexts. At the same time, as in Chapter 2, brief passing references will be made herein to expressive congruities between the two aspects.

Pitch Distinction and "Tonality"

One "qualified musical universal" in this context is that the vast majority of human musics that utilize pitch distinction as an element (which, yet again, seems to be the overwhelming majority) do so using limited pitch collections that can be understood and described according to certain principles rather than as random phenomena (Wallin et al. 2000:14; Arom 2000:28). In keeping with the underlying theory expressed in Chapter 1, and as noted in Chapter 2 under the heading "Primacy of Primes," the elemental nature of the prime numbers two and three figures prominently in human musical matters. With regard to pitch, this prominence is best understood as being manifested in the elemental intervals (pitch distances) described by the frequency ratios of 2:1 and 3:2.

However, a number of preliminary issues must be addressed prior to any examination that might reveal the details of such principles and systems operating within identifiable pitch collections. Indeed, the simple notion of pitch distinction

[1] Recall from Chapter 1 that "pitch" is here defined as *the human perception of audible fundamental frequencies and their relationships*.

is itself a subject worthy of broader exploration than is possible here. The typical "just noticeable difference" between pitches is often considered to be somewhere in the range of 4–8 cents (one cent being a measurement of pitch distance equal to 1/100 of a Western "half-step"), but can vary widely upward from this norm depending on such factors as whether the two pitches are sounded sequentially or simultaneously, in what frequency range the pitches fall, how loud they are, the duration of each, and other factors (Sethares 2005:44). Generally, human listeners seem readily willing to accept wide variations in pitch relations in musical contexts without losing the ability to identify and then continue to recognize musical motifs (see, for example, Burns 1999; Marcus 2007:26; Sethares 2005:52).

Because musically contextual hearing of this kind is linked with the fundamental musical idea of tension and release, the very notion of identifiable distances, or "intervals," between pitches becomes a perceptual issue that is likewise closely related to human concepts of acoustic consonance and dissonance. While both concepts seem to be relative rather than absolute in the context of musical style, one must nevertheless come to grips with the apparent human preference for pitch intervals at the smallest frequency ratios of 2:1 and 3:2, which are generally perceived as consonances and understood to be stable musical anchors across world cultures (see, for example, Trehub 2000:431–3 and Burns 1999:240–2; Boomsliter and Creel 1961 give a different but still confirming explanation).[2]

But the question of tuning and timbre must also be considered in this context, since notions of acoustic consonance and dissonance are highly dependent on it. That is to say, it is now known that very complex frequency ratios can sound "consonant," (that is, produce less "beating") when the timbre better matches and reinforces the appropriate overtones in the sound wave. William Sethares (2005) builds a convincing case that, with proper control of all aspects of timbre (as is now possible with computers, in real-time musical performance and in recordings), any division of the octave or tuning system can become aurally "consonant." While this is relevant to a number of world musics (such as Indonesian *gamelan*) that feature timbres that reinforce partials above each fundamental pitch that are not along the harmonic series (that is, that are "inharmonic"), the pitch element in a great majority of music-making involves instruments and methods (stretched strings and skins, columns of air, vocal folds) that do in fact reinforce and rely on the frequencies of the harmonic series (though less perfectly as they appear higher up in the series). Moreover, human listeners typically distinguish pitch according to harmonic components related to the fundamental (Pierce 1999:15–16). Albrecht

2 The likewise small-number ratio of 4:3 is sometimes considered to be a consonance akin to 2:1 and 3:2, and while this may or may not be true in isolation, the approach of this chapter will suggest a very different place for 4:3 in the context of a system based on projections of 3:2 within 2:1 above a given starting pitch. The logic behind this will become clearer as the chapter unfolds. Meanwhile, the disposition of 4:3 as a consonance or dissonance has a storied history in the West, and Tenney (1988:12, 43–9, 83, 95–6) offers extended discussion of both views.

Schneider, in his otherwise highly cautionary discussion of pitch perception in inharmonic contexts, acknowledges that the fundamental frequency is important in complex tones even when obscured by other frequencies (2001:491–4); that music listeners assign relevant pitch distinctions to the sounds they hear (514); and that, in the end, successful musics with a high degree of inharmonicity, such as *gamelan*, are organized timbrally so as to provide pitch information to listeners in ways that the human auditory system (employing mechanisms suited to hearing harmonic spectra) may process well enough (502, 511–12).

And so the relationship between pure ratios and actual pitch production and discrimination in musical contexts is a complex one. One is in the end left to come to terms with the fact that, because the human voice and the majority of musical instruments are capable of very fine gradations of pitch, musical intonation is in actual practice in flux from moment to moment (Sethares 2005:75). In the context of analytical music theory, two possible reactions to this state of affairs seem likely: (1) Insistence that pitch in every music must be analyzed solely within a framework unique to its specific context, thus preventing any possibility of a "global music theory"; or (2) Acceptance that there is sufficient evidence about human response to pitch stimuli to allow some general principles to be posited as being applicable (again, in varied ways) to the realm of qualified universals in human music-making, especially for the advantageous purposes of musical analysis across human cultures arising from twenty-first-century musical realities. This study adopts the latter value.

In that light, the implications of the 2:1 frequency relationship, commonly known as the "octave," appear to be especially important for describing musical pitch practices (see Carterette and Kendall 1999:734–5, 780). Not all octaves conform in practice to a pure 2:1 ratio, and music-makers and listeners appear to have a wide tolerance for such vagaries while also maintaining the concept of "octave equivalence," that is, the notion that pitches separated by one or more approximate octaves are understood as functionally in the same pitch class (Burns 1999:252–6; Sethares 2005:72–3).[3] Division of the octave proves also to be a useful basis for discussing varied pitch collections (Wallin et al. 2000:14), though the question of equal versus unequal division is complex. On the one hand, unequal consecutive intervals within pitch collections appear to be preferred, while on the other hand the notion of tuning (or "temperament," that is, evening out of interval discrepancies) based on equal division of the octave (EDO) has been most prevalent (Trehub 2000:433; Barbour 1951). The octave may be divided into any number of equal or unequal parts, though some schemes are more well established than others, including 5-EDO (approximate to the Javanese *slendro* scale), 7-EDO (Thai), 9-EDO (possibly the superset for Indonesian *pélog*, discussed later in this chapter), 12-EDO, and 53-EDO; Barbour (1951) documents the histories, advantages, and disadvantages of many more.

3 Indonesian *gamelan* tunings show an especially wide variety of octaves sizes, a feature to be considered further later in this chapter.

The second most important defining interval is that of 3:2, which produces the first note other than an octave in the harmonic series, and also constitutes the second-lowest frequency ratio. Moreover, unlike 2:1, which endlessly recreates the same pitch class, stacked 3:2 ratios generate a very large number of additional intervals. It is this much broader range of intervals than that allowed by 12-EDO, and a concomitantly finer level of pitch distinction, that must be available in a globally useful theory of pitch. The question is actually one of how and how much to limit the available number of possible intervals so as to have a practical system in which to conduct meaningful comparative analysis. These ratios of 3:2 and 2:1 (or close approximations), operating as qualified universals at the heart of music-making, may successfully form an appropriately limited basis for the operative principles of pitch collections in a global theory of "tonality," broadly conceived, albeit in a variety of sophisticated ways that differ from music to music. Such a view of tonality allows for the contributions of many global musical systems outside of the Western tradition and 12-EDO, such as those of *rāga*, *maqām* and *gamelan*, as well as those from already globally integrated musics such as jazz, rock, global pop, film music, and indeed much of the art music of the twentieth century. As will be demonstrated, even the pitch collections of most musics that might not otherwise be appropriately described as "tonal" in this same sense may nevertheless also be successfully understood as derived from 2:1 and 3:2 interval relations. In short, then: *for the practical purpose of analysis, pitch collections and relationships in human music-making can be understood and expressed as arising directly or indirectly from frequency ratios of 3:2 and 2:1 in various combinations.*

To be sure, some of this stems from theoretical ground that is already well trod, but that nevertheless appears not to have yet been applied fully to these same ends. The documented history of both 2:1 and 3:2 as defining pitch ratios seems to stretch back to ancient Babylon, *c.*1800 BCE (West 1994), and to gather steam in the arena of music theory in Greece about a century after Pythagoras (*c.*500–400 BCE). As is implicit in Barbour (1951), however, the main aim of 3:2 tuning was to construct what came to be called the "diatonic" seven-tone scale (for example, C–D–E–F–G–A–B–C, though transposable to start on any frequency, and reconfigurable so as to create various modes by retaining the consecutive intervals but starting on a different pitch within the sequence). This evolution may have stemmed from a desire to reconcile pitch structures resulting from 3:2 ratios with those resulting from 2:1 ratios—something that quickly proved impossible in both theory and practice, because stacks of pure 3:2 never cycle back around to pure 2:1 octave equivalencies (see Sethares 2005:54).

And so the generation of a diatonic scale according to Pythagorean principles offers a workable compromise by allowing six of the seven pitches to flow from pure 3:2 (for example, C–G–D–A–E–B), and then fills in the final pitch (for example, F) by calculating 3:2 *down* from the starting frequency (for example, C down to F). This, unfortunately, is where so much Pythagorean musical thinking has remained focused, despite the fact that by *c.*40 BCE the Chinese musician and court official Ching Fang (78–37 BCE; see McClain 1979:208) had demonstrated that, after 53 pure 3:2 stacks, one arrives at a pitch that is within 3.615 cents of the octave-reduced equivalent of a pure 2:1 ratio—well within the tolerance of what human ears would consider to be an equivalency. Thus, for all practical human musical purposes, a stack of 53 pure 3:2 pitch ratios reconciles 3:2 with 2:1.[4]

Bosanquet (1876) emphasized what might have been the final step in this series of developments by noting that a pure 2:1 octave divided into 53 equal steps (53-EDO) produces a pitch collection that is functionally equivalent to a stack of 53 pure 3:2 intervals. As the chart below shows, no 53-EDO pitch diverges from its pure 3:2 equivalent by more than 3.615 cents, and most are much closer.[5]

Some additional explanation of the information on this chart is in order. In the now common system of 12-EDO, each scale step is 100 cents (1/100 of a 2:1 octave). The column of "nearest 12-EDO" pitches uses the conventions of interval naming from Western music theory, such as "m2" (minor second, or 100 cents), "P4" (perfect fourth, or 500 cents) or "M6" (major sixth, or 900 cents), as well as "TT" for "tritone," an interval that spans three major seconds of 200 cents each, for a total of 600 cents. These 12-EDO reference points are included only for convenience and comparison. Meanwhile, because "neutral" tunings of certain intervals or scale degrees are commonly featured in some pitch collections, these too are indicated on the chart.

Following the relationships demonstrated on the chart (under the heading "Nearest pure 3:2 node"), the shorthand "S," followed by a number from 0 to 52, will be used in this system to designate a note's position in the 3:2 "stack," and "F," also followed by a number from 0 to 52, will indicate a note's concomitant scale degree in the 53-EDO collection (with the understanding that the 53 F numbers form a circle, rather than a straight line, so as to reflect actual distances between pitches from either direction).

On the basis of these preliminaries, the following conclusion may be posited: *identification and comparison of melodic pitch collections and patterns within 53-EDO, using a system of numbers and symbols that illuminate pitch relations and processes through dynamic relationships between identified anchor tones and satellite/tendency tones along the proximate 3:2 continuum, offers a practically manageable method of analysis that is sufficient to accommodate fine pitch*

---

4 As Partch (1974:400) notes, a stack of 306 3:2 ratios would constitute the next cyclical point at which 2:1 comes very close, within 1.8 cents. However, 306-EDO seems unnecessarily unwieldy for the practical analytical purposes proposed here; in only a relatively few cases would having so many extra pitches available prove commensurately helpful.

5 Barbour (1951:123) notes that, according to Boethius, the concept of 53-EDO actually goes back to Pythagoras's disciple Philolaus, and that it was mentioned by a number of seventeenth- and eighteenth-century Europeans as well. But it was Bosanquet's understanding of the practical advantages and possibilities, resulting in his design of a "generalized keyboard" reflecting full 53-EDO, that might have altered music history. Instead, as is well known, the 12-EDO keyboard prevailed.

Figure 3.1 Table of 53-EDO values

F♯ (Scale degree)	Cents value	S♯ (nearest 3:2)	Cents difference	Nearest 12-EDO	Comment
0	0	0 (3.615)	3.615	PU 0	
1	22.642	12 (23.460)	0.818		
2	45.283	24 (46.920)	1.637		
3	67.925	36 (70.380)	2.455		
4	90.566	48 (93.840)	3.274	m2 100	
5	113.208	7 (113.685)	0.478		
6	135.849	19 (137.145)	1.296		Neutral 2nd
7	158.491	31 (160.605)	2.114		Neutral 2nd
8	181.132	43 (184.065)	2.933		
9	203.774	2 (203.910)	0.136	M2 200	
10	226.415	14 (227.370)	0.955		
11	249.057	26 (250.830)	1.773		
12	271.698	38 (274.290)	2.592		
13	294.340	50 (297.750)	3.410	m3 300	
14	316.981	9 (317.595)	0.614		
15	339.623	21 (341.055)	1.432		Neutral 3rd
16	362.264	33 (364.515)	2.251		Neutral 3rd
17	384.906	45 (387.975)	3.069		
18	407.547	4 (407.820)	0.273	M3 400	
19	430.189	16 (431.280)	1.091		
20	452.830	28 (454.740)	1.910		
21	475.472	40 (478.200)	2.728		
22	498.113	52 (501.660)	3.547	P4 500	
23	520.755	11 (521.505)	0.750		
24	543.396	23 (544.965)	1.569		
25	566.038	35 (568.425)	2.387		
26	588.679	47 (591.885)	3.206	TT 600	

F♯ (Scale degree)	Cents value	S♯ (nearest 3:2)	Cents difference	Nearest 12-EDO	Comment
27	611.321	6 (611.730)	0.409	TT 600	
28	633.962	18 (635.190)	1.228		
29	656.604	30 (658.650)	2.046		
30	679.245	42 (682.110)	2.865		
31	701.887	1 (701.955)	0.068	P5 700	
32	724.528	13 (725.415)	0.887		
33	747.170	25 (748.875)	1.705		
34	769.811	37 (772.335)	2.524		
35	792.453	49 (795.795)	3.342	m6 800	
36	815.094	8 (815.640)	0.546		
37	837.736	20 (839.100)	1.364		
38	860.377	32 (862.560)	2.183		
39	883.019	44 (886.020)	3.001		
40	905.660	3 (905.865)	0.205	M6 900	
41	928.302	15 (929.325)	1.023		
42	950.943	27 (952.785)	1.842		
43	973.585	39 (976.245)	2.660		
44	996.226	51 (999.705)	3.479	m7 1000	
45	1018.868	10 (1019.550)	0.682		
46	1041.509	22 (1043.010)	1.501		Neutral 7th
47	1064.151	34 (1066.470)	2.319		Neutral 7th
48	1086.792	46 (1089.930)	3.138		
49	1109.434	5 (1109.775)	0.341	M7 1100	
50	1132.075	17 (1133.235)	1.160		
51	1154.717	29 (1156.695)	1.978		
52	1177.358	41 (1180.155)	2.797		
0/53	0/1200	0/53 (3.615)	3.615	PU 0/P8 1200	

gradations in acoustics and perception across a broad range of musics. In short, 53-EDO may serve effectively as the master pitch collection compromise for global musical analysis,[6] though a number of additional implications and clarifications need first to be explored.

Anchor Tones, Satellites and Tendencies

Just as rhythmic dynamism arises from a complex web of interactions between groups of two and three at various hierarchical levels, so pitch dynamism arises from the interaction of tones in a given pitch collection according to their disposition in the 3:2 stack, as approximated by 53-EDO. It thus becomes important to determine whether specific pitch collections feature "anchor tones" (normally including at least S0 and S1), and if so, what those pitches are in the transposition at hand. Upon that basis, the rest of the pitches in the collection may be considered "satellite tones" that revolve dynamically around the anchors, and around one another, according to certain tendency principles, namely, by virtue of the relationship between S numbers (that is, the place on the 3:2 stack as approximated in 53-EDO), and proximity (also within 53-EDO, using F numbers).

The import of such principles can be understood in fairly simple terms. Generally, the higher the S number, the more acoustic/melodic tension or dynamism is created by the pitch in relation to S0; pitches with lower S numbers provide less tonal tension/dynamism (with zero being the most restful or least dynamic). F numbers demonstrate relative proximity within 53-EDO. The concept of proximity is also important in terms of melodic contour in the sense that it can help to distinguish "conjunct" (that is, stepping) from "disjunct" (that is, leaping) motion: the greater the difference in F numbers, the less conjunct the melodic motion may be understood to be. However, the threshold between those two types of motion is likely to be dependent on the particular interval content of the pitch collection being used; specifically, how many divisions of the octave the collection (not 53-EDO) entails.[7]

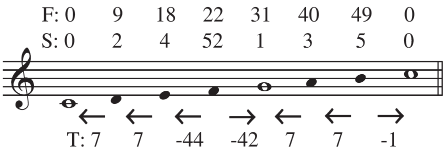
These two axes (S and F numbers) must be considered together. Both within the collection and within the melody itself, pitches that have higher S numbers tend to evoke an expectation to resolve to pitches with lower S numbers that are in close proximity. In fact, again speaking generally: *the strongest melodic tendency or expectation of any given note in a collection is to move toward the most proximate note with a lower S number in that same collection.*

Take, for example, the diatonic pitch collection in what is commonly called its "major scale" configuration (the derivation of which was touched on earlier):

[6] As an interesting comparison, Johnston (1964:66–74) explores some of the detailed implications of 53 *unequal* divisions of the octave in just intonation.

[7] In any event, the notion of proximity in pitch relations is understood to be a fundamental processing attribute in listeners; see for example Deutsch 1999a:321.

Ex.3.1 “Diatonic” pitch collection, “major scale” configuration



According to the principle stated above, the strongest expected tendency of S2 here is to move down to S0 rather than up to S4 (equally proximate, but higher S number) or up to S1 (lower S number, but less proximate). Note also that the strongest tendency of S1 is to move up to S0, because while the latter is not very proximate to the former, it is nevertheless *the most proximate note with a lower S number*.[8] In general, however, movement away from the S0 and S1 anchors toward other pitches is to be considered separately, as these do not really have tendencies apart from the one just mentioned. Certainly such movement contributes substantially to tonal shape, because it constitutes a rise in the S number and, consequently, in tonal tension.

The extent to which melodic note movement follows this principle is the extent to which tonal tension is dissipated; likewise, tonal tension or dynamism increases to the extent that note movement abrogates this principle. The management of this tonal tension and release constitutes the contribution of pitch to the expressive effect of the music. Yet, while the basic principle operates quite reliably, some allowance must nevertheless be made for the flexibility and ambiguity that is always attendant in music. In some cases there will be multiple tendencies that are very close in strength. For example, if two notes are equally proximate to a given note, and both of these have lower S numbers, the tendency to move to either is in practice sometimes equally strong even if one of the target pitches has a lower S number than the other. Such equality or closeness of tendency may also operate when the S numbers of two possible targets are very close but not equally proximate. This is precisely the case, for example, of S52 in Ex.3.1 immediately above; the pitches on either side of it both have much lower S numbers. In general, the lowest S-numbered anchors in the collection exert more pull towards

[8] This particular S-number pitch sequence, by the way, does in fact constitute a 4:3 ratio, strongly suggesting that *tonal context* is important in determining its consonance or dissonance. That is, a ratio of 4:3 with S1 as the lower note has a very different effect from the same ratio with S0 as the lower note. Part of the issue is that the most proximate occurrence of the “4:3 note” in the 3:2 sequence (for example, F in relation to C) stands at 521 cents (S11), or a ratio of approximately 23:17, rather than the 498 cents generated by 4:3. As indicated in Fig.3.1, only when S52 is reached does the pitch come close enough to practical equivalence to 4:3. This confirms that, despite its small frequency ratio, 4:3 is not in fact a consonance outside of the S1-S0 melodic context noted here.

themselves, especially in smaller collections. Yet in this case, the pull away from S52 is so strong that its proximate resolution in either direction is quite common.

Moreover, if a clear set of anchor pitches, including at least S0 and more normally also S1, cannot be determined for a given melodic collection, the whole idea of measuring pitch dynamism according to the 3:2 stack becomes more complex; this is sometimes (but not always) the case in symmetrical collections such as the "whole tone" and "octatonic" scales/collections (both discussed later in this chapter), deliberately "atonal" chromaticism, and the especially intriguing case of "pandiatonicism," in which the tendencies of the diatonic collection are deliberately avoided. In such cases, internal intervallic consistencies identified by pitch class set theory might be a very useful way of understanding the pitch organization. However, cases like these are in fact relatively rare (and generally quite recent) in the larger scope of global musical practice. The method advocated herein can provide a way to see how such techniques might be successfully meshed with those of a redefined tonality, as, for example, seems integral to the work of numerous composers and improvisers spanning the twentieth century and beyond. Moreover, the symmetrical or ambiguous nature of such collections may in a way free the analyst to make more than one reasonable hypothesis about where S0 may lie.

All of this reinforces the point that the principle must be used descriptively and not prescriptively; the proposed system may serve as a guide to interpretive comparative analysis, but the pitch dynamics of real musical events cannot ever be successfully reduced to a set of unimpeachable numbers.

The simplest analysis of melodic tension and release according to 3:2 relations, then, consists of noting when the strongest tendencies are followed and when they are not. Much of the time, this is sufficient, as will be demonstrated subsequently. In many cases it is even preferable, because it more openly allows for the ambiguities noted above. Nevertheless, for more detailed analysis it is sometimes useful (or even necessary) to describe the *degree* of tendency strength between any pair of notes in a collection; again, the value of this description increases as the pitch collection increases in size and/or ambiguity of anchor relations, and as the attendant ambiguities of its tonal relations increase concomitantly. As implied above, both S number relationships and proximity are important factors, and should therefore both be reflected in such a descriptive tool.

A measure of tendency strength may be determined by taking the difference (positive or negative) between the S numbers of the originating pitch and the pitch to which it moves, and adding to it the absolute value of the difference between the F numbers of the two notes. (Note that F number differences must be determined based on melodic direction, as if the collection is a circle rather than a straight line.) This value may appropriately be called the melodic T number (for "tendency"). *Generally speaking, the lower the T number, the stronger the tendency for the first pitch to move to the second pitch*, with T=0 suggesting tendency neutrality. It is also important to note, however, that because each pitch collection has its own S number dynamics and ranges, T numbers are only useful relative to one another *within the same collection.*

For example, as explained above in the major scale configuration of the diatonic collection (Ex.3.1), S2 has a solid tendency to move down to S0, the most proximate note with a lower S number; the S number difference is −2 and the absolute F number difference is 9, making the T number for this pair relatively low at 7. Compare this to S2 moving up to S1: the S number difference is −1, but the F number difference (absolute value) is 13, making the T number 12; this reflects a slightly weaker tendency than T=7. Compare again to S5 moving up to S0, with a stronger T value of −1. Compare yet again to the note S52 moving down to S4 (the most proximate note with a lower S number): the S number difference is −48 and the F number difference is 4, making the tendency exceedingly strong at T=−44. But in this latter case the T value for S52 moving up to S1 is virtually equal at −42.

Calculating the T number between each consecutive pair of melodic notes therefore offers a more detailed but still only approximate guide to patterns of tonal tension and release in the melodic movement from moment to moment, so as to make possible comparisons within and between musical examples.

Examples of Melodic Dynamics within Specific Pitch Collections

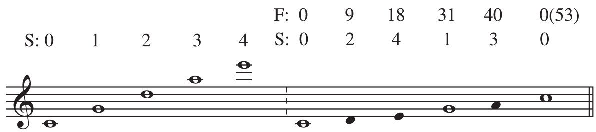
Most of the world's music does in fact feature melodic pitch collections of limited size (typically five to seven notes) with a limited set of unequal intervals between proximate pitches (Trehub 2000:433, 441; Carterette and Kendall 1999:735). As suggested earlier, these can be understood as projections of 3:2 frequency relationships, typically organized around an S0 anchor, most often with an S1 anchor as well. However, some collections and systems do not follow this principle unambiguously, and thus "tonality" is obscured to the extent to which clear articulation of an S0 is deliberately avoided, though some of the same organizational aspects may be applicable if a reasonable interpretation of S0 can be determined by examination of emphasis. What follows, then, is an attempt to demonstrate the applicability of 53-EDO analysis to the tonal dynamics of a wide (though by no means exhaustive or even comprehensive) selection of well-established melodic pitch collections.

World Pentatonic

In the context of a broad theory of how melodic pitch collections work, the most fruitful discussion might commence with *pentatonicism* (melodic pitch collections of five basic notes), both because it defines a very large part of world melodic practice and because its relatively simple tonal dynamics illustrate well the concepts put forward in this chapter. What is widely held to be the oldest pentatonic collection, and certainly the most ubiquitous worldwide even today, consists of the lowest five members of the 3:2 stack, condensed into the closest possible interval configuration above the original S0 pitch. Both Arom (2000:28) and Mâche (2000:475) suggest that this collection, which may be appropriately labeled "world pentatonic," might be a human musical universal.

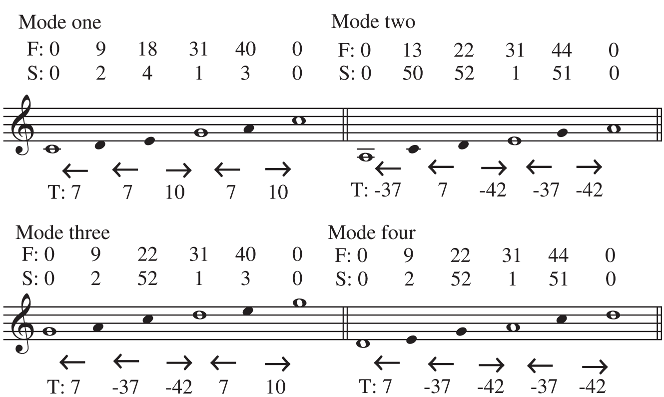
World pentatonic, in what may be helpfully designated as "mode one" (its most common configuration) is shown in Ex.3.2 below. Here and in several subsequent examples, the anchor pitches are shown as whole notes while the tendency or satellite tones are designated by stemless quarter notes:

Ex.3.2 World pentatonic, mode one



This collection has three additional configurations, or modes, that are commonly used; each mode shifts the focus to different anchor tones, as shown in Ex.3.3 below. At the same time, as a consequence of the anchors located at S0 and S1 in all four modes, the basic tendency layout between adjacent pitches remains identical in each, despite the differing dissonance levels and tendency strengths. It is important to recall here that tendency strengths, or T numbers, are only useful relative to one another within the same collection:

Ex.3.3 World pentatonic, modes and tendencies



Some of these tendencies warrant comment. Why, for example, might S52 in mode two ever tend toward S50 as opposed to S1? Both resolutions are equidistant, but the S differences (and concomitant T differences) are vast. Certainly the principles outlined thus far indicate that S1 would be the likely target most of the time. Yet this is an example of one of the caveats suggested earlier: because S52 is so dissonant in the collection, and because both pitches on either side of it have lower

S numbers, the possibility for either directionality is not remote. However, it is the pull of S0 from below S52 that explains the most; if S52 did indeed move to S50, the melodic motion would then be much more likely to be expected to continue downward to S0. Note also how the subtlety of tendency strength differences in mode one makes the variable tendencies indicated all the more open-ended, a feature also observed in how S51 in mode two hovers closely between S0 and S1. Finally, modes three and four (the former of which is more common, and especially to be found in East Asian music) combine attributes of the much more ubiquitous modes one and two.

Thus it is that the particular dynamics of each whole collection come into play analytically, while the basic information given above merely sketches out some of the most prominent characteristics.

To reiterate, tonal tension or dynamism is created when the tones of a collection move against their expected tendencies, whereas when they move with their tendencies a sense of resolution results. This is evident in each of the three world pentatonic melodies analyzed below: the Christian hymn tune *Amazing Grace*, a Bolivian traditional tune to accompany the *Llamerada* dance and the ancient Japanese *gagaku* melody *Etenraku*. Here and in subsequent melodic analyses, note that some tendency resolutions are delayed before being fulfilled in close proximity, while others are abrogated entirely. Asterisks, accompanied by explanations, appear in such instances.

Ex.3.4 *Amazing Grace* (world pentatonic mode one)

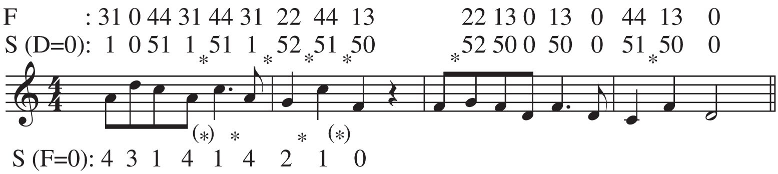
Here the analysis is appropriately simple: the only notably unresolved tendency in this well-known tune occurs between bars 7 and 8, and reinforces the climax of the melodic shape.

Among the many global melodies that are situated in world pentatonic mode two, the following main phrase from a Bolivian *Llamerada* tune is a very good specimen:[9]

---

[9] In the realm of global popular music, Peter Green's *Black Magic Woman* from 1968 provides another excellent example of this mode.

Ex.3.5 Bolivian traditional *Llamerada* tune, main phrase (world pentatonic mode two)



The more inherently dynamic nature of mode two is evident here, though much of the movement follows expected tendencies. It is interesting that the first two bars can be understood as well or better in mode one, with S0=F; in that case the moments marked with (*) follow tonal expectations somewhat more closely. Note also the satisfying structural resolutions in bars 2 (F to G) and 4 (C to D), which reduce further the moments diverging from tendency expectations in either mode.

Ex.3.6 Etenraku (basic melodic outline; world pentatonic mode three)

This ancient Japanese *gagaku* melody follows the tonal organization of the mode very closely. The tension of the leap from S2 to S52 that occurs twice is immediately balanced with strong tendency resolution movement back toward the bottom anchor of the collection, while the leap from S2 to S1 is a bit more tonally disruptive. The (*) indicates that the inversion of normal direction and large leap create a degree of melodic tension even though the S numbers move according to tendency, with a T number of −12 versus the expected −37.

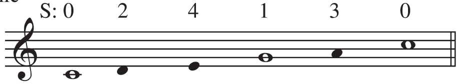
An interesting example that arises theoretically from 7-EDO but that in practice at first appears to amount to a variant tuning of world pentatonic mode one is that of Thai music, especially that associated with the idiophones *renat ek* and *gong wong yai*.[10] Duriyanga (1972) details the 7-EDO basis, with each scale step at 171.43 cents (and all seven pitches sometimes used in music), but the main

[10] Sethares (2005:303–16) also gives a detailed account of the relationship between tuning and timbre in Thai music. The observed *renat* tuning values given by Sethares (304) are even closer to 53-EDO than those used in Ex.3.7.

example given in his study is limited to a clear pentatonic subset, a characteristic that Fletcher (2001:303) and Morton (1976:24) confirm as a common feature of Thai musical culture. The example below details the comparison of the Thai collection to world pentatonic mode one, with the tuning in cents below the staff and the S numbers above:

Ex.3.7 Thai collection—world pentatonic?

53-EDO Thai tuning	F:	0	8	23	30	38	0
	S:	0	43	21	42	32	0
Expected world pentatonic mode one	F:	0	9	22	31	40	0
	S:	0	2	4	1	3	0



Thai tuning:	0	171.43	342.86	685.71	857.14	1200
53-EDO:	0	181.13	339.62	679.25	860.38	1200

The tonal melodic dynamics in this instance would, according to the theory proposed here, vary significantly from the expectations of the world pentatonic mode one model, necessitating a different set of T numbers. Yet a difficult question arises: when a melodic collection is as close to another well-established model as this one is, should they be conceived of as virtually equivalent? This reveals one of the reductionist dangers of a global music theory against which the analyst must be on guard. In this case, the known parameters of the Thai system lead to a more correct choice, but the temptation to reduce is probably always lurking. In any event, this example actually reveals the value of the options offered by a full 53-EDO approach, since not having such options might more easily lead to judgments of equivalency. For indeed, to some listeners, this Thai music seems quite like world pentatonic, something to which Duriyanga himself alludes (1972:8). This question is complicated further by the difference between structural theoretical variation in melodic tuning and the vagaries of real human performers and instruments (including the voice) that do not hew with computer-like accuracy to mathematical models. This latter issue will be taken up subsequently in this chapter.

Many other world musics appear to utilize subsets of world pentatonic. For example, Kaemmer (2000:314) notes that many songs of the San people of southern Africa use mode one without S4, while aural observation of Native American Sioux melodies reveals that they are often limited to or strongly emphasize the first four pitches of mode two. Another example using world pentatonic, from Central Africa, is analyzed in Chapter 6, and demonstrates the potential for ambiguity between the various modes and subsets.

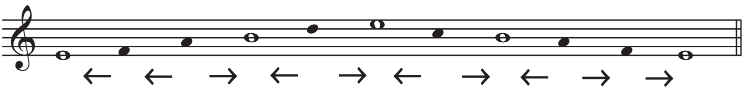
Miyako-Bushi Mode[11]

A good example of a well-established pentatonic melodic system that utilizes some smaller internal intervals than those found in world pentatonic can be seen in the Japanese collection called *miyako-bushi* that is normally inflected at the top of the octave in rising patterns with a tri-chord from *min'yō*:

Ex.3.8 Inflected *miyako-bushi* collection, with tendencies

min'yō inflection

F:	0	4	22	31	44	0	35	31	22	4	0
S:	0	48	52	1	51	0	49	1	52	48	0



T: -44 14 -42 -37 -42 -31 -44 -42 14 -44

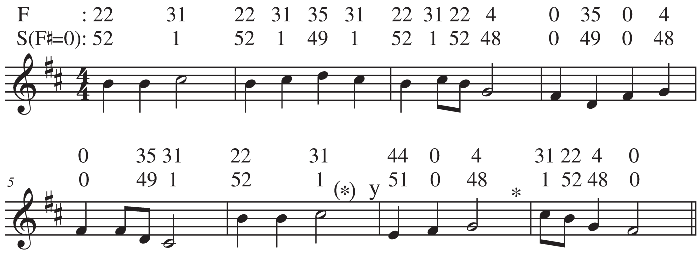
The second note of the collection is sometimes performed lower in pitch, and thus could also be designated outside the 12-tone chromatic collection at S36 or S24 (but probably not as low as S12); this variability might decrease the tonal tension of the note somewhat, but not enough to change its strong tendency toward S0. Likewise, the second descending note in the pure *miyako-bushi* pattern might be performed closer to S37 or S25, again without a significant effect (apart from strength) on its tonal tendency. For the sake of simplicity and clarity, therefore, these two notes are here designated as S48 and S49 respectively, though a more detailed performance transcription of actual melodies could easily take into account the other pitch levels. Interestingly, the basic tendency configuration of this dual-pentatonic collection is the same as that of all the world pentatonic modes, and with all the same caveats (S52 would be more likely to move through S48 on the way down to S0, for example). However, the T numbers tend to be more dynamic overall because of the closer proximity of some pitches.

Sakura ("Cherry Blossoms"), one of the most famous folk songs of Japan, uses *miyako-bushi* exclusively, except for one *min'yō* alteration near the end (marked with a "y" below). For the sake of efficiency, repeated motives and phrases have been removed in Ex.3.9 below.

Like *Etenraku*, *Sakura* follows the expected tendencies very closely. It is interesting that all the melodic "surprises" happen right before the very end, with noticeable effect. The motion marked (*) is technically not against tendency within the *min'yō* inflection, but reflects the leap and sudden change of mode. A more complex example of melody based on this collection, *Rokudan*, is analyzed in Chapter 6.

[11] The naming of Japanese pitch collections is inconsistent across sources and genres (see Tokita and Hughes 2008:19–20). For the sake of simplicity and broad applicability, the more recent scholarly designations *miyako-bushi* and *min'yō* are used here.

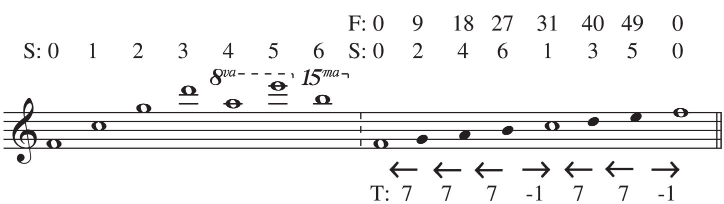
Ex.3.9 *Sakura* (repeated motives and phrases removed)



Diatonic (heptatonic) Collections, Western Tonality/Modality, and "Chromatic" Inflection

As touched on earlier, the diatonic (heptatonic) collection is as ancient and as global, if perhaps not quite as historically ubiquitous in use, as world pentatonic. Indeed, the two additional notes needed to extend world pentatonic into full diatonic may be derived by simply continuing up the 3:2 stack. Interestingly, however, the direct result of this process is not the modern "major scale" configuration, but rather what is today commonly called "Lydian" mode (a name taken by medieval European scholars from Greek theory, but which does not describe the same sequence of intervals as the original; see, for example, Barry 1919:580–82). Here, as in all modes of the diatonic collection, the demarcation between tendencies is quite stark, with the two pitches in closer proximity to the anchors displaying much stronger attraction to them:

Ex.3.10 Lydian mode of the diatonic collection



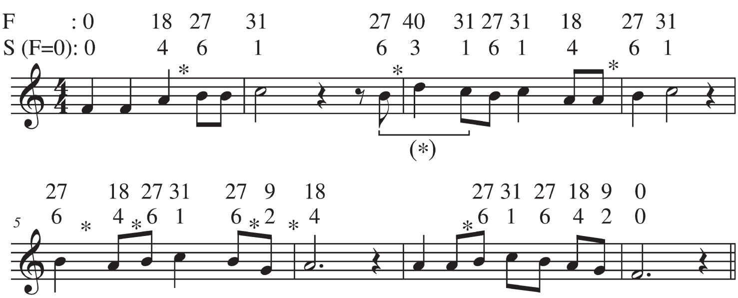
One important feature of this modern version of the mode is the interval of a "tritone" (the span of three "major seconds") from the bottom note to the fourth note in the scale. As is clear from above, this fourth note, or S6, will more likely be expected to resolve upward to S1 rather than down to S4, because of proximity and a lower T number. This feature constitutes an important aspect of musical expression in the "major/minor" system of Western music.[12] However, the so-called "raised fourth" also immediately presents an analytical dilemma in 53-EDO

[12] Chew (1983, especially 35) explores some of these implications.

because, on the one hand, S6/F27 is the proper tuning for the pitch based on 3:2 stacking, while on the other hand S47/F26 would be the correct placement in order for all the intervals in the collection to be of consistent size. That is, the Western "minor second" normally consists of the distance between four F numbers, the "major second" the distance of nine F numbers, the "minor third" 13 F numbers, the "major third" 18, and so on, all of which require the placement of the fourth degree in Lydian at S47 to keep these values intact throughout the collection. This issue applies most often to this particular "tritone," but also comes up with respect to other pitch tuning choices in various Western harmonies, as will be explored in Chapter 4. However, whether the fourth degree of Lydian is set at S6 or S47 does not affect its basic tendency as explicated above, but rather only its strength as reflected in the T numbers. For melodic purposes, S6 is chosen here simply because it reflects the importance of the diatonic collection being understood conceptually as consisting of the first seven S numbers (0–6).

The next example demonstrates the tonal melodic dynamics of the Lydian configuration itself:[13]

Ex.3.11 Icelandic traditional tune



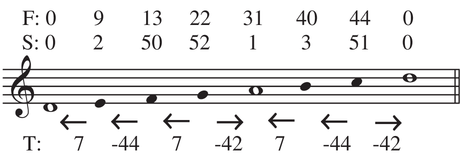
The first and last phrases of this melody feature only the mildest tonal tension in the rising of S4 to S6, and, as expected, the latter phrase releases the tension with a direct conjunct descent to S0. The second phrase includes just a little more dynamism, including one delayed resolution of S6, and the third phrase is the most dynamic of all, with motion suspended around S2, S4 and S6. Thus, tonality contributes to the musical shape of this melody via rising tension through the first three phrases, and a significant release in the last.

As with world pentatonic, the notes of this diatonic collection can be reordered so as to produce a number of additional modes. Though the history of the relationship between diatonic modality and the "major/minor" system of Western European music that emerged from the late seventeenth century is exceedingly

[13] In this chapter, brackets and slurs do not indicate rhythmic groupings as in Chapter 2; instead, brackets are used here to show connections between groups of pitches or pairs of non-sequential pitches.

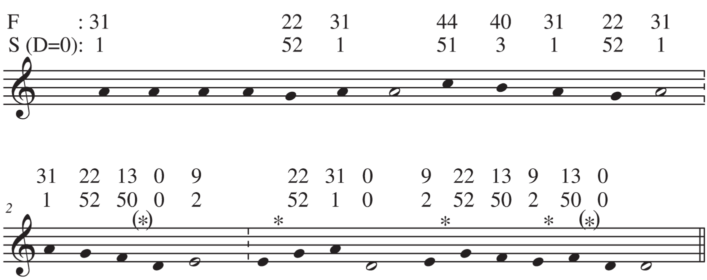
murky (compare, for example, Wienpahl 1971 and Powers 1981), the origins of "major" and "minor" need not be of concern in this context; rather, it is simply the dynamics of the pitch collections to which these terms refer that is of interest here. At the same time, it is clear that all such collections are "modes" (in the sense used in this study) or configurations of the diatonic collection, and, most importantly, that they follow the same trend as the world pentatonic modes in the orientation of their tonal dynamics according to the established S0 pitch and the intervals projected above it. The basic distinction between "major-" and "minor-" sounding modes derives largely from the disposition of the third scale degree, that is, whether it is situated nearer to S4 or S50. For example, a relatively common diatonic mode that fits into the larger category of "minor-sounding" generally takes the name Dorian:

Ex.3.12 Dorian mode



The change in tonal dynamics between this mode and Lydian is significant, due to the presence of several pitches with much higher S numbers and, therefore, much stronger tendencies. The import of some of these expectations can be seen in an example of European "plainchant," a style for Christian worship probably developed in the sixth century (Apel 1990) and preserved for continued use in the *Liber Usualis* of the Roman Catholic Church:

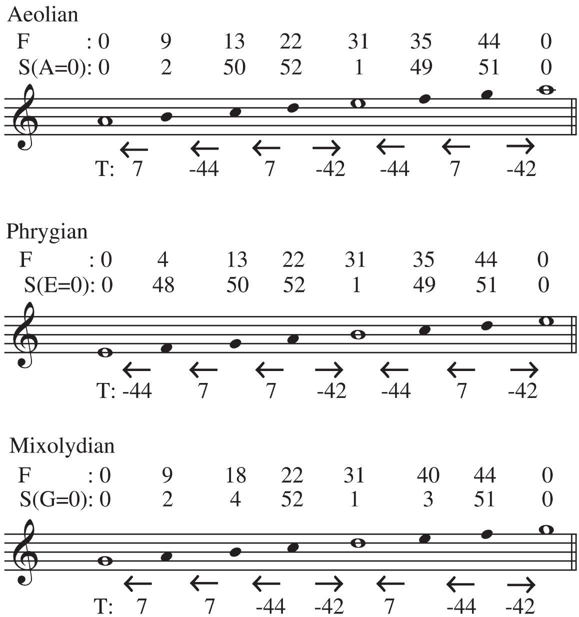
Ex.3.13 *Liber Usualis*, Mass IV, *Benedicamus*



As in world pentatonic mode two above, S52 may just as often resolve down to S50 as up to S1 despite the T number discrepancy, especially when the melodic motion continues down through S2 towards S0 (as in bars 2 and 3 above). Likewise, S51 could be expected to go either direction due to its very high S placement coupled with the low S numbers on either side of it; and, in this case, the T numbers are also very close at −42 versus −44. Finally, the two instances of movement from

S50 directly down to S0 rather than through S2 may be understood according to the pull of S0; moreover, the T numbers are fairly close at −37 versus −44. Three times, tension is increased by the movement of S2 upward to the highly dissonant S52 (with T=63) or S50 (with T=52), while otherwise the music hews closely to the tonal tendencies of the mode.

Ex.3.14 Other diatonic modes



The other three most commonly used diatonic modes are designated Aeolian, Phrygian, and Mixolydian, with dynamics detailed above significantly influenced by the placement of the larger and smaller intervals between adjacent notes.

Robust, creative contemporary usage of these diatonic collections continues in globalized music of various kinds, especially popular music (see, for example, Moore 1992).

The dynamics of the major scale configuration, shown in Ex.3.1 above, are fairly easily understood in the abstract. Yet the complexity of the complete major/minor system is such that providing further analytical detail at this point is important. Many of these details follow logically from the modal configurations outlined above.

Ex.3.15 below shows the pitch configuration out of which actual music in minor keys tends to be constructed.[14] The sixth and seventh scale degrees are variable,

[14] Tymoczko (2004:225–6) gives an interesting and helpful analysis of the logic of minor scale formation.

Ex.3.15 “Minor” scale dynamics

F : 0 9 13 22 31 40 49 0 44 35 31

S (A=0): 0 2 50 52 1 3 5 0 51 49 1 etc.

T: 7 -44 7 -42 7 (7) -1 (-42) 7 -44 etc.

largely depending on melodic direction. This is encapsulated by what is termed the “melodic” form of the scale, with its ascending and descending distinctions.

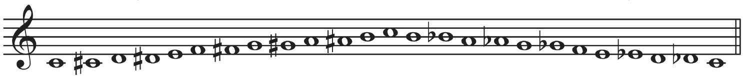
Some of the tendencies indicated here are less clear than in other cases, largely because the contextual expectations of both the major and Aeolian collections operate in free combinations. For example, even though S5 could be seen as tending toward either S3 or S0, the strong pull of the latter normally prevails in musical practice, and reflects the relative distinction between T numbers as they are in the major scale (that is, −1 versus 7). At the same time, despite the indicated T numbers, it is often just as common for S51 to be pulled through S49 on the way down to S1 than for S51 to resolve upward to S0. One might speculate that the reason for this is the expectation that movement from the seventh degree up to the tonic would make use of the “raised” (S5) seventh scale degree version available in this context. Even in (the relatively rare) cases in which the sixth degree is situated at S49 while the seventh degree is simultaneously at S5 (also known as “harmonic” minor, not shown here), the dynamics of each would remain the same. All of this reinforces yet again that although the principles laid out in this chapter do hold in general, they are not always in perfect harmony with one another. As Leonard Meyer (1956) correctly notes, musical effect unfolds through the interaction of expectations and the fascinating and important exceptions to them.

Since these major and minor scale configurations are freely intermixed in global musics, and because a number of pitches from outside the diatonic collection are frequently used for both ornamental and functional expressive purposes, a larger but still limited non-diatonic analytical subset needs to be identified within 53-EDO. Examination of the building-block intervals in the various modes of the diatonic collection, namely the “whole” and “half” steps between adjacent pitch pairs and their concomitant musical effects, leads naturally to the notion of dividing the octave by the smaller of the two, producing 12 equal divisions. As Barbour (1951, especially Chapter 4) explains in some detail, the standardization of this development was remarkably long in coming, possibly because of strong devotion to Pythagorean roots. At any rate, in most theoretical contexts this 12-EDO collection has become known as “chromatic,” to distinguish its expanded “color” possibilities from those of the more limited diatonic set.

The question of which 53-EDO subset(s) are most appropriate for understanding the chromatic expansion of diatonicism (as in Western European music) is a challenging one, especially the more chromatic such music becomes (see, for example, Fuller 1991:220–23; Barbour 1951:123–8; Bosanquet 1876). For the practical analytical purposes envisioned in this study, however, two subsets that approximate the 12-EDO chromatic collection that has increasingly been adopted in global music practice seem worth comparing:

Ex.3.16 Two versions of the 12-tone "chromatic" collection in 53-EDO

F:0 5 9 14 18 23 27 31 36 40 45 49 0 49 45 40 36 31 27 23 18 14 9 5 0
S:0 7 2 9 4 11 6 1 8 3 10 5 0 5 10 3 8 1 6 11 4 9 2 7 0



F:0 4 9 13 18 22 27 31 35 40 44 49 0 49 44 40 35 31 27 22 18 13 9 4 0
S:0 48 2 50 4 52 6 1 49 3 51 5 0 5 51 3 49 1 6 52 4 50 2 48 0

The first of these (above the pitches in Ex.3.16) is built around those pitches closest to pure 3:2 nodes lower in the series. The second (below the pitches) conforms more closely to both the Pythagorean conception and to 12-EDO, though at the expense of falling along some nodes that are very high in the 3:2 series. The first version is more pure acoustically, but it has significant problems for Western music: the half steps between adjacent pitches are not the same size, nor are they symmetrical throughout the scale; moreover, the fifth note of the collection (a "perfect fourth" above the "tonic," in Western parlance) cannot be situated in 53-EDO so as to be in tune with both the tonic and the "minor seventh" (the tenth note in the collection), something that can only be addressed by changing its position back and forth between the 11th and 52nd 3:2 nodes, depending on context. The second version solves the latter problem, while also producing a symmetrical (though not equal) pattern of adjacent half steps. As will be explored in Chapter 4, chromatic *harmonic* contexts require even further adjustments within 53-EDO; the collection here is suggested strictly for melodic analysis. It is interesting to note that since the same diatonic nodes (0, 2, 4, 1, 3, and 5) appear in both collections, much of the analysis revolving around anchors and tendencies is likely to be similar in either case. In both cases, internal intervals that would be identical within 12-EDO are slightly different depending on which scalar notes they involve, though this is generally far less remarkable in actual melodic practice than it would be harmonically.

Furthermore, it is very likely that both versions (and probably many others) are put to use regularly in musical practice: instruments of continuous pitch, such as strings and voice, are free perform along more pure 3:2 lines, while fixed pitch instruments, especially keyboards, rely on the compromises of 12-EDO. Thus, when musicians across these two groups perform together, those using instruments of continuous pitch are likely to be making constant adjustments that the fixed pitch instruments cannot.

Theoretically, then, it might seem appropriate to use the first subset when approaching melodies; the second subset when focused on harmony in works for piano, organ, and the like; and some combination of the two for music written for mixed groups, understanding again that the underlying principles of tension and release are essentially the same for both situations, only more acute in the latter. From a more practical perspective, however, since very little in the Western European repertoire falls outside a 12-EDO context (whether or not the music was written with that firmly in mind), and since most Western music is thoroughly harmonically conceived, it is just as well to accept the 53-EDO subset closer to 12-EDO (that is, the version below the pitches in Ex.3.16) when analyzing such melodies. This is also the version indicated on the 53-EDO chart earlier in this chapter.

An example by W.A. Mozart that features fairly extensive use of the variable minor/chromatic collection is presented in Chapter 6. Meanwhile, the example below illustrates more ornamental use in the context of the major scale:

Ex.3.17 Jesus Gonzalez-Rubio, *Jarabe Tapatio* (nineteenth-century Mexican traditional)

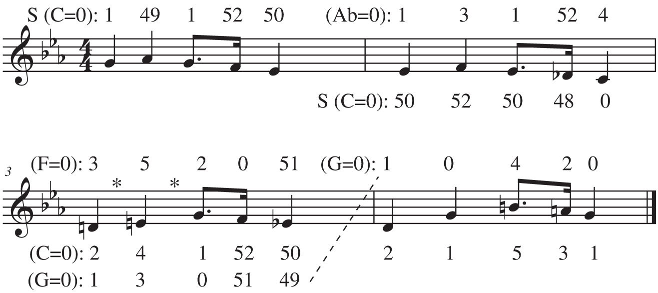
The S numbers in the bracketed gestures are indicative of the level of tonal tension introduced by the chromatic ornaments. Especially interesting here is the fact that the two middle sub-phrases include the most dynamism, the first sub-phrase has little, and the last has none, confirming the pitch effect of the melodic shape. In bars 5 and 6, the (*) show that there is only a slight difference between the expected T numbers: S52 to S2 produces T=−37 versus the expected −44 (S52 to S4) or −42 (S52 to S1). Still, this difference contributes something to the tonal shape, and in Western harmonic theory would be part of a significant chord change.

It is also important to emphasize that in analyzing music that "modulates" (that is, changes S0 orientation) it is necessary to re-orient the 53-EDO subset to each new tonic at the local level, and to consider the relationship of each new tonic to the original tonic. Ex.3.18 demonstrates such considerations (with F numbers omitted for clarity).[15]

The first two bars each establish S0 clearly in conjunction with the melodic motive outlined by S1-S52–S50 and S1–S52–S4. The third bar is the most ambiguous: F=0 has been chosen to some degree based on the harmonies (not

15 An example by J.S. Bach that also includes a modulation is analyzed in Chapter 6.

Ex.3.18 Frederick Chopin, *Prelude*, Op. 28 no. 20, bars 1–4



shown here), but also on the rising S3–S5 pattern that might appear in melodic minor; one reasonable interpretation is that the first two or three beats are heard in F=0 while the last two or three (with an overlap) move back toward C=0, as evidenced by the S1–S52–S50 motive. However, the descending pattern toward S1 in G=0 works just as well in terms of expected tendencies. In any case, the ambiguity of bar 3 contributes significantly to a rise in tonal tension that is resolved somewhat in bar 4. Assuming, based on the remainder of the piece, that C=0 overall, the larger S relationships could be described as S0–S49–S52–S1 (that is, C–A♭–F–G), outlining an attractively dynamic tonal shape as the sudden rise in tension from S0 to S49 is followed by a delay in the expected strong resolution from S49 to S1 via S52.

Moving beyond the Twelve-Tone "Chromatic" Collection

Each of the examples detailed thus far, however, can be analyzed within the 12-EDO collection. In order to bring a much wider variety of world musics into the dialogue of a global music theory, intervals both smaller and larger than those available within 12-EDO must be accommodated, and it is here that the resources of 53-EDO become both clearer and more useful.

Much prior discussion of these intervals has revolved around the idea of the "comma," or the difference between seven pure 2:1 octaves and 12 3:2 stacks. Known widely as a Pythagorean or ditonic comma, this interval amounts to 23.46 cents. For the related reasons discussed earlier, each 53-EDO scale step is very close to this interval, at 22.64 cents, and also known as the Holdrian comma.

Beyond this basic measurement, various musics utilize in practice a number of other non-12-EDO intervals, including the "quarter tone" of Arabic theory (Touma 1996:17–18), at the approximate ratio of either 36:35 (48.77 cents) or 33:32 (53.27 cents). The 12-EDO equivalent would be one-half of a half step, or 50 cents, while 53-EDO offers an approximation of 45.28 cents.

In fact, however, very little of the world's music is truly quarter-tone in conception; rather a number of "neutral" intervals more regularly come into play. These neutrals are typically conceived of as relatively small frequency ratios, and include seconds at 13:12 (138.57 cents), 12:11 (150.64 cents), or 11:10 (165 cents), approximated as 135.85 or 158.49 cents in 53-EDO; thirds at 11:9 (347.4) or 16:13 (359.47), approximated as 339.62 or 362.26 in 53-EDO; sixths at 13:8 (840.53) or 18:11 (852.52), approximated as 837.73 or 860.38 in 53-EDO; and sevenths at 11:6 (1049.36) or 13:7 (1071.57), approximated as 1041.5 or 1064.15 in 53-EDO.

One well-established case in which such intervals operate in ways that increase the complexity of the melodic tonality is that of Arabic *maqāmāt*. Although many Arab theorists suggest a melodic system of quarter tones (or 24-EDO; see Touma 1996:17–18), it is in fact the neutral intervals noted above that appear in identified collections. In practice, these are variable in pitch, though in theory they conform to something approaching 150 cents on either side. The S values chosen here are based on this theoretical understanding, and in the case of *rāst* come even closer to the actual values suggested by Marcus (2007:25–6) for Egyptian music, but analysis using either of the neutral values listed on the chart in Figure 3.1 would produce roughly the same result. Touma (1996:23) and Davis (2004:12–15, reflecting Tunisian practice) provide good supporting information on these neutrally tuned notes. Yarman (2007) suggests an unequally divided 79-tone octave alternative in Turkish music. Once again, 53-EDO appears to offer a workable compromise.

Ex.3.19 *Maqāmāt: Rāst, Bayātī* and *Ḥijāz*

Rāst

F: 0 9 16 22 31 40 47 0 44 40 etc.

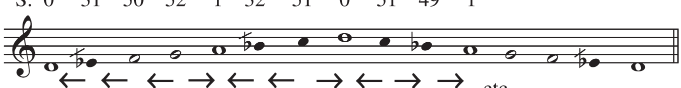
S: 0 2 33 52 1 3 34 0 51 3

T: 7 -24 -13 -42 7 -24 -28 -42 -44 etc.

Bayātī

F: 0 7 13 22 31 38 44 0 44 35 31 etc.

S: 0 31 50 52 1 32 51 0 51 49 1

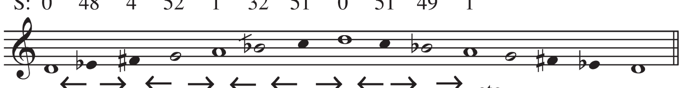


T: -24 -13 7 -42 -24 -13 -42 -42 -44 -44 etc.

Ḥijāz

F: 0 4 18 22 31 38 44 0 44 35 31 etc.

S: 0 48 4 52 1 32 51 0 51 49 1



T: -44 -30 -44 -42 -24 -13 -42 -42 -44 -44 etc.

Three common examples of *maqāmāt*—*rāst*, *hijāz*, and *bayātī*—are here notated in traditional fashion with a slash through the flat symbol. Each includes a subset of focal pitches around which melodic sections are organized. In the case of *rāst*, two of the three focal pitches correspond to the anchors S0 and S1, while the third is a satellite/tendency tone at S33, thus configured in some ways not unlike the diatonic minor modes, though with the neutrality of scale degrees three and seven perhaps mitigating the strength of their tendencies somewhat. In both *rāst* and *bayātī*, the two neutral pitches are designated 3:2 apart.

Because the focal pitches of *maqāmāt* may not all be anchors in a tonal sense, interactions between both focal and anchor sets should be considered. In both *hijāz* and *bayātī*, the primary anchors are in fact still S0 and S1, though only S0 is considered a focal pitch. In the case of *bayātī*, the other two focal pitches are S50 and S52, while in *hijāz* they are S52 and S32. Thus, when melodic motion orbits these non-anchor focal pitches, a noticeable degree of expressive tonal tension is created.[16]

The following analysis of the opening of *Samāʿī Bayātī* by Ibrāhīm ʿAryān (1850–1920) illustrates this tension between anchor/satellite tendencies and organization around focal pitches. S0=D:

Ex.3.20 Opening of *Samāʿī Bayātī al-ʿAryān*, melody only[17]

In this context, the *īqā* dictates grouping of eighth notes as 3+2+2+3 for each bar. Note that nearly all of these groupings begin with one of the three focal pitches

[16] The tuning of *hijāz* is based here on Marcus (2007:14, 41) and Touma (1996:33); Davis (2004:13–15) suggests that the second scale degree might be slightly higher, which would further mitigate its T strength.

[17] Additional examples in *bayātī* can be found in Cohen and Katz (2006:52–62, 370, 386, and 406–8), and in various other *maqāmāt* suitable for analysis in Davis (2004).

or a conjunct satellite pitch leading to a focal pitch. Interestingly, some instances where this is not the case revolve around S1, which is also the upper anchor in this passage (though sometimes approached from above). The shape of the melody is similar to many others in that the tonal dynamism is concentrated more in the middle and less at the beginning and end, creating a kind of arch. Also like other examples, a rise in rhythmic complexity corresponds with the rise in tonal dynamics (for example, the end of bar 3 through bar 4). One element not reflected in this simplified transcription is the heterophonic texture resulting from several performers playing the melody with slightly different ornamentation, but this does not change the basic dynamic of the overall melodic shape. The three instances of (*) with a bracket are examples of delayed or ornamented resolutions. The (*) in bar 2 technically follows regular tendency, but noticeably displaced by an octave, while the non-bracketed instance in bar 4 has a low T number that is in the range of other regular resolutions in the collection (see Ex.3.19 above).

Indian Rāga

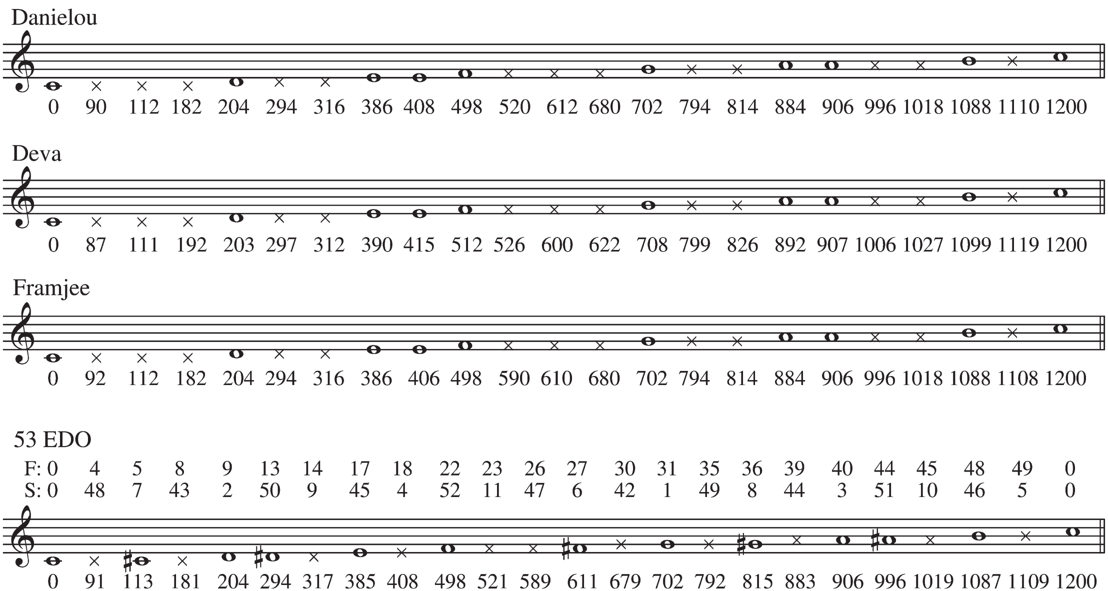
A second particularly well-established example of melodic practice lying outside of 12-EDO conception is that of Indian *rāga*. On the one hand, *rāga* stems theoretically from the concept of 22 śrutis that define intervals within an octave.[18] On the other hand there are only seven named pitches, or *svaras*, which may be altered chromatically, and which in transcription are usually represented using the 12-EDO system.[19] At the same time, Indian musicians insist on finer pitch gradations than 12-EDO allows, and these gradations are not completely independent from the śruti concept. Despite some evidence that there are no fixed intervals in Indian music (Kaufmann 1968:9–10; Jairazbhoy 1975), a number of scholars (Danielou 1980; Deva 1973; Framjee 1986; Sambamurthy 1999) have arrived at various śruti tunings. Ex.3.21 below (with values indicated in cents) shows how several of these vary in certain respects. Each also reflects the basic pattern of the number of śrutis per consecutive *svara* as 4–3–2–4–4–3–2, documented by Jairazbhoy (1975:39, 53). In the aggregate, these lead to a 53-EDO model that includes 23 rather than 22 possible values, shown at the bottom of the figure. The subset of seven *svaras* is emphasized here, with the 53-EDO model also reflecting chromatics that maintain internally pure 3:2 relations, though at the cost of divergence from the closest 12-EDO values and inconsistent half steps (Sambamurthy's version is not included, since it is so close to the others, and especially to 53-EDO, in most respects).

Rāga pitch arrangements, then, can be seen as subsets of this collection. Moreover, each *rāga* features focal pitches designated *vādī* (primary) and *samvādī* (secondary). It is important to note that Indian melodic practice always occurs against a drone backdrop utilizing what would be S0 and S1, even if the latter pitch

[18] For a discussion of this and what follows, see Fletcher (2001:244–53).

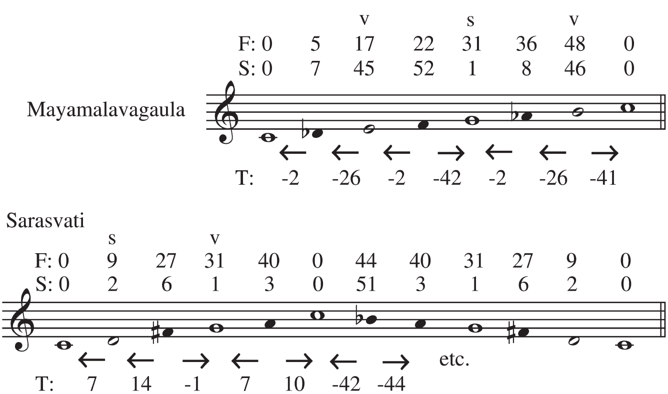
[19] See, for example, Kaufmann 1968 (especially 8–9), Morris 2001, and Morris and Ravikiran 2006.

Ex.3.21 Various interpretations of Indian śrutis, with resultant *svaras* and chromatics (in cents)



does not appear in the *rāga*. Thus the expressive effect of the tonal development is firmly situated in the context of tension and release against these two anchors, and not least in the interaction of these with the *vādī* and *samvādī*, traditionally through a series of *gamakas* (ornaments) and *sanchāras* (characteristic phrases). Two common, contrasting examples are the Carnatic (South Indian) *rāgas Māyāmālavagaula*, which is the same ascending and descending, and *Sarasvati*, which features a smaller number of notes and different ascending and descending forms. The *vādī* and *samvādī* are labled "v" and "s" respectively; in these examples, S1 serves as both an anchor and as *vādī* or *samvādī*. Because of the many śruti alternatives shown above, the *rāga* models below may not always be definitive in practice; indeed in a subsequent section of the chapter, a number of variable pitches will be shown in use, including possibilities that are within 53-EDO but outside the śruti model given above. Nevertheless, this seems to be a useful place to begin.

Ex.3.22 Models of *rāgas Māyāmālavagaula* and *Sarasvati*, with tonal dynamics



The designation of S45 and S46 as *vādī* in *Māyāmālavagaula* creates a great deal of dynamism, as, for example, in the following extended characteristic phrase revolving around the two notes; recall also that S0 (C) and S1 (G) sound a continuous drone throughout, interacting with each melodic note:

Ex.3.23 A traditional *Māyāmālavagaula* characteristic phrase

The overall dynamics of *Sarasvati*, including clear examples of two of its characteristic phrases, can be seen in the following excerpt from the end of the *anupallavi* section of *Anurāgamulēni*, a *kriti* (sacred devotional song) composed by Tyagaraja.[20] Here S0=C, and the melody follows the tonal tendencies predicted by the S numbers, departing from them briefly for the pitch climax and for an ornamental moment (as indicated by the asterisks):

Ex.3.24 *Anurāgamulēni* excerpt, with two characteristic phrases in *Sarasvati*

The Dynamics of Pitch Variability: A Comparative Analytical Sampling of Four Vocal Recordings

Turning now to a more detailed demonstration of both the potential for and the complexities of analyzing melodic pitch dynamics across cultures, four recorded performances of music from rather different contexts are examined, namely, vocal examples in West African pentatonicism, African-American "blues," Arabic *maqāmāt*, and Indian *rāga*. Spectrographic analysis—provided here only for comparative purposes among these few examples in which some non-12-EDO pitch material is expected and thus more clearly analyzed—confirms that tuning and interval sizes are in constant flux during actual music-making, regardless of context. Nevertheless, a number of expected pitch relationships within identified collections can still be illuminated through this method, and at levels of detail not otherwise as clear. The frequency data (in Hertz) obtained from spectrographic analysis, as well as the resulting pitch interval measurements (in cents), relies on some averaging in order to mitigate against vibrato, technical vagaries of the recordings themselves, and, in several cases, aggregate results of more than one performer playing similar pitches at the same time. Despite the fact that even anchor relationships vary from theoretical expectations in these performances, this section demonstrates that annotated 53-EDO renderings still provide an analytically useful picture of the melodic pitch dynamics according to the principles laid out earlier in this chapter. At the same time, similarities and differences between these melodies, both subtle and pronounced, can be seen because of the use of common analytical terms.

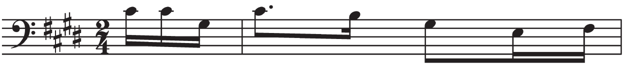
[20] Adapted from material presented by Wade 1979:44.

Sierra Leonean Song

The first example, the opening solo phrase from a Temne Christian song from Sierra Leone,[21] seems to fit reasonably well aurally and theoretically into world pentatonic mode two, with the upper C♯=0:

Ex.3.25 Temne Christian song phrase

Predicted	F: 0	31	0	44	31	13	22
	S: 0	1	0	51	1	50	52
Observed	F: 1	35	1	45	31	13	25
	S: 12	49	12	10	1	50	35



Hertz:	275	214	275	243	204	160	188
Cents 1:	1258	823	1258	1043	741	320	599
Cents 2:	1200	766	1200	986	683	262	542
Average:	1229	795	1229	1015	712	291	571

S0=E				0	11	18	0
				0	26	4	0
S0=low C#		26	0	15	26	33	14
		47	0	21	47	25	9
Predicted	31	22	0	13	22	31	13
	1	52	0	50	52	1	50
Observed	31	24	52	14	25	32	13
	1	23	41	9	35	13	50

204	186	133	162	187	205	160
741	581	0	341	590	749	320
683	523	-58	284	532	691	262
712	552	-29	313	561	720	291

In reality, however, a much more complex set of considerations should be taken into account. For one thing, the disparity between the high and low S0 (1258 cents as opposed to the expected 1200) leaves some doubt as to where to set the zero-cent mark. Additionally, both the high and the low tunings of S0 must be considered the strongest local attractors regardless of these disparities; this is why the analysis includes measurement of intervals against both the high and the low version of S0, as well as those values averaged together. These data appear below the staff.

---

21 Transcribed from a personal recording made in the field by Alton Shea, *c*.1975; used by kind personal permission of Mr. Shea.

One important example of this dual measurement is the note B in relation to C♯. World pentatonic mode two predicts that B would be S51; this is indeed how it appears measured against the high C♯, while the average measurement of 1015 cents puts it a little higher and less tonally tense at S10. At the same time, however, the measurement between this B and the subsequent low C♯ comes in at 1043 cents, or right in what has been called "neutral seventh" territory around S22. Likewise, the second E in the example (second full bar) comes to 341 cents in relation to the low C♯ just before it, putting it within "neutral third" territory around S21; this is so even when averaged with the two 320-cent occurrences measured against the low C♯. These two neutral intervals, E (a third above S0) and B (a seventh above S0) are sometimes considered to be a feature of African tuning (see, for example, Ekwueme 1974:132–3 and Kubik 1985:35), and can also be discerned in the example of African-American blues singing that follows later in this chapter. Designating them as S21 and S22 respectively would furthermore retain a 3:2 ratio between them. Some analytical/interpretive consideration should be given, then, to a range of possible interval sizes for these members of the melodic collection even as their tendencies within world pentatonic are discussed.

Above the staff in the example, the theoretically predicted S values are compared with the observed values (again, based on the averages). Each tendency moment may be considered in turn. The expected tendency leap from G♯ back up to C♯ in the opening gesture is reflected by both the model and the observation; the fact that the latter (T=−15) is actually much stronger than the theory predicts (T=21) does not detract from the tendency expectation, but rather enhances it. The dynamic tension of the next moment, from C♯ to B, does not at first seem as well predicted (T=7 versus the expected T=60), but this discrepancy can be mitigated by considering the B to be S51 at that point in relation to the C♯ immediately preceding (that is, at 986 cents down from 1200), in which case the tonal dynamic corresponds much more closely, at T=48.

This same consideration is important in the subsequent movement from B to G♯. In the world pentatonic mode two model, B's tendency back up to C♯ would be T=−42, whereas B down to G♯ would be T=−37, making them close. On the other hand, the rather neutral calculation from observed data of T=5 does not suggest a significant move against tendency either. (Reorienting B to S51 again and G♯ to S42 produces the same result). And, given the observed averages here, B at S10 actually would be more likely to move down to G♯ at S1 than up to C♯ at S12.

Because of the lack of clarity as to whether to measure against the lower or the higher observed S0, or to use averages, tonal dynamics within the next two beats become somewhat harder to analyze. Most problematic is the E to F♯ movement, because the F♯ is so much higher in pitch than expected, no matter which measurement is used. (Indeed, the F♯ is really much more like a "neutral fourth" above S0 throughout the excerpt, a characteristic that will also be observed in the African-American example that follows this one). The model shows E to F♯ constituting a mild rise in tension (T=11), with F♯ to G♯ constituting a significant release of tension (T=−42). Certainly the latter is true whether using the predicted or observed values, but E to F♯ seems to constitute a mild release of tension according to the observed averages (T=−6). However, this is not the case using the measurements from the lower S0; there the E to F♯ movement would be from S9 to S47, with T=40. Using the measurements from the higher S0, the movement would be from S38 to S23, with T amounting to a somewhat neutral −3. Finally, the speed with which the melody passes through this moment, compared to the held G♯, seems to suggest that the ambiguity of the tonal import is not as significant. More important seems to be the tonal tendency for a raised F♯ to hover closer to the G♯.

This higher F♯ then leaps nearly the distance of a Western tritone down to the low C♯. Here the best aural/analytical choice seems to be to firmly orient around this C♯ as S0, and thus to finish the analysis using values calculated on that basis (reflected in the third highest set of numbers above the staff in the example). As noted before, this puts one of the two Es in "neutral third" territory, and gives both of them lower S numbers. It also further accentuates the very high tuning of what would normally be S52 "fourths," but what are instead S47 tritones; the similar S numbers, however, actually make their tendency dynamics approximately the same. Most problematic is the G♯, normally expected to be closer to S1 at 702 cents, but here at S25 (749 cents). While this tuning does not fatally detract from the dynamic of F♯ at S47 moving to G♯ at S25, it does alter the analytical interpretation of the final movement from G♯ to E at S9, presumably a release of tension. However, there is something to be said for this insight, since the E actually constitutes the cadence at the end of the phrase. Because of this, a better analysis might in fact reorient the music yet again to E as S0 near the end (reflected in the uppermost set of number above the staff in the example); while the F♯ would still be very high as the second scale degree, the G♯ would become a well-tuned third scale degree at S4, moving to S0 in world pentatonic mode one. This might also explain why several phrases in the entire song, including the final phrase (not shown here) end on B: if S0=E at times, B as S1 could serve as a plausible cadential note.

African-American "Blues"

Moving forward, an examination of the melodic implications of the African-American "blues scale" is a particularly apt next step here, because the blues are a clear and well-established example of an intercultural (global) musical hybrid. This collection can be understood according to the terms of this study as a synergy of certain West African rhythmic and melodic characteristics and Western tonal harmony. Blues melody can also be most simply understood tonally as arising from an extension of world pentatonic mode two, along the lines observed in the previous Temne song. Due to the orientation of the underlying harmonies, and for the sake of clarity, the scale degrees will in this context be discussed as if they are a subset of Western "major" and/or "minor" scales.

Traditionally, then, the extensions from pentatonic include the more variable "neutral third" scale degree (not unlike in the Arabic *maqām rāst*, but lacking an intermediary scale degree between it and S0), the similarly conceived "neutral seventh," and an additional raised fourth degree, all aspects already observed in the Temne analysis above. Moreover, again due to the Western harmonic aspects of this music, both more purely "major" and "minor" versions of scale degrees three and seven may also be included. The example below details these configurations. The addition of S6 to world pentatonic mode two simply creates another tendency toward S1. Meanwhile, the neutral third and neutral seventh even out the extreme

Ex.3.26 Blues scale

"neutrals": F15/16 S21/33 F46/47 S22/34

F:	0	13	18	22	27	31	44	49	0
S:	0	50	4	52	6	1	51	5	0

differences in tendency between S50/S4 and S51/S5, while remaining strong enough to gravitate in the same expected directions. One can imagine the tonal shape of three common blues figures, for example: the progressive release of tension in S52 rising through S6 to S1; the perhaps more dramatic S6 moving down through S52 (a strong rise in tension), through S50 (a slight release of tension) or S21/33 (with more release of tension), and ending on S0 (a considerable release of tension); and the similar S1 rising through some combination of S51, S22/34, and/or S5, on the way up to S0.[22]

Analysis of two vocal phrases from *Lost Your Head Blues*, as originally improvised on recording by Bessie Smith (*c.*1925), is highly instructive. The transcriptions below are based on the theoretical model of the blues scale noted above, but further informed by spectrographic data analysis of the recorded performance. (From this point on the Hertz data is omitted from the examples, and only the resultant intervals are shown in cents.) The expected neutral third and neutral seventh are both present, indicated by an expanded pallet of accidentals, and a variety of fourth scale degrees operate flexibly between scale degrees three and five. Precisely because of this variability, the dynamics of tonal tension and release are a bit more complex in reality than in theory. Still, they operate largely around the principles identified throughout this chapter. In the Ex.3.27a, S0=D.

This first phrase hews rather closely to the model predictions overall, though the few exceptions are notable. The G♯s in the first complete bar are considerably higher than expected, but this does not interfere with their tendency to move upward to the A; indeed such tendency is intensified here. The first G♯ in the second full

---

[22] It is not surprising, then, that performers of the blues on fixed-pitch instruments such as the piano often attempt to approximate the neutral pitch varieties by rapid alternation between and/or simultaneous playing of consecutive chromatic pitches.

Ex.3.27a Bessie Smith, *Lost Your Head Blues*, first example phrase

Predicted	F:	18	22	27	31	0	16	22	27	31	27	22	15	0
	S:	4	52	6	1	0	33	52	6	1	6	52	21	0
Observed	F:	18	22	30	31	0	16	22	26	32	27	23	15	0
	S:	4	52	42	1	0	33	52	47	13	6	11	21	0

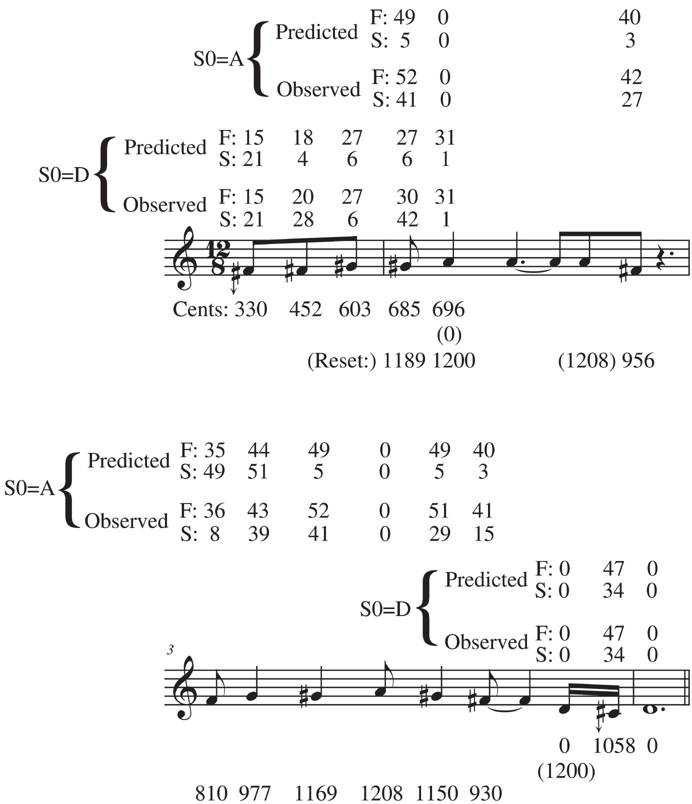
Cents:	408	495	685	704	0	358	499	582	726	602	516	335	0

bar is simply the alternative Western tuning of S47, which again merely intensifies its tonal dynamic, while the last G♯ finally settles into the expected S6 tuning. In this same bar, the neutral thirds each fall into one of the two expected tunings. The last G♮ is a bit higher and has a lower S number than expected, which does diverge somewhat from the tonal dynamic predicted by the model, but not enough to significantly change the overall shape of the figure. Perhaps the most interesting feature is the long A in the second full bar, which, like one of its counterparts in the Temne song, is tuned quite high at 726 cents; this phenomenon does not alter the dynamic shape drastically in relationship to the previous note (G♯), but does leave the A at a higher level of expressive tension than normal while also contributing subtle tonal ambiguity to the rest of the bar.

A dual analysis of the second phrase presented below (Ex.3.27b, the third phrase of the composition) is helpful, because the change in the underlying harmony (from "tonic" to "dominant" in classic Western terms) actually resets the pitch collection transposition for most of the phrase such that S1 (A) becomes S0.

The shift to S0=A causes the neutral thirds to become unexpected neutral sixths (as in *maqām bayātī*), while the range of fourth scale degrees become variable sevenths. The collection shifts back to S0=D at the very last gesture of the phrase (two sixteenths leading to the long D), and features a clear neutral seventh. This second phrase shows clearly that a wide range of neutral intervals comes into play, but also that, in the aggregate, these create tonal shape largely along predicted lines. As in the first phrase, however, a few notable exceptions invite further comment. One of these is that G♯ is consistently tuned quite high, with a noticeably higher S number. The explanation for this seems fairly straightforward: the performer wishes to create more tonal tension as she drives the line up toward S0 or S1. In that sense, the numbers in the model do predict the correct dynamic tendency, but not the potential intensity of its strength in the performance. This is why emphasis needs to be placed on the general tonal pull of S0 and S1. A second exception is the almost mirror-image tonal shape of the prediction versus the observation in the four-note sequence starting with the F♯ just before the internal dotted quarter rest. At the same time, the larger shape of that sequence, from S27 through S41 to S0, is matched somewhat by the S3 to S51 to S0 contour of the model. Here the limitations of the theory may be seen; however, though not every detail of every melodic moment is captured, a reliable overall picture may be drawn from it nevertheless. And it is

Ex.3.27b Bessie Smith, *Lost Your Head Blues*, second example phrase

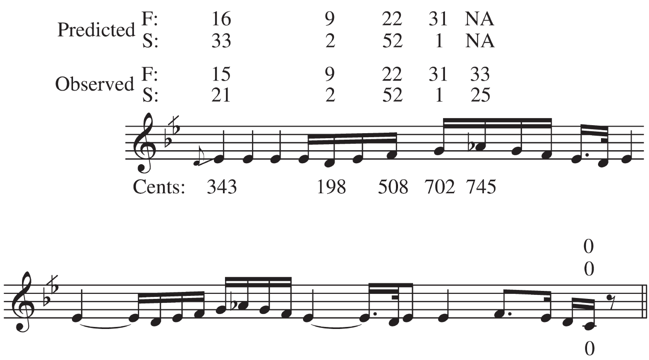


appropriate to remember again that neither are the details of such tuning vagaries in Western tonal music captured by traditional 12-EDO analysis.

Palestinian Mu'annā Revisited

Many of the same issues and elements relevant to the Temne and blues examples also apply to the following example of Arabic singing, including the dynamics of neutral scale degrees in the presence of established *maqāmāt* focal pitches and possible ornamental pitches around them. The example includes the first two phrases of unaccompanied Palestinian singing from the *Mu'annā* already examined rhythmically in Chapter 2. This piece is in *maqām rāst*, as detailed in Ex.3.19, which explores the neutral third as a focal pitch. Remarkably, none of the pitches varies by more than one cent (on average) from its first appearance in the recording, and so each is detailed only once here. The A♭ is an ornamental pitch not typically included in *rāst*, though its repeated resolution back to G (S1) is predicted well:

Ex.3.28 Palestinian *Mu‘annā*, first two phrases



Both the tuning consistency of the singer and the closeness to values predicted in 53-EDO are remarkable in this case. That S21 is a heavily emphasized focal pitch does introduce a different sort of tonal dynamic in this music, although the fact that the performer sings this neutral third closer to the lower of two possible S numbers (that is, 340 versus 362 cents, the ambiguity of which is also reflected in the blues scale example earlier) should not be ignored. At the same time, S0 and S1 are also focal to this *maqām*, providing considerable inherent stability in the tonal balance.

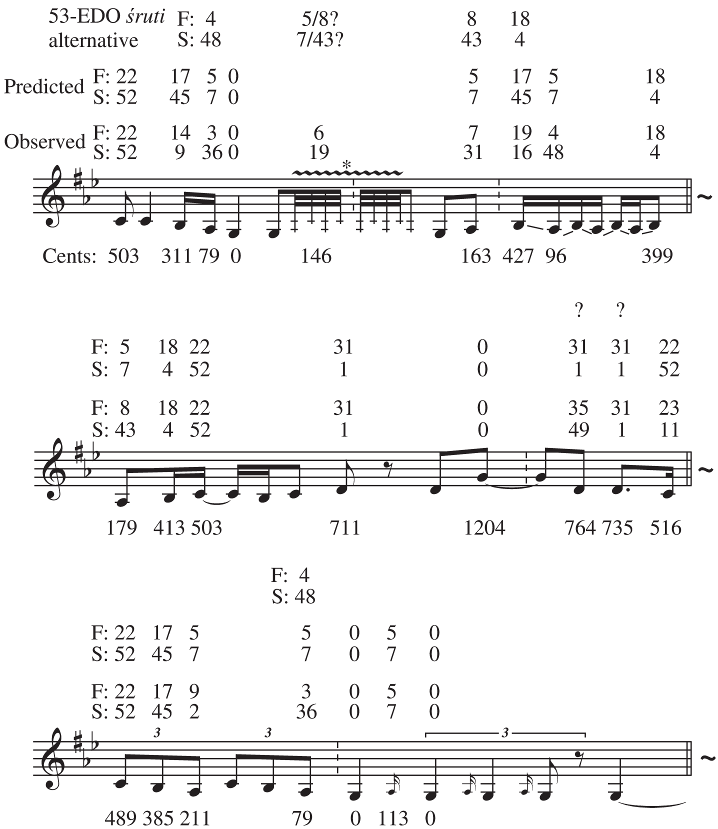
Vidulaku (Indian Kriti) Revisited

The final comparative example in this section (Ex.3.29) is drawn from another piece examined rhythmically in Chapter 2, three selected phrases from the *pallavi* (first section) of *Vidulaku*, a *kriti* by Tyagaraja, as sung by M.S. Subbulakshmi (1970), one of the most revered Carnatic singers of the twentieth century. The *rāga* here is *Māyāmālavagaula*, already presented in Ex.3.22, with S0=G.

The gesture marked * is one of the traditional *gamaka* (ornaments) in this *rāga*, a wide *kampita* (vibrato) around the second and third scale degrees, which explains the complexity of the tuning at that moment and in the sliding in last bar of the first line. This *kampita* moment proves very challenging to the analysis, as no śruti approximation is close to the observed 146-cent pitch (though either S19 or S31, outside the śruti model, is reasonably close). Such a situation may be due to the limits of the spectrographic analysis technique, but it may also demonstrate the limits of melodic analysis with regard to complex ornamentation, and encourage more attention to clearer structural pitches.

Other data suggest that the śruti model put forward earlier may itself be too limited. Connected to the ornamentation in this particular example is the highly variable nature of the second pitch in the *rāga* collection, approximated as an A♭ in the example. S48 and S43 emerge as reasonable 53-EDO śruti alternatives to S7 for this pitch in some instances, emphasizing a higher level of tonal tension. The opposite

Ex.3.29 Three phrases from *Vidulaku*[23]



of this (that is, less tonal tension) is reflected in the S16 and S4 alternatives to the third pitch in the collection, approximated as B in the notation. Thus the example suggests that more accurate variable tunings from within 53-EDO śruti possibilities are available if desired, and might be particularly useful in developing analytical models for specific *rāgas* based on known characteristics. At the same time, many aspects of the tonal dynamic are reasonably well predicted by the original, more generic model. As in the preceding examples analyzed using spectrographic data, even the S1 anchor is subject to variability; interestingly, S37 and S32 are close to the realities of the Ds near the end of the second line of this example, but these do not fall into the 53-EDO śruti models presented earlier. This suggests the option of abandoning the limitations of śruti-based modeling, a possibility that ought to be seriously considered, given these data. In either case, however, the overall usefulness of 53-EDO is reaffirmed.

---

[23] *Vidulaku Mrokkeda (kriti)*, as performed by M.S. Subbulakshmi. Copyright © 1970. Published by Saregama India, Ltd. All Rights Reserved. Used by Permission.

At the Edges of Tonality and Timbre: Selisir Mode (Pentatonic Subset) of Pélog

Having examined the proposed system in the context of some performance realities, and continuing with the tacit assumption that such issues will be inherent in any musical situation, it is appropriate now to consider a well-established global pitch collection that is both more limited in scope and more challenging in its implications.

As Michael Tenzer (2000:27–33) and Jay Rahn (1978) demonstrate, Indonesian *gamelan* tunings present considerable challenges to the notion of an underlying consistent theory of interval sizes along the 3:2 spectrum (or 53-EDO equivalent). In fact, as both Sethares (2005) and Schneider (2001) show in great detail, the acoustically strong inharmonic aspects of *gamelan* instruments, coupled with no consistent tuning from ensemble to ensemble, inconsistent octave sizes, and clear tuning variations from octave to octave in the same instrument (Tenzer 2000:30, 32; Rahn 1978:73–4), almost suggest that specific interval sizes based on fundamental frequencies are not critical to the apprehension of *gamelan* melodies. Tenzer reinforces this notion to some extent in his description of melodic contour (and timbral strata) as more important than melodic intervals, since, for example, Indonesian listeners seem to find little difficulty identifying the same classic melodies when played by different ensembles with different tunings. This comports with other research suggesting that pitch contour is very important for melodic identification in humans, a topic that will be considered briefly at the end of this chapter.

Still, contour alone does not seem sufficient to explain specific melodic recall in a system in which only five pitches are used. Rahn (1978:77–8) appropriately questions "how one [could] know … that a given ensemble or instrument is tuned to *pélog*" if there is no consistent underlying basis for *pélog* tuning at all. Tenzer (2006b:212) suggests that the "small-small-large-small-large" general arrangement of the scale intervals is sufficient, but Rahn's statistical treatment of data from a large number of ensembles implies that something more specific is at work. Moreover, Tenzer's note (2000:28) that *gamelan* tunings may have their roots in singing suggests possible affinity with fundamental ratios.

Such ongoing discussion notwithstanding, a workable model of this *pélog* subset is needed that is sufficient for practical comparative analysis. Three very different theoretical approaches may serve to provide input for such a model. Using statistical analysis to build on the work of Kunst (1973), Rahn (1978) provides some convincing evidence that, in theory, the derivation of the Javanese *selisir* mode (common pentatonic subset) of *pélog* is as likely to lie within or very close to 9-EDO (with 133-cent steps) as anything else. Weintraub (1997), citing West Javanese theorist Koesoemadinata (1902–79), provides additional support for the 9-EDO view, as does some analysis from data in Surjodiningrat et al. (1972).

Alternatively, Tenzer (2000:31) presents the findings of Andrew Toth, who records three classes of Balinese *pélog* tunings; in keeping with the spirit of convenience suggested by Tenzer (2000:xxiv), 12-EDO pitch approximations are used here and in subsequent transcriptions. *Begbeg* is characterized by greater differentiation between small and large intervals, while *tirus* offers more even convergence between them. The "middle" tuning, *sedeng*, represents a sort of compromise between the other two more extreme conceptions. It is interesting to note that *sedeng* offers a smaller first interval (136 cents) in comparison with the second interval (155 cents), something that is loosely reflected in Tenzer's 12-EDO representation of these first two steps as C♯ to D and D to E. Remarkably, if one considers both relative pitch locations and interval sizes, any of Toth's measurements hews fairly closely to 53-EDO intervals; nearly all such comparisons are less than 10 cents apart, many are within three cents or less (that is, virtually exact), and the two largest discrepancies are 11 cents.

Finally, Fletcher (2001:275), citing Richard Widdess, notes the possibility that Indonesian pitch collections were derived from Indian śrutis. Using some of the classic śruti measurements presented earlier in this chapter could yield the seventh configuration below, based on a combination of Toth's models. And, as noted above, the actual interval sizes are likely to be adjusted for different pitch ranges and timbres within and between instruments in the *gamelan*, making "stretched" or "compressed" octaves not uncommon.

All three of these approaches are reflected in the models below:

Ex.3.30 Various *gamelan* tuning measurements, and 53-EDO approximations, in cents

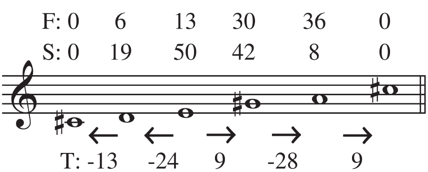
9-EDO subset	0	133	266	666	800	1200
53-EDO	0	136	272	657	792	1200
begbeg	0	120	234	666	747	1200
53-EDO	0	113	226	657	747	1200
sedeng	0	136	291	670	804	1200
53-EDO	0	136	294	679	815	1200
tirus	0	197	377	724	828	1200
53-EDO	0	204	385	725	838	1200
53-EDO *śruti*-based	0	113	294	679	815	1200
53-EDO stretched octave 1	0	136	272	679	815	1222
53-EDO stretched octave 2	0	113	249	679	792	1222
53-EDO compressed octave	0	113	249	656	769	1177

While such models are clearly theoretical and designed to reasonably reflect the nature of the *selisir* mode of *pélog* within 53-EDO for comparative analytical convenience, considerable flexibility in practice, combined with the overall proximity of the various actual measurements to 53-EDO intervals, suggests sufficient correspondence to bolster confidence that they are at least in the right conceptual universe for these purposes.

Setting the first interval at 136 cents and making it the smallest interval in the configuration seems to be a reasonable analytical choice, since it is 136 cents in the *sedeng* example and 133 in 9-EDO; aural experience of *gamelan* music seems to correspond with intervals at the bottom of the collection that sound rather more like neutral seconds than like Western half-steps of 113 cents. Likewise, continuing the model with 53-EDO values can be seen to reflect the rest of Toth's *sedeng* and also to hew closely to the śruti approximations given earlier. While this is the pitch model that will be used for the sample analysis herein, it is important to reiterate that a variety of simultaneous and shifting models, all credibly situated within 53-EDO, could be used in more detailed *gamelan* analyses.

It is useful, then, to consider the following tonal dynamics inherent within an approximate composite model:[24]

Ex.3.31 Model of tonal dynamics in *selisir* mode of *pélog* subset



Because no 3:2 (702-cent) intervals are present, the tendency appears to be toward convergence around three anchors, in the following order of decreasing strength: S0, S8 and S19. This creates a number of tonally dynamic complexities not as clearly present in many other small collections such as world pentatonic or even *miyako-bushi*. Thus, observation of the T numbers during analysis becomes more critical. The resulting shapes can be observed in the following *gamelan* excerpt, an extract from a particular version of the popular 1951 Balinese *gamelan gong kebyar* composition *Oleg Tumulilingan*[25], in the way both the *neliti* (fixed core melodic shape) and the more elaborately ornamented *ugal* melody (based, as all

[24] As but one example of another version from within 53-EDO, the third pitch might be designated as S38 rather than S50, something that would provide for a more consistent "small" interval size and alter the T-number dynamics somewhat. The larger point is that the 53-EDO collection allows for such flexible options, even within single analyses.

[25] Adapted from a transcription by, and used by kind permission of, Michael Tenzer.

Ex.3.32 Extracted cycle from *Oleg Tumulilingan*

the parts are, on the *neliti* outline) unfold.[26] Only selected portions of the *ugal* elaboration are indicated as illustrative.[27]

Among the many interesting features demonstrated in this particular passage is the clear preference for S8, rather than S0, as the most consonant anchor. The consistent motion around the strongest tendency tone, S50, and its polarity with S8, may account for much of the melodic pitch energy here. The prominence of the expressive figure outlining S8–S42–S50–S19 (descending and ascending), with its arc-like tonal dynamic shape, is also noteworthy. Finally, the interactive texture of this example provides an introductory glimpse into the features of polyphony and heterophony that will be considered further in Chapter 5.

Here too, more attention might be paid to the T-number shape of the *neliti* as it unfolds. It is interesting that the highest T number (that is, the most tonally dynamic moment) occurs between the tenth and eleventh notes of the 16-note cycle, which is almost precisely the 2/3 point. While it may be coincidence in this case, the question of whether the Golden Section serves as a "qualified universal" with regard to musical shape and process will be revisited briefly in Chapter 5. Meanwhile, the rather precipitous mix of low and high T numbers here is also noteworthy, exemplified once again by the figure S8–S42–S50–S19, with its T-number sequence of −19, 40, 25, and −24.

Tenzer is careful to emphasize that each of the five tones of the *pélog* subset does not operate musically under the same precise concept of "octave equivalence" as understood in, for example, pitch class set theory, but rather projects an independent pitch space, or "tone region" throughout the range of the various *gamelan* instruments. Thus, "when *gamelan* melodies move from tone to tone, they proceed not only by either conjunct or disjunct motion along a continuum of pitch relations, but they also—simultaneously and without in any way contradicting this—travel among five independent scale-tone regions … " (2000:37). This suggests a possible circular, quasi-symmetrical fluidity of scale- tone relationships (see, for example, Tenzer 2000:39). One area for further exploration, then, might be around the notion that the tonal orientation of the five scale tones could change between musical passages, in a way perhaps loosely akin to modulation in Western music. If this is true, it might be interesting in this instance to reorient S0 on A rather than on C♯:

---

26 Schneider (2001:502–12) demonstrates the technicalities of how, despite the significant amount of inharmonic sound surrounding the pitch fundamentals, it is the *neliti* (played at a slower rate in more middle registers) that listeners are best able to follow, rather than the faster ornamental levels played in higher pitch ranges. That is, somehow the fundamental pitches of the core melodic shapes are in fact being perceived. It is interesting in this regard that Perlman (2004) suggests that Javanese *gamelan* music may operate around "unheard" and "unplayed" melodies, some of which Schneider might posit are either being obscured or consequentially created by the inharmonic acoustical interactions of the *gamelan* instruments.

27 Additional transcribed *gamelan* examples suitable for analysis may be found in Tenzer (2000, 2006b) and Perlman (2004).

Ex.3.33 Reoriented model of tonal dynamics in *Oleg Tumulilingan* passage

F: 0 17 23 30 47 0

S: 0 45 11 42 34 0

← → ← → →

T: -62 -28 -24 9 -28

Revisiting the analysis from this perspective would neatly explain a number of observations in the music, including the presence of the redefined S0 and S11 (now the two most consonant pitches in the collection) as the bounding interval in the passage; the single higher instance of S45 (now the most dissonant pitch); and the tendency for S42 (E) to move down to S11, up to S34, and, in one notable instance in the *neliti*, up to S0 (T=−19). Interestingly, other than at the point that A moves up to C♯ and back near the middle of the first line in the *ugal* part, the T numbers would remain the same in the musical analyses despite the different tendencies between adjacent pitches in the two models.

This circular quasi-symmetry, which Tenzer consistently alludes to as a key feature in Balinese *gamelan* analysis, serves as a segue into the final section of this chapter, a discussion of the challenges inherent in truly symmetrical collections, and may explain further the attraction of twentieth- and twenty-first-century global composers to such features.

Expanded Options: Non-Tonality

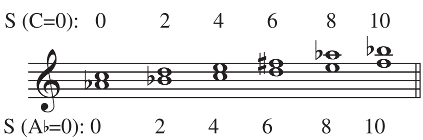
As noted earlier, 12-EDO non-tonality (in its expanded meaning) poses a particular challenge to the analytical methods proposed here, largely because of the difficulty in determining a meaningful S0 in symmetrical collections. Echoing scholarly consensus, Patel (2007:20) notes that asymmetrical scales are "far more common" than symmetrical scales, possibly because the latter lack the property of uniqueness (containing each interval class a unique number of times) which assists the listener with determining the location of notes in relation to the first note of the scale.

Of the various symmetrical scalar approaches that may be found, three stand out both in terms of frequency of use and in terms of serviceability for analytical modeling: whole tone (all whole steps), octatonic (exact alternation of half and whole steps) and 12-EDO serialism (the use of pitches from the chromatic collection in highly systematized ways that attempt to avoid tonal identity). Freely "atonal" use of the 12-EDO chromatic collection (that is, in ways much less systematized than serialism) might also be included, though the chance of an S0 emerging through emphasis of one kind or another might be higher in that case, despite the intent of the composer. Though not symmetrical, the non-tonal effect of pandiatonicism may be understood in a relatively uncomplicated way as simply raising the tonal dynamic to a higher level of complexity by deliberately and to some degree consistently avoiding the expected tendency resolutions of a diatonic collection. In such cases, assuming an S0 can be deduced from evidence in the music, the analysis would proceed along the same lines as for any other diatonic collection, and would clearly illuminate the extent to which tonal expectations were being skirted.

It is in fact the creative use of non-tonal options in combination with other materials that is most salient for a global music theory. Indeed, both the origins and the development of whole tone and octatonic usage seem to emerge from eclectic contexts. The three brief sample analyses that follow may serve to demonstrate the potential of this perspective.

One of French composer Claude Debussy's (1862–1918) most explicitly and consistently whole tone compositions is *Voiles* (*Preludes* Book 1, no. 2). The work reveals a tonal ambiguity that may be loosely related to something Pomeroy (2004) terms "tonal pairing" in Debussy, and perhaps also to what Bribitzer-Stull (2006) calls "the A♭–C–E complex" in nineteenth-century Western music. Indeed, here the ambiguity revolves around A♭ and C as dual S0 anchors, mediated by B♭ (that is, adjacent to both, as S2 in the former and S10 in the latter):

Ex.3.34a Dual whole tone orientation in Debussy, *Voiles*

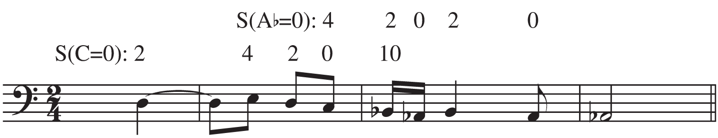


Ex.3.34b Debussy, *Voiles*, bars 1–7

One way in which this dual orientation is developed can be seen in bars 1–7 of the work. At first, A♭ serves as S0, with the first two semi-cadences (bar 2) on S0 and S4 followed by S2 and S10, the latter of which represents the pitches on either side of S0. But by bar 5 the collection shifts to cadence on S0=C, after which the mediating B♭ begins its long cycle of repetition while an A♭–B♭–C figure reinforces the orientational ambiguity.

A new melody in bars 10–13 (condensed to single pitches in Ex.3.34c) moves back to S0=A♭ via something like an "orientational modulation," in which D begins as S2 in the previously prevailing C orientation, but then falls through the mediating B♭ back to A♭ at the cadence. It is also worth noting that the falling thirds figure from bars 1–5, with its A♭–C ambiguity, is repeated simultaneously with this melody, and that the mediating B♭ continues to be repeated in the bass (though neither of these is shown below):

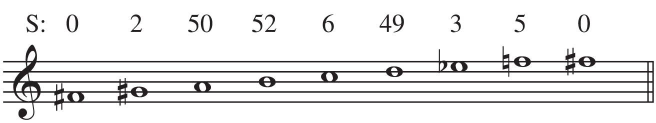
Ex.3.34c Debussy, *Voiles*, melody in bars 10–13



The very brief middle section that occurs later in world pentatonic mode two with E♭=0 reinforces relationships with both A♭ (since E♭ is S1 of A♭) and B♭ (S1 of E♭). This is followed by a return to the materials of the earlier section noted above. The last eight bars reiterate the falling thirds figure (reinforcing A♭), but the piece ends with a repeated cadence reinforcing C. Thus, even within these whole tone ambiguities, tonal orientation dynamics that affect melodic shape may be discerned.[28]

Of the two possible configurations of the octatonic scale, the one beginning with a whole step is the most challenging for S analysis because it lacks an S1 anchor, and contains other inherent ambiguities:

Ex.3.35 Octatonic scale, S0=F♯



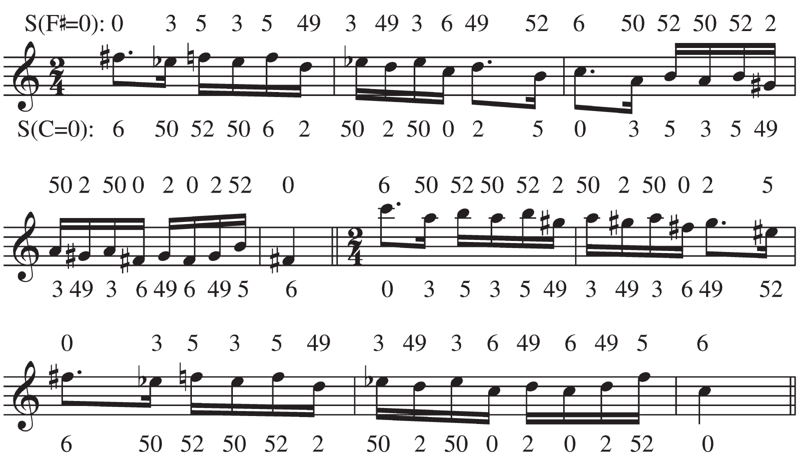
Interestingly, S6 in the middle of the scale serves as a kind of anchor, pulling both adjacent pitches (S52 and S49) toward itself, while S3 movement up to S0 and S6

[28] Another fascinating and creative use of the whole tone collection can be found in Béla Bartók's *Ten Easy Pieces* for piano, Sz.39, no.9.

movement up to S3 (each the most proximate note with a lower S number and both at T=10) are no stronger than S3 movement to the adjacent S5 (T=11). Meanwhile, S3 itself might also be considered a secondary or tertiary anchor, especially due to the strong attraction of S49 to it at T=−42. Many of the other dynamics inherent in both octatonic configurations are similar to those in diatonic modes, perhaps explaining why octatonic and diatonic collections are often combined effectively, such as in many contemporary film scores.

Extensive use of the scale is featured in *Katschei the Immortal* by Nicolai Rimsky-Korsakov (1844–1908). In one especially clear melodic example, an ambiguous dually centered spiral results from Rimsky's repeat of the same sequence in close proximity, starting first on F♯ and then on C, reinforcing the notion that S0 and S6 are the main anchors:

Ex.3.36 Rimsky-Korsakov, *Kastchei the Immortal*, Scene one, orchestral figure between rehearsal marks 33 and 34



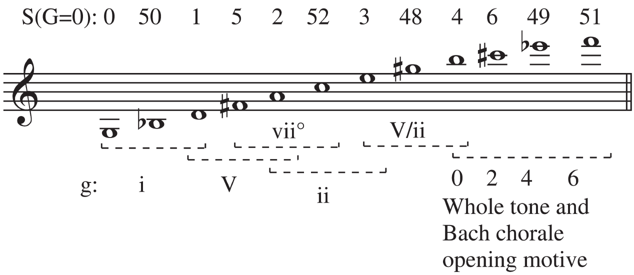
Here also, the S numbers (starting the melody on S0) show how the melodic dynamic essentially mirrors that of the falling scale pattern, increasing in tension as it proceeds down but then dissipating precipitously at the bottom of the lower tetrachord.

More deliberately atonal music essentially falls outside the scope of "world tonality" as envisioned in this study. However, it is useful to touch here on one brief example of how ostensibly atonal moments or procedures may be understood to mesh with otherwise broadly tonal orientations.[29] Such synthetic thinking is demonstrated by Alban Berg (1885–1935) in his *Violin Concerto* (1935), which weaves together 12-EDO serialism, references to functional Western European harmony, vague allusions to the whole tone scale, and a chorale quotation from J.S. Bach. This approach is clearly reflected in the tone row itself:

---

[29] Another example along these lines, by Olivier Messiaen, is considered in Chapter 6.

Ex.3.37 Berg, *Violin Concerto*, tone row analysis



Among the interesting ways in which this synthesis plays out in the work is the emphasis on the triads built on S0, S1, S2, and S3, as noted above, along with their plausible harmonic functionalities. These chords are articulated, for example, in a chorale-like moment in bars 11–14 of the work. At the same time, the violin solo begins in bar 2 with an open-string figure that encompasses the chord roots (G–D–A–E). This basis of "consonance" allows the higher S numbers to add expressive tension; the work opens in bar 1, for example with the same 3:2 figure as bar 2, but built on S50 (that is, B♭–F–C–G). Berg also cleverly plays on the fact that Bach's opening melodic sequence is a whole tone fragment that rounds outs the serial row. This connection is made explicit, for example, in bars 135–47, where the chorale tune is presented as if S0=B♭, while other fragments of the whole tone scale transposition that includes B♭ are presented as figuration (especially in the second violins, bars 145–7). Thus the association of the whole tone scale with the chorale tune firmly establishes B♭ as S0 for both collections, allowing for meaningful comparative analysis. This also implies a broader connection between the tonalities of G and B♭, reinforced in bars 1–2 as noted above. The tension between G as S0 and B♭ as both S50 and S0 (analogous to the "relative" key relationship between G minor and B♭ major in Western harmony) provides a dynamic milieu for the creation of melodic shape while at the same making use of the resources of full, non-functional 12-EDO chromaticism.

A Brief Word on Melodic Contour

Aside from pitch dynamics according to 3:2 principles, melodic contour seems to be a key factor in listener perception and retention of melodies (see, for example, Trehub et al. 1987:747–8 and Deutsch 1999b:353–6). Each music makes use of a particular set of techniques for melodic development, but these are based on the establishment of clear patterns followed by repetition and limited variation of same. Agawu (1990:221–2) suggests that contours and processes may be generalized within (and possibly even across) cultures, noting that African melody segments tend to start at their highest pitch point and descend (a shape that could also be said to characterize Native American Sioux melodies). Chapter 5 addresses the question of repetition, variation and contrast in musical development, but here a brief discussion of melodic contour patterns is in order.

In "Pitch Frames as Melodic Archetypes" (2006), William Thompson summarizes and reinforces much of the content of this chapter while advancing the elegant notion that the contours of human melodies across times, places, and peoples seem shaped with remarkable consistency around what have herein been called S0 and S1. Presenting a wide variety of cultural examples and drawing on significant scholarship in music psychology and perception, Thompson asks whether "a close shave with Ockham's Razor might not be overdue; far too many 'entities' seem to muddle the conceptual stew. Can we not reach an overarching consensus? A basic theory?" with regard to human pitch processing in music (2006:86).

Focusing even more specifically on contour rather than tonal pitch dynamics, Charles Adams (1976) posits a number of "qualified universals" (though not using that term) with regard to melodic pitch shapes. Citing Alan Lomax's work in cantometrics, Adams suggests (but does not find sufficient) four general cross-cultural patterns: arched, undulating, descending, and terraced (1976:183–4). Carterette and Kendall summarize Adams's work by noting that his solution to this question is more complex, however, being "a typology wherein melodic-contour types are defined as the product of three primary features (slope, deviation, and reciprocal) and some secondary features that determine melodic-contour shape (for example, recurrence and repetition of local pitch extrema)" (1999:751–2). Adams demonstrates this relationship between type and shape using melodies from two Native American cultures, the Southern Paiute and the Flathead, finding that they exhibit both significant similarities and differences (1976:212). This approach further reinforces the notion that a global music theory may use common terms to illuminate, rather than sublimate, individual musics. Moreover, the notated examples provided by Adams conform very well to Thompson's pitch frame thesis, and to 53-EDO analysis. Combining these two ideas, then, it may be suggested that melodic contour is influenced by the qualified universal intervals of 2:1 and 3:2 as anchors. Perhaps in collections that feature more complex arrangements of 3:2 dynamics, contours will be commensurate with those arrangements while still conforming to broad archetypes. In any case, further work needs to be done on this relationship and how it might be helpfully incorporated into melodic analysis.

Summary

In a way analogous to the rhythmic method proposed in Chapter 2, analysis using 53-EDO may reveal intriguing webs of pitch interactions in a wide range of sophisticated musics, and perhaps especially those that combine multiple pitch collections and approaches. Likewise, a global theory of pitch must of necessity be as much interpretive as it is analytically descriptive. As is abundantly evident, each music and each musical situation offers analytical challenges regardless of the theory employed to explain it. A useful theory will be sufficiently accurate to capture reasonably predicted pitch dynamics and, if the analyst has the inclination to examine aural data, the flexibility needed to adjust to performance realities. Human hearing is certainly capable of pitch distinction beyond 53-EDO, but it is at the same time accepting enough of pitch variability to make 53-EDO a practical compromise for analysis that also reflects the clear human preference for pitch structures situated around complex expressions of 2:1 and 3:2.

Chapter 4
Global Harmony

Introduction

Since Chapter 3 of this study dealt with pitch linearity, the reader might expect Chapter 4 to focus more particularly on pitch simultaneity. However, the practice of harmony typically involves both simultaneity in the form of chords, defined here as any simultaneity of two or more pitches, and linearity in the progression of chords. Many of the questions surrounding the relationship between pitch linearity and simultaneity are enormous and beyond the scope of this study, though Chapter 5 will offer an attempt at considering some of the most basic of those under the umbrella of textural and process evaluations. Meanwhile, the current chapter is limited to examining some of the implications of extending the 53-EDO pitch dynamics discussed earlier into the realm of chords and chord progressions, understanding as always that other established methods of harmonic analysis may also prove useful in specific circumstances. Indeed, this chapter itself makes many comparative references to "functional" and "non-functional" harmonic analysis,[1] since both (and especially the former) seem crucial to global musical considerations.[2]

Harmony in World Context

In fact, one would find it difficult to deny that, to the extent that increasingly globalized musics feature harmony, its nature tends to be influenced by some four centuries of Western European practice and dissemination (see, for example, Nettl 1986:362, 367), that being the culture in which the development of harmony has been the strongest musical focus. However, the aspects of this contribution are diverse. Among others, they include the "functional tonality" of the European "Common Practice"; diatonic modal harmony from prior to the Common Practice as well as in twentieth-century art music and popular music idioms; the further developments of "non-functional" tertian, quartal, and secundal chord structures

---

1 As a result, this chapter makes some use of traditional Roman numeral symbols when discussing Western harmonic functionality.

2 Parncutt (2006) provides a good overview of how some of the concerns of this chapter, particularly with regard to intervals and perception, might be explored more specifically within the harmonic system of the Western tradition, though his conclusions do not necessarily match those suggested herein.

in twentieth-century art music; and the comprehensive, complex functionalities of African-American jazz harmony (itself a globalized hybrid) that reflect all these. Morris and Ravikiran (2006) explicate one particularly interesting development in this regard, the relatively new practice of "meloharmony" in global fusion, an introduction of various chord types into Indian *rāga* practice using the voice-leading of traditional *rāga* patterns and implications. Furthermore, they do so using a 12-tone chromatic pitch set, though ostensibly recognizing the non-12-EDO tuning of Indian *svaras* (2006:256). This sort of creative fusion is probably most reflective of harmonic practice in the twenty-first-century global musical world.

Moreover, there are examples that may be understood according to Western harmonic categories even though they may not originate in the Western milieu, such as the mixed harmony (secundal, tertian, quartal) in Japanese *gagaku*, an example of which will be analyzed later in this chapter. Peter Manuel (1989) explores triadic implications in Andalusian music, noting that although the chords employed in that hybrid are not to be understood as functional but rather as decorative expansions of the mode, they can nevertheless be given analytical symbols that have meaning in the Western tradition. Manuel dubs this particular case "Andalusian Phrygian Tonality," and suggests that the typical progression could be labeled functionally as iv–III–II–I even though it might sound to Western ears more like i–VII–VI–V (1989:71–2); interestingly enough, Moore (1992:84) identifies this same progression (in its latter understanding) as common in twentieth-century popular music.

Other musics seem to share harmonic structures and progressions with Western music, but do so in the context of alternate tunings, while some cultures make direct or indirect use of harmony that appears not to overlap much with Western practice. These categories might benefit substantially from the expanded pitch options available in 53-EDO analysis, and examples of each will be considered presently. First, however, a few brief comments about two of the more recent and salient approaches to harmonic understanding are in order, after which some general questions about harmonic perception will be addressed and a set of specific analytical procedures identified.

"Tonality" Revisited

Recognizing that the harmonic theories of the Western Common Practice, however valuable, were too limited for twentieth-century music, the German-American composer/theorist Paul Hindemith made significant progress in his *Craft of Musical Composition* (1942) toward conceptualizing a way in which harmonies arising from an expanded pitch collection could be understood both in terms of chord "quality" (sonic distinctiveness) and chord "progression" (relative levels of tension and release, or "dynamism," from chord to chord). Because Hindemith's system is confined to only 12 tones per octave in an exclusively Western context, and because it treats certain intervals differently from an understanding based on the 3:2 stack, it is not sufficiently flexible for global analysis. However, Hindemith's understanding of pitch structure as arising from the overtone series above given fundamental frequencies, as well as the hierarchical relationships of consonance and dissonance between those pitches, is a good overall model that leads inevitably back to a conception of musical pitch as broadly "tonal." That is, musical pitch relationships may rightly and normally be seen as stemming from projections of ratios above a "tonic," or what in this book has been identified as S0, rather than as an abstract series of intervallic relationships. In this broad sense, to reiterate, the vast majority of the world's human musics are "tonal."

Contemporaneously with Hindemith, the American composer Harry Partch in *Genesis of a Music* (1974; originally written 1949) concluded that a system of 43 tones per octave (though not of equal division), determined according to a set of criteria that begins (but does not end) with ratios limited to those involving the number 11, offers a richer vocabulary for melodic and harmonic consonance and dissonance, and indeed railed against the damage done by 12-EDO (see, for example, 1974:407–37). With particular regard to tonality, Partch essentially categorized each tone of the collection according to its possible positions in a chord, and extrapolated 28 possible tonal orientations, each of which can be understood as having a particular degree of attraction to another (though in complex, contextual ways). For Partch, this set of relationships constitutes the range of expressive possibilities with regard to consonance, dissonance, and expectation melodically, harmonically, and tonally. In fact, Partch's work in *Genesis of a Music* is in many ways very conceptually close to the proposal being made in this study,[3] though with two critical differences: First, Partch was apparently seeking (or explicating) a method of composition rather than a method of analysis for extant musics; and second, Partch's conclusions about the implications of pitch ratios, consonance, and dissonance, while foundationally similar to those of this study in many respects, veer off into directions that do not appear to comport with the operation of many world musics. In short, Partch was attempting to envision an ideal system for music composition, while the purpose of this study is to offer a workable and credible approach to the musics, ancient and modern, ideal or not, with which musicians constantly interact in our globalized world.

Harmonic Perception

While both melody and harmony involve the nature and interaction of pitch intervals, there is some evidence to suggest that the perception of intervals in the two contexts is complex. Deutsch, for example, proposes a neural model that explains observed understanding of equivalencies among both intervals and chords in

3 For example, in his chapter 11, Partch speaks eloquently of "magnet" and "satellite" tones within tonalities.

various combinations and positions (1999b:351–3), but also suggests that listeners tend to group the intervals found in chords into higher-order aggregates such that chords form a separate aural identity. Thus, for example, a "major triad" is a sound unto itself rather than merely a specific combination of intervals (though it is that as well), a finding that explains retention of the triad identity in various inversions, where the component interval combinations are different and differently arranged.

Still, interval and chord are not wholly separate, and the little evidence available would seem to suggest that the number of different intervals present in a given chord increases the amount of neural processing required to evaluate and give identity to the aggregate of the chord itself. It is interesting to note that some music cultures that include harmony use only dyads, which, strictly speaking, are normally considered to be intervals rather than chords, but that in any case are easier for the brain to process, especially in real time.

Such findings further suggest that harmonic listening takes place to some degree in the context of particular syntaxes that include recognizable categories of chord structures. As the number of different pitches used in a collection grows, and the vocabulary of chords and their place in the expressive system of consonance and dissonance becomes more complex, greater processing effort and experience are required to appreciate the full operation of the harmonic element. A global theory of harmony cannot explain the particular vocabulary or syntax of each music, but it can illuminate the dynamism of harmony in the context of tonality as broadly defined in this study. In that light, and in the light of what relatively little is known of harmonic perception generally, it is not unreasonable to assume that it is important to factor into any harmonic analysis the number and the dissonance level of the intervals involved in each chord, as well as in the melodic (linear) voicing between chords.

12-EDO harmony in 53-EDO

The prevalence of diatonic, modal, and chromatic chords and progressions in global harmonic practices that flow out of 12-EDO conceptions poses particular challenges for the analytical method proposed here, since 12-EDO harmonic tuning cannot be replicated precisely in 53-EDO. Specifically, the size of the approximated Western half step alternates between four and five 53-EDO scale degrees, making other interval sizes different depending on context. This difference is relatively easy to ignore in melodic contexts, but becomes very noticeable in the harmonic contexts to which listeners of 12-EDO tuning have become accustomed.

Fuller (1991:223) offers a solution whereby individual 12-EDO chromatic notes are situated on different 53-EDO scale degrees depending on the arrangement of intervals needed for the 12-EDO chord. This approach may be simplified further by using the variable configuration noted in Ex.4.1 below, and sizing the 12-EDO intervals according to 53-EDO as indicated. Only one enharmonic spelling of each chromatic pitch is shown here, but all would take the same variable values:[4]

Ex.4.1 53-EDO variable tuning for 12-EDO harmony

F:0 (4, 5) 9 (13, 14) 18 22 (26, 27) 31 (35, 36) 40 (44, 45) 49 0
S:0 (48, 7) 2 (50, 9) 4 52 (47, 6) 1 (49, 8) 3 (51, 10) 5 0

Interval sizes (and enharmonic equivalents), in 53 EDO scale steps:
m2 = 4, M2 = 9, m3 = 13, M3 = 18, P4 = 22, P5 = 31, m6 = 35
M6 = 40, m7 = 44, M7 = 49.

This approach is aurally and analytically adequate in all but a very few cases. Generally, the 53-EDO choices for 12-EDO chord construction are made simply by sizing as many of the intervals within each chord as possible according to the values noted above. In a few cases, one or more of these internal interval sizes must be compromised so that the majority of them will sound in tune. A few such cases appear in excerpts analyzed later in this chapter. When this becomes necessary, the pitches of the elemental diatonic set—that is, S0, S2, S4, S52, S1, S3 and S5—should be kept in their original positions while other pitches are relocated to create the best combination of interval sizes possible. Moreover, since the variability of the tritone (S47/S6) is already an unavoidable feature of the 12-EDO approximation in 53-EDO, as explained in Chapter 3, it is usually the best first choice for variable tuning. However, in some circumstances a compromise in at least one interval is necessary, such as in the dilemma of S47/S6 in the very common “secondary” harmonies of the “V” chord in Western Common Practice harmony: in C major, the “V^7/V” chord (D–F♯–A–C) requires placement of the F♯ on S6 in order for the intervals to be correct and consistent, while in the “vii$^{\circ 7}$/V” chord (F♯–A–C–E♭) the same placement means that the interval from F♯ to E♭ (the latter properly at S50) will be one F number too small. Nevertheless, changing it to S47 would compromise several other intervals within the chord, and so acceptance of S6 remains more attractive. More will be said on this issue presently.

Measures of Harmonic Dynamism

An expansion or reorientation of some concepts applicable to Western triadic harmony is necessary in order to have a system of harmonic analysis that is usable for a wide variety of chords within the full 53-EDO collection, beginning with a way

---

4 From this point forward, the reader should refer back to the 53-EDO chart found in Chapter 3.

of calculating and expressing relationships between a broader range of intervals between pitches. In Chapter 3, the notion of intervals was explored solely from a basis above the determined S0 of the collection, and this same calculation will play a large role in harmonic contexts as well. However, an additional clarification is now needed with regard to the consonance and dissonance level of intervals. Specifically, it is useful to establish that an interval between any two pitches can carry the same value (or size) as it would if the bottom note were S0. Thus, for example, the interval between two notes, the higher of which is 31 F numbers above the other (that is, recall, in a circular fashion), is to be considered a "1," as it would be S1 if the bottom note were S0. Likewise, the interval between a note that is 11 F numbers above another note is to be considered a "26," and so on. In this way, the value of any interval can be calculated within 53-EDO. The lower the interval value, the more consonant the interval, and the higher the interval value the more contextually dissonant it is. This is consistent with the melodic approach already discussed in Chapter 3.

The addition of harmonic content adds three important levels of dynamism to the musical context. The first of these is the dynamism of each chord itself as a separate pitch entity. This Chord Dynamism Value (CDV), which is based on an evaluation of the intervals within the chord in relation to its "root," requires several steps to calculate:

1. Determine the root (that is, the basis for calculating the chord intervals). For dyads, the root is simply the lower of the two pitches. For chords of three or more notes in which it is not already determined by stylistic context (more on this in a moment), the root is the note that would be at the bottom of the most consonant interval (that is, lowest value), not including octaves or unisons, when the chord tones are rearranged such that, first, the distance from the lowest to highest pitch is as small as possible, and then (within that outer bounding interval) the smallest intervals are placed as low as possible in the chord stack.[5] For tertian harmony, and especially in Western functional contexts, this will almost always mean that the root is determined through "stacking up" the chord members in thirds, as would be the case anyway, even though this does not result in the most compact note arrangement.[6] In less well-established cases, especially symmetrical structures such as, for example, the quartal chord F–B♭–E♭, the situation may appear a bit more ambiguous, but it should be clear from the foregoing that the correct arrangement would be E♭–F–B♭ (root=E♭), and not B♭–E♭–F (root=B♭), since the former has the smaller interval at the bottom of the

[5] This arrangement is also sometimes known in pitch class set theory as "normal order," from Forte (1973).

[6] However, in some very complex, ambiguously chromatic tertian harmony, such as the first chord in the example by Richard Wagner presented later in this chapter, careful consideration must given to other possibilities.

chord. In the rare cases in which there is still more than one root candidate after following the principles above, the candidate that sounds the lowest in the original chord arrangement should be designated as the root.[7]

2. Determine what may be called the "secondary" S number of each note in the chord, measured as if the root were S0. Include doublings of up to three occurrences of the same pitch class.[8]
3. The CDV will be the sum of these secondary S numbers.

The higher the CDV in comparison to other chords in its particular musical context, the more dissonant (or rather, harmonically dynamic) the chord is in that context. At the same time, chord structures with identical interval content above the root will normally have the same absolute CDV number regardless of context; for example, what is in Western theory called a "dominant" or "major-minor" seventh chord will usually have a CDV of 56 because it contains S-number intervals of 1, 4, and 51 above the root. The only exceptions to this principle occur in cases where interval tunings must be compromised because of specific tonal context.

Recall from Chapter 3 that the strongest melodic tendency of any given note in a collection is to move toward the most proximate note with a lower S number, and that the extent to which note movement follows this principle is the extent to which tonal dynamism is dissipated, while tonal dynamism increases to the extent that note movement abrogates this principle. This has profound implications for the harmonies that would arise from a given collection, because harmony is significantly affected both by the pitch combinations within chords and by the melodic voice-leading between chords. Thus there is a need to assess the level of harmonic dynamism contributed by the composition of each chord and its relations to S0, but also the movement between pairs of chords.[9] Like melodic dynamism, harmonic dynamism is not absolute, but rather to be interpreted within the particular pitch collection and musical context in which it occurs.

The second descriptive numerical value, which may be called the Tonal Dynamism Value (TDV), measures the content of each chord itself in relation to the 3:2 (53-EDO) stack. The TDV is calculated simply by adding the "primary" S numbers of the notes within the chord, that is, as measured against S0 for the whole collection, and includes doublings of up to three occurrences of the same pitch class.[10]

---

[7] Parncutt (1988) suggests an alternative related method for root determination.

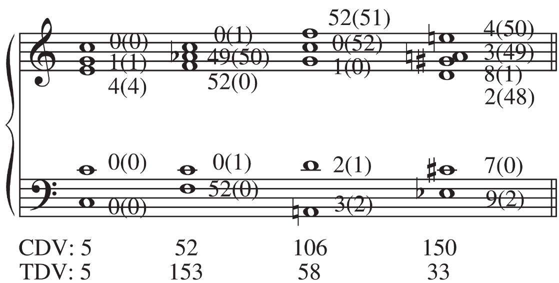
[8] It is postulated here that doublings beyond three occurrences will likely have little or no additional effect on the sonic essence of the chord or its harmonic dynamic, but the analyst should be free to determine otherwise in specific circumstances and adjust the calculation accordingly.

[9] That this latter issue should be addressed is confirmed by Hanford (1987), who reviews its history and offers suggestions in the context of the Western tradition.

[10] See note eight above.

In very general terms, much of the harmonic dynamism of a chord progression can be gleaned by looking at the CDV and TDV numbers of sequential chords, noting the ebb and flow of tension and release at both the chord level and the tonal level. The following example, consisting of mixed chord types with S0=C, demonstrates how these values can be presented, with the "secondary" (chord-level) S numbers appearing in parenthesis next to the "primary" (tonal) S numbers, and the dynamism values below the staff. It is important to note that each of the two categories of values must be understood only in relation to others in the same category; that is, CDVs should only be directly compared to other CDVs, and TDVs only to other TDVs:

Ex.4.2 Example chords with CDVs and TDVs



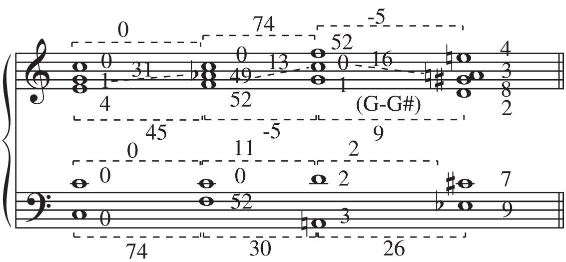
Further comment on these values will follow below. For a more detailed assessment, however, a separate analysis of the melodic voice-leading between chords is also required. This third value, which may be labeled the Harmonic Progression Dynamism Value (HPDV), requires more complex calculation, since it measures the extent to which sequential chord notes in specific voices move according to tendencies that increase or dissipate pitch dynamism.[11] In order to give these elements proper analytical weight, both positive and negative values are needed, as with the T numbers in melodic measurement. If movement between chords within a single voice follows the strongest expected tendency, then a score of −10 is assigned to that voice. In cases where there are two valid tendencies (though not necessarily equal T numbers) and either one is followed, a score of −5 is assigned. The difference between these first two categories can be difficult to determine definitively, sometimes requiring interpretive choices. Meanwhile, if an expected tendency is not followed, then the absolute value of the difference between (1) the T number of the pair (see Chapter 3), and (2) what *would be* the T number for the strongest tendency of the first note of the pair, is determined and assigned to that pair. The idea here is to capture the "dynamic distance" between the expected

[11] The complex issue of how harmonic voice-leading might be assessed in polyphonic textures is one that will not be addressed here, but will be explored in one example presented in Chapter 6.

tendency and the actual movement. So, for example, if the actual T number were 16 and the expected T number were −6, the result for this calculation would be 22, but if the two T numbers were −16 and −6 (or 16 and 6) the result would be 10. Thus a negative number (either −5 or −10) can only be assigned in cases where movement is according to expected tendency. Movement from S0 to any other note is measured like a regular T number, that is, by adding the S number difference (which will in this case always be positive) and the absolute value of the F number difference (based on actual melodic direction). A common pitch in the same octave between two consecutive chords has no progressive effect, and so is assigned a zero. Finally, then, the HPDV for that pair of chords is the sum of all the melodic pairs between the two chords. There may in some cases be value in calculating the HPDV between two different voicings of the same chord, though many times this may be omitted. Likewise, displacements of more than one octave between consecutive chord tones may generally be ignored, though commentary on such might be illuminating.

The following example applies this third set of values to the same music as Ex.4.2 above:

Ex.4.3 Example chords with HPDVs



HPDV: 150 123 48

To illustrate, the values for the pairs of voices between the first two chords are calculated as follows:

- The movement between the two pairs of repeated pitches is zero.
- S1 moves to S49, so the actual T number would be 48+4=52. The strongest expected resolution for S1 would be up to S0, which would have a T number of −1+22=21. The absolute value of the difference between these two T numbers is 31.
- S4 moves to S52, so the actual T number would be 48+4=52. The strongest expected resolution for S4 would be down to S2, which would have a T number of −2+9=7. The absolute value of the difference between these two T numbers is 45.
- The lowest S0 moves to S52, so the actual T number would be 52+22=74, and no further calculation is necessary.

- The total HPDV between these two chords, then, is 0+31+45+0+74=150.

And the HPDV between the second and third chord is determined as follows:

- The movement from S0 up to S52=52+22 F numbers, or 74.
- S49 moves up to S0, so the actual T number would be −49+18=−31. The strongest expected resolution for S49 would be down to S1, which would have a T number of −48+4=−44. The absolute value of the difference between these two T numbers is 13.
- S52 moves up to S1, and since S52 is most likely to move either down to S4 or up to S1, a value of −5 is assigned.
- S0 moves up to S2, so the actual T number would be 2+9=11, and no further calculation is necessary.
- S52 at the bottom of the chord moves down to S3, so the actual T number would be −49+35=−14. The strongest expected resolution for S52 would be down to S4, which would have a T number of −48+4=−44. The absolute value of the difference between these two T numbers is 30.
- Finally, the total HPDV between these two chords is 74+13–5+11+30=123.

For all three of these value categories (CDV, TDV, and HPDV), the lower the number, the more harmonic dynamism is dissipated; the higher the number, the more dynamism is increased. What "harmonic dynamism" really means requires some explanation. In general, the concept is not strictly analogous to "consonance/release" and "dissonance/tension," although it shares some of what is often meant when these terms are used. Because the example above involves mixed types of chords, the relationships between CDVs, TDVs, and HPDVs might seem unexpected, but in fact these values reflect the different ways that each aspect contributes to the harmonic context. For example, in the broadly tonal context by which pitch is being considered in this system it is not surprising that chords three[12] and four have higher CDVs—they are both at a greater remove from the S0=C reference point, though chord three less so than chord four, and both are also considerably more internally dissonant than chords one and two. Likewise, the amount of harmonic dynamism (HPDV) between chords three and four is not especially high because they do not constitute a clear "progression" in comparison with the import of the movement from the I to iv (in Western functional terms) that is formed by the first two chords. Thus the dynamism of the progression increases at the chord level while decreasing at the tonal and voice-leading levels. The totality of the three value "streams" allows comparison using consistent terms across different chord types and categories of dynamism. In subsequent examples, it will become clear that these measurements take on more meaning when the

---

[12] The root of chord three is G rather than F because, although both notes are at the bottom of "1" intervals in the note rearrangement F–G–A–C–D, G is lower in the original arrangement.

harmonic vocabulary itself is more consistent, as it normally is. This highlights both the challenge and the opportunity of listening to and analyzing complex mixtures of chords and "tonalities," and of developing a system that is useful across consistent and inconsistent styles.

It is appropriate at this stage to address some of the issues that might be predicated on root relationships between chords. Because robust resources on this topic already exist in prior theories of functional harmony, in cases where such concerns are important these should be employed. However, in the cases in which harmony is not intended as functional in the traditional Western sense, such an approach might not be particularly helpful. Nevertheless, the additional level of dynamism in the relationship of chord roots ought to be considered, since these function in some ways like other linear melodic relationships. Applying the methods of this study to the fundamental Western harmonic progression I–IV–V–I, for example, reveals that the root relationships between these chords could be designated as S0–S52–S1–S0, outlining very clearly the rise and fall of tonal/harmonic tension that makes the progression and its variations so common in so many globalized musics. Thus, the analyst should consider the stylistic context and the clarity of the chord roots involved, and make comment as appropriate.

As with melodic analysis, these methods only apply when S0 can be determined. However, as noted in Chapter 3, for some symmetrical collections such as whole tone, octatonic, and non-tonal chromatic, determining the S0 and S1 anchors may be very difficult or impossible. In these harmonic cases, as in purely melodic cases, S0 should be chosen based on note usage in the music (repetition, accents, and so on), and the analysis may need to be limited to the CDV and TDV profiles. In cases where no S0 is determinable, other methods such as pitch class set theory may prove more useful; here again, however, it might be reiterated that such examples are relatively rare in global musical practice.

Two additional points should be made here, the first being that the rate of harmonic change should be carefully noted so that a proper selection of pitches goes into assessing each chord and chord change. Sometimes this aspect has a regular rate, sometimes it varies considerably from moment to moment, and sometimes its ambiguity requires interpretive decisions. The second point has to do with which notes are considered part of the prevailing harmony, and which are "non-harmonic," a distinction that can be difficult to determine in cases where the details of the style are not known. In functional tertian harmony, the determination is likely to be easier to make; in less-clear cases sometimes the rhythmic independence of melody and harmony is a useful indicator. Once again, musically interpretive decisions may be required.

The Melodic/Harmonic Dynamic

The measures of dynamism specific to harmony, as outlined above, should be considered on their own terms. At the same time, the interaction of melodic and harmonic pitches in an expanded world of tonality is an important area for exploration that can only be touched on here. Take, for example, two very different musics in which this element is critical, yet in different ways: in Indian *rāga*, elaborate melodies interact with a constant drone on S0 and S1, while in late seventeenth-century European opera arias, changing harmonies drawn from a considerably expanded chord vocabulary provide another layer of tension and release with which (comparatively less elaborate) melodic lines may be coordinated in a variety of ways and at a variety of levels of balance. In the former, the melody drives the musical pitch development, while in the latter the harmony has much more of a developmental role. In *rāga*, while S0 is always an important focal pitch, the S1 that completes the ever-present drone may or may not be. Thus, the interaction of the *rāga* melody with the drone may be complex, but the interaction of the opera aria melody with the harmonic accompaniment is dynamic in at least one additional and ever-changing way. All this is merely to say that musical pitch analysis should normally include at least some attention to the level and nature of the melodic/harmonic dynamic. This feature increases in complexity yet again when multiple melodies are present against a rich harmonic backdrop. But it should also be said that in cases where more levels of melodic/harmonic interaction are present, there is also in a way more dispersal of attention and interest. Thus, the level of sophistication or complexity in this element is not a measure of value, but rather a measure of focus.

Full 3:2 (53-EDO) Harmony: A Brief Word on Practical and Expressive Implications

As noted already, the conventions of 12-EDO continue to dominate global harmony as of the writing of this book. At the same time, harmony in some musical cultures, such as that of some traditional Indonesian and African musics, do grow directly or indirectly out of non-12-EDO approaches. Moreover, the tools now exist for composers to create music electronically in any pitch/timbre universe they can imagine (see Sethares 2005, especially 179 –98 and 322–3). Modest strides also continue to be made in pitch-flexible acoustic instrument conception and design; consider, for example, Geoff Smith's "fluid," real-time microtunable mechanical piano (Brown 2009). How these expanded resources might affect broader harmonic practices in music is not yet clear.

Meanwhile, the expressive resources of full 53-EDO harmony can be imagined by listening to Ben Johnston's *Second String Quartet* from 1964; while the work uses a slightly different division of the octave into 53 parts, its effect is similar enough to demonstrate enhanced possibilities for consonance and dissonance. Moreover, one of Johnston's most helpful contributions was in adapting and applying microtuning concepts to conventional instruments and notation in practical ways (see, for example, Gilmore 1995:472, 478). Earlier, in 1924, another American composer, Charles Ives, wrote *Three Quarter-Tone Pieces for Two Pianos* tuned approximately 50 cents apart, effectively utilizing 48-EDO harmony. And, as noted earlier, composer Harry

Partch spent his musical lifetime exploring expanded possibilities for consonance, dissonance, and flexibility in just intonation with 43 (non-EDO) tones per octave. Depending on how many tones of the collections are used, and which ones, both the quarter-tone approach of Ives and the 43-tone just intervals in Partch are mostly manageable analytically within 53-EDO, though the former more so than the latter. Partch in particular insisted that his pitch collection was more acoustically suited to human hearing, since (according to Partch) the ratios involving 11 are the first to be truly outside the traditional experience of Western listeners, hence the first (but certainly not the last) to effectively expand the tonal vocabulary (see Partch 1974:123–31). Meanwhile, the 3:2 stack seems to be reflected robustly in a wide variety of global musics.

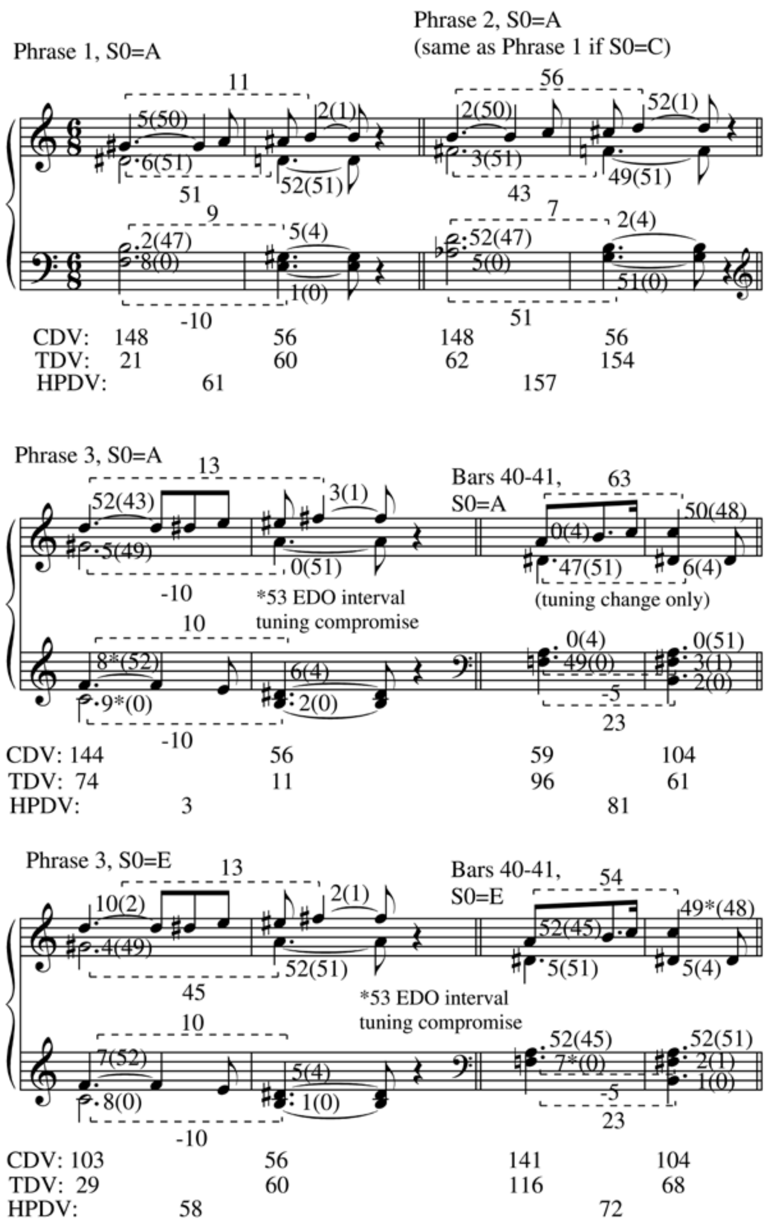
Musics such as these that feature harmonic syntaxes based on an expanded set of intervals are still rare, yet it is likely that as non-12-EDO pitch collections have more influence on harmony, a fair number of incidentally expanded chord structures and tunings may become part of the aural vocabulary of the twenty-first-century musical world. The analytical method proposed in this study offers the resources to consider such music in terms consistent with the global fusions in which it is likely to play a part.

Analytical Examples

The limited set of illustrative examples presented in this final section of the chapter is designed to demonstrate a range of harmonic features that might appear in various musics. Each example is particularly challenging or unusual in some way; no especially straightforward examples are included here, though some examples that address harmonic vocabularies such as Western Common Practice functionality and modality more directly and clearly will be presented in Chapter 6. Moreover, because this is a chapter about harmony, only brief reference will be made to the interactivity of melodic and harmonic pitch dynamics, and only in the last example. However, this element will arise more naturally later in the book.

Perhaps one of the most harmonically intriguing pieces of music in the Western canon is the orchestral Prelude to the late nineteenth-century opera *Tristan und Isolde* (1859) by Richard Wagner. Because the piece is generally understood to exist in an ambiguous sort of netherworld between functional and non-functional harmony, it is especially fitting to consider how some of its chords and their sequencing might be viewed under the system suggested in this study. Reductions of three phrases encompassing portions of bars 1–8, plus one progression from bars 40–41, are shown below.

The infamous first chord of the first and second phrases in Ex.4.4 (sometimes called the “Tristan” chord) is here understood to be a modified version of the “French Augmented Sixth” chord in Western parlance, built on the unraised sixth scale degree in the key of A (here tuned as S8 for intervallic consistency), which therefore also serves contextually as its root for CDV purposes. Under this reading, Ex.4.4 Harmonic reductions of selected phrases from the Prelude to *Tristan und Isolde* by Richard Wagner (from the piano arrangement by Richard Kleinmichel, *c.*1882)



the chord would have a pre-dominant function, leading to the V^7 in the second bar. The second and third phrases above could then also be seen as transpositions of that same progression into other keys, that is, C and E respectively, or they could be understood as continuing in A. Each of these possibilities is included above.

The tonal ambiguity of the Tristan chords produces the curious effect of their having lower TDVs than the chords that immediately follow them, these latter having much stronger tonal implications even as they serve cadentially. While the first chord of the third phrase is rather different in construction, its CDV and function remain analogous to the configuration of the first two phrases, and so C (tuned to S9) is concomitantly designated as the root. Meanwhile, in the phrase from bars 40–41, the function of the first chord is once again the same as in phrases one, two, and three, though the progression does not proceed according to the same expectations.

Taken as continuing throughout in S0=A, the analysis reveals that the first three phrases together constitute a clear rising and falling shape in terms of harmonic tension and release at the tonal (TDV) and progression (HPDV) levels. Alternatively, if the three phrases are understood as modulating from A to C to E, their harmonic dynamism is essentially unchanging. The internal dynamics of phrase three are different, however, in that they are essentially reversed depending on its S0 orientation. One interesting consequence of an interpretation that does in fact move the S0s from A to C to E is that the macro shape of those "modulations" would be S0–S50–S1, roughly similar to the smaller rising-falling shape of the first three phrases in S0=A noted above.

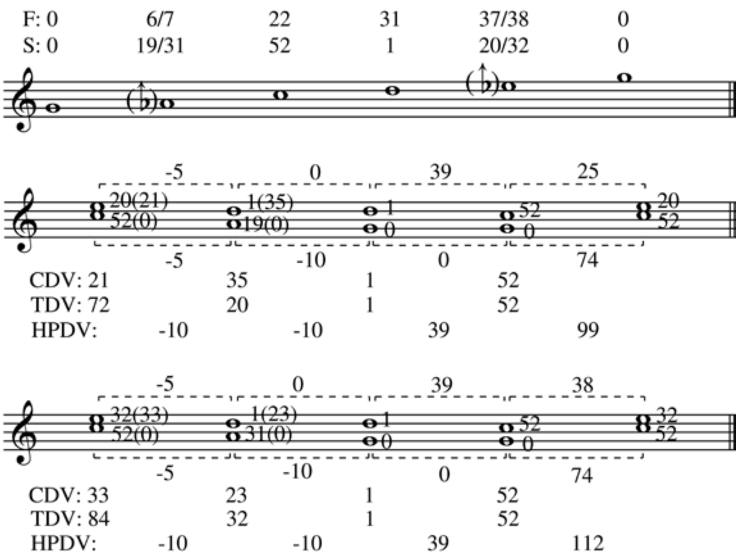
The phrase in bars 40–41 is interesting in that, if S0=A, its CDV and TDV shapes are mirror images: the internal dissonance level of each chord rises even as the tonal dynamism falls somewhat. Moreover, its TDV and HPDV shapes are very similar regardless of which S0 is assumed, whereas its CDV dynamics would be essentially reversed.

Another issue worthy of comment concerns the tuning differences in the first bars of phrase three and the phrase in bars 40–41, which vary significantly depending on S0 orientation. This in part accounts for the TDV/HPDV similarity in the two analyses of bars 40–41, and, conversely, for the parallel discrepancies in phrase three. These compromises stem from concerns related to the overall sonic effect of the chord itself, or its "quality," yet they also clearly affect the relations between chords and within tonalities. In an even larger sense, this opens up the question of how pitch variability might be as important an expressive issue harmonically as it is melodically. Johnston (1966:114–15) discusses this in ways that could open up dialogue about the advantages of more deliberately training musicians for a greater degree of fine pitch distinction, a goal that exposing them more meaningfully and systematically to a wider variety of world musics with non-12-EDO pitch approaches, in concert with a concomitantly flexible analytical system, might very well contribute to. It is useful to remember that, in the end, a global music theory is about the facilitation of global musicians.

In that vein, two African examples may serve to demonstrate some implications of harmonies conceived within non-12-EDO contexts. Both are dyadic cyclic progressions, the first from Central African Zande *kundi* (harp) music (adapted from material as presented by Kubik 2000:266) and the second from Zimbabwean Shona *mibra* music. In each case, the first chord of the cycle is repeated at the end in order to show the dynamics from the end back around to the beginning of each periodicity.

In Ex.4.5 the scale is world pentatonic mode three, but with two notes alternately tuned as "neutrals." Because the tuning of these neutrals is uncertain, two analyses have been provided. In the TDV and HPDV levels, the differences are somewhat insignificant, but the CDV shows that the dissonance levels of the

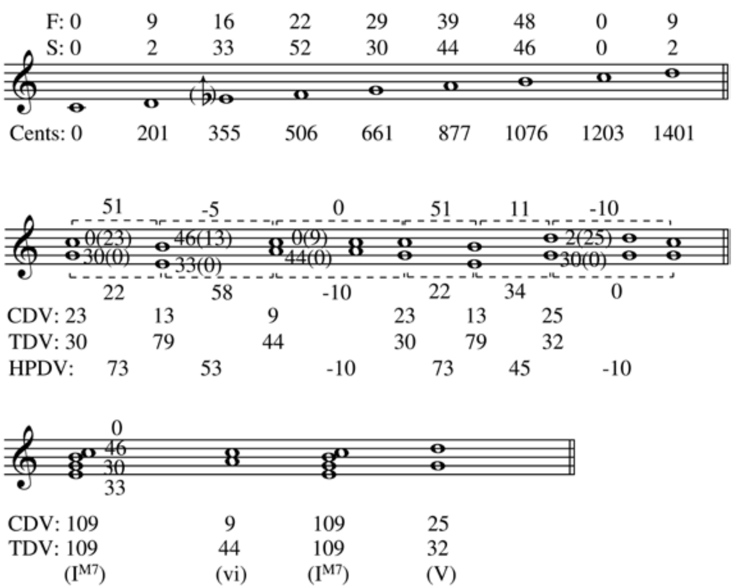
Ex.4.5 Dyadic harmonic progression in Zande *kundi* music



first two chords would be reversed, though within a narrow range of values. The analysis indicates a clear harmonic shape in the progression, with the first three chords falling in tension and then rising again as the sequence moves through the fourth chord and cycles back around to the beginning; this same shape is reflected in the root relationships (S52–S19–S0–S0–S52) and more vaguely in the CDVs of the dyads themselves. As Kubik notes (2000:266), this progression is more structural than actual, with the chords appearing near one another at important referential points in the music rather than in strict juxtaposition; nevertheless, the effect of the progression between them is aurally apprehended.

The second example, the "response" portion of the Zimbabwean traditional *mbira* piece *Chamutengure*,[13] is one that could be seen as reflective of Western functional harmony, though it is unclear whether or not such a relationship is intentional.[14] Like the Zande example, the content here is a series of dyads or bi-chords, but if the first two of these are combined at the beginning and again in the middle, a steady harmonic rhythm emerges that outlines a clear, functional progression. Of importance, however, are the complex tuning or "chuning" issues explicated by Berliner (1993:55–70). The example is here presented using an average of two of Berliner's measurements in cents (those of Mude and Gondo, Berliner 1993:65), isolating a single range of the pitches, and calculating S and F values around S0=C (which Berliner, 1993:82–3, agrees is the tonal center of the piece). This collection features the neutral third that appears to be common in many African contexts, as well as tunings of the fifth, sixth, and seventh scale

Ex.4.6 Harmonic progression from Zimbabwean *mibra* piece "Chamutengure"



---

[13] This version was taught to the author by Simbarashe Kamuriwo; Berliner (1993:82–4) presents another version of the piece.

[14] Berliner (1993:26–7, 41n) makes it plain that *mbira* practice has absorbed Western musical influences, but is less clear about the extent to which such interactions have reshaped traditional pieces such as this one.

degrees that are slightly lower than what would be expected in what otherwise appears to be a diatonic major scale. Because the *mbira* is an idiophone with metal tines of different lengths that produce the pitches, some of this tuning variance may stem from inharmonic timbral elements as touched on in Chapter 3.

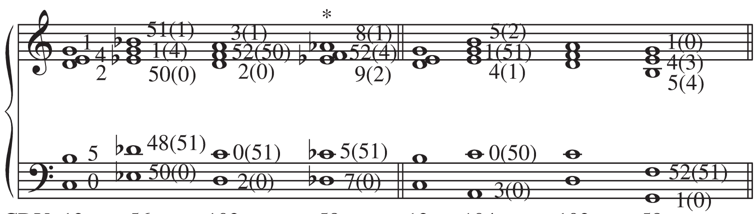
The actual dyadic presentation (middle row above) shows a two-part HPDV cycle, each half of which begins relatively strongly and then falls in dynamism toward the end. This shape is mirrored by the CDVs in the first half, but the CDVs of the second half instead dip down and then up slightly higher before settling again on the beginning value. The TDVs of each half suggest yet another slightly different shape, one that starts lower, shoots up, and then falls slightly back to its starting point. Once again, a fair amount of dynamism is created by the interaction between these different aspects, not unlike that between hierarchical levels in rhythmic analysis.

But this example can also be heard in another context, as a four-chord progression that conforms well to a Western functional analysis as noted above. As suggested earlier in this chapter, it is difficult to determine whether this music is a true hybrid of Western and African elements, or whether the resemblance is merely a coincidence, perhaps resulting from some of the acoustic tendencies suggested in this study. In any case, the root of the first chord (a combination of the first two dyads) is S0 according to the root determination principles discussed earlier, making its resemblance to a I^{M7} chord even stronger. Because of the alternately tuned notes, however, the TDV and CDV do not conform as well; were the tuning to be the same as the diatonic major scale, the CDV/TDV stream would be an undulating 10–3–10–3, somewhat reflective of the half-cycle shape in the dyadic version.

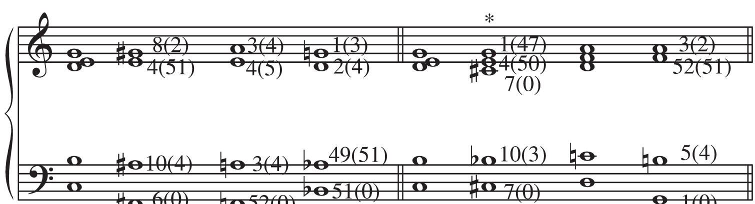
A comparison of these Zande and Shona progressions also yields interesting possibilities. While on the surface both are dyadic and both use neutrally tuned intervals, the structure and dynamics of the underlying collections of each are quite different, as are the resulting harmonic shapes. However, one might be tempted to consider whether the Zande collection ought actually to be seen as an alternately tuned world pentatonic mode one rather than mode three, with S0=C rather than G, for it would then share the bottom trichord (S0–S2–S16) with the Shona scale. Moreover, the third and fourth dyads of the Zande example could then be compared directly to the last and first dyads, respectively, of the Shona example, where they would still be found to be rather different in terms of harmonic dynamics, due to the significant tuning differences. However, it is not difficult to imagine that the S1 of this reoriented Zande collection (that is, S1=G) might in practice actually be closer to the S30 version of the Shona scale; the range of 23–45 cents between S1, S42, and S30 (three consecutive F numbers) is certainly noticeable, but also well within the tuning variations already seen in other examples in this study. While all of this is highly speculative, the point of the proposed theory is to explore both how various musics are different and how they might have underlying (if obscure) similarities.

By way of integrative comparison, consider the complexities of the main chord progression from the jazz standard *Anthropology* by Charlie Parker and "Dizzy" Gillespie, shown below. Kubik effectively frames some of the questions surrounding the relationship between Western functional harmony and African musical elements in jazz, including what he calls "blues tonality" and a more nuanced discussion of "pitch areas" as an alternative to "neutral" intervals (2005:190–99). As Kubik also implies, instruments of fixed pitch designed around 12-EDO (especially the piano) compel jazz musicians toward a great deal of creativity in order to capture some of these nuances. The progression below, conceived for piano, provides some insight into how complex chord "qualities" and their relationships are one way in which such nuances are attempted. Because in this case each chord root is the lowest note, and because several chord types repeat, it is not always necessary to show all of the S numbers. Moreover, secondary S numbers need not be shown when they are the same as the primary S numbers, a convention that reduces clutter, as does the decision in this case not to show the voice-leading calculations that determine the HPDV numbers. Finally, an asterisk indicates the chords in which interval tuning is compromised slightly:

Ex.4.7 Main progression from *Anthropology*, by Parker and Gillespie[15]



CDV: 12 56 102 58 12 104 102 58
TDV: 12 200 59 81 12 13 59 63
HPDV: 206 14 17 -20 14 51 72 -5
(I) (TT sub of A, vi) (ii) (TT sub of G, V) (I) (vi) (ii) (V)



CDV: 12 57 13 58 12 100 102 57
TDV: 12 28 62 103 12 29 59 61
HPDV: 50 42 89 20 24 52 41 (-30)
(I) (TT sub of C, I) (IV) (VII) (I) (vii°7/ii) (ii) (V)

15 *Anthropology*, by John "Dizzy" Gillespie and Charlie Parker. Copyright © 1948 (Renewed) by Music Sales Corporation (ASCAP) and Criterion Music Corp. Copyright © 1946–1974 Atlantic Music Corp. International Copyright Secured. All Rights Reserved. Reprinted by Permission.

Each of the four "phrases" is a variation of the same progression (I–vi–ii–V in Western functional terms) with S0=C, sometimes employing "tritone substitutions" for specific chords. As is often the case in this genre, the movement between chord roots yields a dynamic melodic shape in the bass line that is interesting as much for its relatively few higher S numbers and their placement as it is for the balance between expected resolutions and the lack thereof.

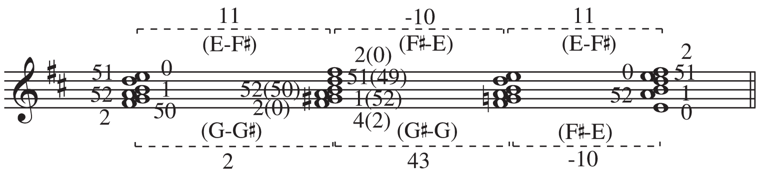
The CDV, TDV, and HPDV streams all indicate somewhat different shapes of tension and release, demonstrating the interactive complexity of the harmonic effect. In general, the close voice-leading often valued in this style keeps the HPDV levels relatively low, especially during the cadential moments leading to each new phrase, three of which constitute the only negative HPDVs in the analysis (the last one assuming a return to the same chord that begins each phrase). It is notable, however, that the first phrase starts with a very dynamic progression not matched elsewhere in the sequence. In terms of the chord qualities (CDVs), one can perceive a somewhat consistent rising toward the middle and falling toward the end of each phrase (sometimes matched by the HPDVs), though the third phrase offers a welcome variation on this shape. The TDV shapes are less consistent, though one can glean a general tendency for the tonal import to rise at the end of each phrase.

As an example of hybridity in its treatment of harmonic elements, the progression above is interesting in at least two respects. The first is its combination of a repetitive, cyclic approach with a more extensive developmental sense. In actual practice, the African examples do feature some slight harmonic variations from cycle to cycle, but it is fair to say that most of the development takes place in the rhythmic and melodic spheres instead. The Western approach to harmony seen in the Wagner is focused more on extensive development of established or implied chord progressions, including possible shifting of the tonal center, often temporarily. The *Anthropology* progression reflects a synergy of these approaches in its use of complex chord substitutions that are nevertheless functional and tied to a repeating progression in which the tonic does not change. A second synthesis, suggested earlier, is the use of complex chord qualities within 12-EDO as a way to imitate non-12-EDO tuning effects in fixed instruments, especially the oft-used piano, though actual alternate tunings are also no doubt used whenever possible by performers with more flexible pitch options.

At a somewhat further remove from the foregoing discussion, the *shō* (mouth organ) parts in Japanese *gagaku* music offer some very complex mixed harmonies that can be described using the Western terms secundal, tertian, and quartal, but certainly operate outside of any Western functional context. The example below shows a progression from *Goshōraku no Kyū* (adapted from material as presented by Nelson 2008:56).

In order to simplify the analysis, as many common tones as possible between chords are assumed, each of which contributes nothing to the HPDVs. Nelson lists the mode of this piece (*hyōjō*) as being analogous to the diatonic Phrygian mode with S0=E, while Tokita and Hughes (2008:19) confirm that the tuning is most

Ex.4.8 Abstracted harmonic progression of the *shō* part in *Goshōraku no Kyū*



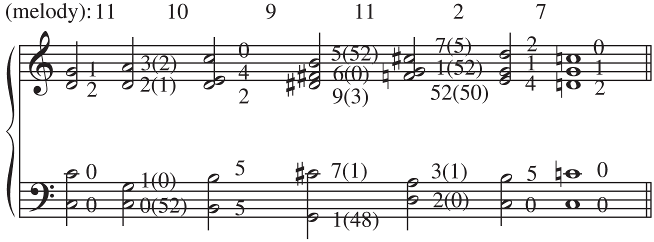
CDV: 156 153 156 106
TDV: 156 112 156 106
HPDV: 13 33 1

likely along the Pythagorean lines used for diatonic collections in this study. Since E is projected constantly as a tonic throughout the music (in parts not shown here), the question of where each chord root lies is more complex. However, E is probably heard contextually as the root whenever possible, making it fairly clear that such is the case in all but the second chord; according to the root determination principles discussed earlier, it would there be F♯. This analysis also conforms well to other musical evidence, such as the E to F♯ contour at the very tops of the chords, and the inclusion of both E and F♯ in some of the *biwa* (chordophone) chord outlines not shown here. The result is an undulating shape at the TDV level, but more of a drop-off shape in the CDVs because of the higher internal dissonance level of chord two. Meanwhile, the HPDV shape is a gentle, slightly-tilted arch. These shapes within each sphere are subtle, a feature that is consistent with *gagaku* and with much Japanese traditional music in general.

Finally, a brief piece composed for this chapter brings together many of the aspects discussed herein while also offering a glimpse into questions of proportion that will be addressed in more detail in Chapter 5:

Ex.4.9 A chorale etude by the author

T (melody): 11 10 9 11 2 7



CDV: 3 55 16 104 108 12 3
TDV: 3 6 16 18 65 12 3
HPDV: 33 23 44 83 -21 -30

The goal of this exercise was to create a little more clarity of both contrast and shape harmonically while keeping the arrangement relatively simple. The position of the root in chords two, three, and four is unexpected, but following the method outlined earlier yields the clear candidates indicated. The overall root movement between chords is relatively consonant, creating a gently arched, back-and-forth shape of S0–S1–S0–S6–S2–S0–S0. This follows fairly closely the TDV shape that rises slowly but steadily before a sudden climax in chord five (which is also 5/8 or .625 of the duration of the piece, a structural ratio that is important and will be discussed in Chapter 5), and falling back down through chords six and seven. The HPDVs essentially mirror this same shape in their own realm. Even the CDVs conform to this pattern overall, with the notable exception of chord three, in which the arrangement of tones may evoke a higher aural dissonance level than predicted by its low CDV; in general, the low S number of the "major seventh" interval is a feature that does not comport well with its historical place as a strong dissonance in Western music. This may be a culturally conditioned rather than an acoustic matter; the interval can aptly be described as "bright" rather than as "dissonant," as the very common use of it in the tonic harmony of jazz suggests. At the same time, the traditional view ought not to be dismissed too quickly; as noted in Chapter 3, S5 does have a strong tendency to resolve up to S0 *in the context of diatonicism*. But in a mixed harmonic vocabulary such as the one presented here, the stylistic expectations are more uncertain.

Indeed, just as interesting is the demonstration here that what would in Western harmony be considered a "quartal" chord (chords one and seven above, S0–S2–S1) of a higher dissonance level is, in the way of thinking suggested here, as consonant as a triad can be. Certainly, however, the tonal dynamism of such a chord would rise precipitously as its basis moved away from S0; a transposition consisting of E♭–F–B♭ where S0=C would, for example, still have a CDV of three, but a TDV of 153. By way of comparison, a C–E–G triad, where S0=C, has a CDV and a TDV of five, while an E♭–G–B♭ triad in that same context would have a CDV of five but a TDV of 102. These values are difficult to contextualize, reinforcing the point yet again that the most challenging music analytically will be that in which chord types and their presentations are freely mixed, whereas musics with a more limited and fixed harmonic vocabulary and syntax will normally afford more consistent patterns that can be meaningfully compared internally. Yet at the same time there is a certain harmonically "placid," non-dynamic effect of the quartal chord that may be reflected accurately in its CDV of three in comparison to the major triad with a CDV of five.

An attempt was also made in this example to compose a clear melody that could be analyzed interactively with the harmony. It is important to understand the melodic T numbers shown above the staff as separate from the HPDVs, to be compared only within their own sphere. These melodic numbers show a very steady level of dynamism compared with the harmonic shape, with one stronger moment as the C♯ resolves up to D. One conclusion that might be drawn from this is that the harmonic progression constitutes the place in which the greater musical interest lies for this particular example, and indeed the progression was composed thinking about harmonic values far more than melodic values. As suggested earlier, the balance between melodic and harmonic dynamism can vary greatly, and, as will be considered in the next chapter, may form an important part of the panoply of musical processes that are extant in any musical product.

This page has been left blank intentionally

Chapter 5

Global Synergy in Musical Processes and Products

Introduction

As is likely evident both from the experiences of the reader and from the concerns of this study, some of the most immediate effects of what human cultures think of as "music" are dependent on the interactivity of time, pitch, and timbre in very sophisticated ways. Clearly these interactive webs are synergistic in the sense that their whole is greater than the sum of their parts. Moreover, much of this interactivity is captured analytically in the term "process," which can be further clarified using terms like "texture," "complexity," and "similarity." Because music is something that unfolds over (and across) time, it is certainly better described as a "process" than as "form," or even as "structure." Process may be fleshed out to indicate broader interaction of rhythm, linear and/or simultaneous pitch, texture, and timbre/tuning (with other sound elements such as articulation and amplitude being useful largely for grouping delineation), forming recognizable musical ideas that are then subject to exposition, repetition, variation, and contrast, measured in part by way of comparative similarity level.

It is exceedingly useful for a practical global music theory to have a consistent way of signifying where along the continua of complexity the processes of any given musical example lie in any given moment. The term "complexity" here implies no value judgment, but is nonetheless essential to the sense of tension and release that lies at the heart of musical effect; more complexity clearly requires more attention and more processing power from listeners, which may be seen as increasing the sense of dynamic tension in the music. Texture, which may be considered a special subcategory of process, can take on more specific meaning with regard to the relative independence of various layers of rhythm, pitch, and timbre, in ways that will be discussed presently. This chapter explores how the complexity of textures and other processes in music might be expressed in analytically manageable ways, with considerable general attention to the question of similarity levels. Embedded among these are ways in which both the distinctions and the relationships between twos and threes operate influentially.

The musical product, then, is a dynamic synthesis of these various musical processes, which can be approached through an expanded return to the ideas of musical grouping first discussed in Chapter 2. The affective aesthetic or culturally situated experience of or response to the musical product is something different, however, and will not be substantially considered here, though it will be seen that some analytical leeway can be made for such considerations when they are known.

Grouping Revisited within the Process Space

Process in music can be understood simply as an extension of grouping and group relations. In that light, more detailed examination of how various musical elements may play a role in comparative grouping is now in order. This examination begins with acknowledging that musical process rests on four basic procedures: exposition, repetition, variation, and contrast; that is, musical material must first be presented ("exposed"), after which it can be presented again, either identically (repetition) or recognizably with some factors changed (variation), or else some other material can be presented (contrast). However, there are a number of nuances not captured by these terms, since they, like so many elements considered in this study, represent a continuum of possibilities. Before these can be considered, the larger question of how groups are identified must be taken up, though the two topics are closely intertwined.

That is, there is some considerable overlap between factors by which groups may be delineated and factors by which they may be compared, and thus it is useful to speak of grouping within the multidimensional process space. Aspects of either delineation or comparison include rhythm, pitch (melody and/or harmony, focused as appropriate to style), and texture (as defined later in this chapter), while a variety of other "lower-level" aspects such as tempo, articulation, and amplitude ("dynamics," though not to be confused with rhythmic and pitch dynamics as explicated in this study) are most usefully applied only to delineation. In many instances (but not all), the very same grouping considerations that would be part of the web of rhythmic relationships may serve in a more comprehensive process grouping scheme.

Yet any focus on complexity and its musical effect demands first the consideration of the parameters of the process space, and specifically of its limitations. To how many different simultaneous musical groupings, and at how many different simultaneous hierarchical levels, can a listener be expected to devote his or her attention? In one sense, "exposition" occurs when the answer to this question is "one" and "one" respectively. For there to be the perception of repetition, variation, or contrast, the answer would have to be at least "two" and "one" respectively (that is, two groupings on at least one level). Yet even these matrices do not capture the whole perceptual story. David Temperley speaks helpfully of the role of revision in "diachronic" ("across-time") musical listening (2001:205 and following), noting that analytical hearing seems to require constant comparison between musical material that has already occurred and that which is now occurring, until "the best" interpretation of their relationship (and concomitant structural "meaning") is determined. In such a "revisionistic" hearing model, to how many previous groupings/levels is the grouping analytically at issue being compared?

Adam Ockelford (2002) suggests a partial answer to the question of simultaneous attention by hypothesizing that listeners perceive analytically on no more than three levels, while Sloboda (1985:167–8) cites evidence that listeners can only concentrate analytical attention on one musical entity (such as a melody) at a time unless there is a larger structural Gestalt into which the listener can meaningfully subsume at least some aspects of the multiple entities some of the time. Taken together, these comments confirm the limitations on the human analytical listening required to apprehend integrative musical processes, and further suggest that the number of simultaneous musical groups and the number of hierarchical levels involved in such listening effectively constitutes a process space of no more than two or three dimensions.[1]

A review of the examples presented in Chapter 2, for instance, shows that three (or fewer) hierarchical levels of rhythmic analysis are typically the most useful. Such acknowledgement would seem to justify the prudence of limiting the dimensions of a practical process analysis model to a maximum matrix of three by three; that is, no more than three musical elements (characteristics, "chunks," or Gestalts) at no more than three hierarchical levels. Ockelford (2004:40) would seem to support such an interpretation in his assertion that, because the cognitive capacities of listeners might easily be overwhelmed by the almost infinite possible levels of similarity and difference in various musical aspects, the number of these relationships must be severely restricted and carefully chosen in the course of musical conception; otherwise, the experience of music might at times devolve into a perceptual chaos. From this observation it could be extrapolated that limiting the number and type of similarity/difference categories to those suggested in this study (that is, those that seem to be important in a wide variety of musics, though in different combinations and ways), while not a perfect model of human cognition, at least corresponds to certain realities. Sloboda (1985:167) cites other research affirming that attention can be devoted to more *different* things at once, and so expectation that a listener could attend to up to three levels of three different aspects in three different areas—say, rhythm, pitch organization, and texture—might still be appropriate, even if all but the most oriented and committed listener might typically do less.

Thus, in determining where along the repetition/variation/contrast continuum a musical moment or section lies requires some sub-determination of where the rhythmic, melodic/harmonic, and textural (with timbral) aspects each themselves lie on that continuum, while at the same time acknowledging that the elements work together as syntheses on yet another set of levels. The next set of questions,

[1] While it is reasonable to note that more simultaneous layers of perception are likely to develop through repeated exposure to the same piece of music, these findings suggest that each set of layers may operate within its own simultaneous limitations as the listener quickly switches attention back and forth between sets.

then, revolves around how listeners go about making successful categorical choices within these processing limitations. These will be considered in due course, but it can be said at this point that general principles of parsimony and simplicity tend to predominate.

Still, the complex relationship between grouping and similarity level should not be underestimated, nor should the power of "lower-level" surface aspects such as tempo, articulation, and amplitude, all of which fit well into LaRue's "Sound" category (1970).[2] As an example, consider the Japanese aesthetic concept of *jo-ha-kyū*, originating from *gagaku* (Wade 2005:38–9), in which the first section of music (*jo*) starts at a certain tempo (usually perceived as slower and not always regular); proceeds to a second section (*ha*) that settles into a more steady sense of beat and an increase in tempo; and then moves to the fastest section (*kyū*), which also usually decelerates briefly or moves abruptly to stasis at the conclusion. As a process-related concept that can operate at any number of hierarchical levels in music,[3] *jo-ha-kyū* represents an elegant synthesis of the ideas suggested herein, in that it (1) is limited in its tripartite conception; (2) is delineated into (sub-)groupings by virtue of a clear (if lower-level) musical relationship; and (3) suggests both a Gestalt (a single accelerating shape) and three pairs of relations at lower levels—each portion compared to each of the other two. The similarity value with regard to the salient matter of tempo between each pair of groupings appears on the surface to be essentially zero. Thus the most appropriate letter designations (again, only with regard to tempo) would seem to be A–B–C. However, there is an intriguing relationship that arises from the deceleration often included at the end of the third section of the shape: that whole third section can be seen as a retrograde of the first two sections (that is, starting faster and slowing down to stasis as the reverse of starting in stasis and accelerating).

Two other less culturally specific but still well-established process concepts that also reflect the notions suggested herein are the so-called "forms" often labeled "binary" (A–B) and "ternary" (A–B–A). Like *jo-ha-kyū*, these adhere to the elegance of two and three as preferred limitations in the realm of perceptual relationships. The question of just how different "A" is from "B," and in what

---

[2] Ockelford notes that often the similarities or differences sought by analysts are thought to be in the pitch or rhythmic realms, when in fact timbre, texture, tessitura, amplitude, and other factors that LaRue would place in the "Sound" category seem most determinative (2004:31). However, the pitch and rhythmic elements and their development cannot be incidental to this process, as their randomization would likely affect structural perception, but their processing is also of a higher order than the "Sound" aspects (2004:32). Moreover, the lower-order elements are so vague musically as to be of little help in distinguishing between many sections or many pieces, yet listeners seem to be able to do so. Ockelford seems to suggest that it is the combination of lower- and higher-order distinctions (in that order of importance) that is required.

[3] See, for example, the accelerating micro-level percussion shapes in *gagaku* as presented by Nelson 2008:59.

ways, arises often in these cases; many times it could be said that the distinctions among a number of aspects are much less clear than suggested by the labeling, and that a more specific system of designating relationships would be very helpful. These concerns become even more salient as the complexity of processes and products grow, as in, for example, Western sonata-allegro "form," *sangatis* (gradual, transformational development processes) in Carnatic *kriti* sections (see Morris 2001), or West African multi-ostinato textures.

But Ockelford insists that "similarity" alone is not a sufficient way to distinguish groups: "all pieces comprise an intricate mix of identities, similarities and differences, and it is not any one of these characteristics but their perceived interaction that serves to define musical content and structure" (2004:55). Once again, many of the principles for rhythmic grouping outlined in Chapter 2 of this study can be adapted for broader use. Ockelford (2004:72), for example, highlights proximity and "good continuation" (that is, some measure of expectation and fulfillment) as important factors. Sloboda (1985:189–93) discusses grouping in terms of perception of "closure," as well as with regard to similarity relations. Whatever the criteria, the grouping and the comparison process will continue back and forth until some sort of satisfying conclusion is reached (again, reflecting Temperley 2001).

Along the Textural Continua

Once preliminary larger groupings are determined to one or extent or another, analysis can commence as to what sorts of similarity and complexity relationships may exist between them in ways that articulate process in the music. As noted earlier, texture can be considered a special type of sub-process. Though they are not culturally neutral at all, the four terms that musicologists have traditionally used to refer to basic musical textures are as good a starting place as any. Like all terms, however, these are limited in that they do not reflect the range and the fluidity of musical texture as it unfolds. In reality, textures can better be understood to exist along a broad linear continuum, in relation to markers that may initially be labeled "monophonic," "heterophonic," "homophonic," and "polyphonic," but with many shades of gray in between, and for a number of different reasons.

Yet even such a conceptual continuum, improvement though it may be upon the static terms, is too limited by its one-dimensional nature. In what order would the four terms come along the line? And how much linear room ought there to be between them? The considerable difficulty in many cases of determining where along this continuum a texture lies is due largely to the qualitative differences between rhythmic independence and pitch independence. Moreover, these traditional labels omit an element that contributes to the perception of textural complexity: timbral distinctions, which are in turn, as has been discussed, also related to tuning. It may therefore be more helpful to see basic musical texture as arising from both the type and the level of interactivity of rhythm, pitch, and timbre within a three-dimensional space, articulating a continuum from pure monophony (a single rhythmic and/or melodic stream using a single basic timbre) to complex polyphony (multiple independent melodies with distinct timbres). The extent to which harmony is a factor, that is, the balance between pitch linearity and pitch simultaneity, is a complex issue that will be addressed in due course. This continuum is meant as descriptive rather than as a way to assign hierarchical value, and is also subject (as are all the methods proposed in this study) to considerable contextual interpretation.

A three-dimensional array of numbers, designated Tx(x,y,z), then, becomes useful for placing a textural concept or moment within a space where Tx denotes "texture" and the parenthetical x represents the level of multiple (normally simultaneous) rhythmic independence; y represents the level of multiple (normally simultaneous) pitch independence; and z represents the level of multiple timbral independence, with each factor arbitrarily assigned a value between zero and ten. In such a model, a multitude of textural states are possible, and at least three of the four classic labels may be located so as to reinforce their distinctiveness: the simplest "monophony" at Tx(0,0,0), with minimal independence in all three aspects; complex, multitimbral "polyphony" at Tx(10,10,10), with maximal independence in all three aspects; and typical "heterophony" perhaps at Tx(5,0,5), with minimal pitch independence and somewhat more rhythmic and timbral independence. Fewer musics tend toward the Tx(0,0,0) state; Islamic *qu'rānic* recitation and Japanese solo *shakuhachi* music are good examples. "Homophony" becomes harder to locate in this space, since the line between "melodies" and "harmonies" can sometimes be very fine indeed, and many textures that are meant to accompany primary melodies in subordinate ways may nonetheless contain a mixture of lesser "melodies."

How the independence of any of these elemental aspects is determined is obviously a key issue, one that can be facilitated using rhythmic grouping analysis; analysis of the pitch dynamism and contour of any separately perceived melodies; timbral distinctions ranging all the way from simple perceived differences, such as that between a *sitar* and an oboe, to detailed assessment of how specific overtones and inharmonic aspects are reinforced by design in the sound(s); and consideration of ways in which harmony (if any) is articulative. In the case of timbre, the value of finer distinctions needs to be carefully considered, since even though every "monochromatic" instrument or ensemble has a subtle range of timbres, the proposed measure is most analytically useful when clearer timbral distinctions are made. At the same time, such decisions must remain contextual. An African *mibra* or a Western orchestral string ensemble or a choir of Tibetan throat singers might each represent only one timbre in a piece involving all three, whereas some further distinctions could be meaningful in a piece involving only one of them.

A "homophonic" texture could thus conceivably fall into any Tx designation. A homorhythmic harmonic chorale performed on the piano (understood here as relatively monochromatic for purposes of timbral distinction), for example, might be aptly labeled Tx(0,2,0) or (0,7,0) depending on how independently conceived the pitch contours and dynamics of the individual chord voicings are; a solo instrumental melody with a relatively simple chordal accompaniment might fall into the Tx(5,5,5) range; and a more elaborate opera aria with multi-instrumental accompaniment that contains some clearly identifiable but still subordinate countermelodies might better be labeled Tx(4,10,10). The possibilities along this continuum are vast.

There is also considerable room for overlap in this scheme. Take for example a folk song melody with an unchanging pitched drone and single drum accompaniment: this type of texture has sometimes been called “monophonic,” yet it features more levels of pitched, rhythmic, and timbral interactivity than the absolute monophony imagined at Tx(0,0,0). The drum part would likely be rhythmically distinct from the melody, while the drone, though lacking any rhythmic identity, would create some pitch dynamic against the melody. And all three elements would likely be rather timbrally distinct. Yet this texture is neither “heterophonic,” “homophonic,” nor truly “polyphonic.” Perhaps Tx(6,4,10) will do, even though one could imagine a more “homophonic” piece bearing these same numbers. In fact, this problem largely disappears when the traditional labels are removed and the textural effect is described within the array space instead, because the goal is merely to characterize the level of textural complexity in a way that retains some distinction as to how that complexity is constituted through a combination of multiple rhythmic independence, multiple pitch independence, and/or multiple timbral independence.

The question of when and how often to take a measure of the texture must be left to the particular situation. Certainly, clear changes of texture should be noted, but in many instances there will be no such changes for an entire section or even an entire musical piece, while in others the texture may change quite frequently. Such analytical decisions are also likely to be linked to larger grouping and process questions in the music.

Similarity Relations among Groups

With regard to the broader realm of process in which texture plays an important role, Ockelford (2005:20) argues that “the source of perceived musical order lies ultimately in repetition,” but this can be stated in more flexible terms by saying that musical order is perceived as a series of relationships arising from various levels of repetition or non-repetition. These levels of non-repetition range from absolute contrast to the difficult gray area traditionally termed “variation,” in which some aspects are repeated while some are not. But even this is not yet clear enough for practical analytical use. Despite concerns from some quarters,[4] it is here asserted that the level of similarity between two musical entities (or, in fact, groupings) can

4 See, for example, Ockelford 2004, in which it is argued that there are salient fundamental derivational (“zygonic”) relationships that do not fit neatly into the common conception of “similarity,” such as event onset.

be most efficiently and usefully (though imperfectly) determined and stated as a percentage value.

A Similarity Percentage Value (SPV) may be established between any two groupings at any level within the music. However, in general the analysis should focus on determining SPVs between higher rather than lower level groupings. The difficulty here is in determining at which level a grouping comparison is most likely to be salient to the musical effect, as some occur at levels either too low or too high to be perceived by most listeners; moreover, levels function differently in various musics. Thus, determining the appropriate level for SPVs must remain contextual, though certainly some similarity aspects at lower levels will affect the SPV at the chosen analytical level. All in all, it is likely that SPV comparisons will most often be useful between musical "chunks" or groupings that Clarke (1999:476) suggests would fall into the "perceptual present," that is, the amount of musical material that can be held in the listeners attention as a grouping, which hovers reliably between 250 milliseconds and 10 seconds, after which the material is committed to memory for the kind of comparative processing with which this chapter is concerned. Thus, the actual amount of musical material perceived in this way will vary depending on tempo and, to some extent, on density as well, but some sort of "chunking" or grouping within these parameters clearly must take place for musical process to be perceived. In many musics, these "chunks" will correspond to "motives," "sub-phrases," "phrases," and similar such units of whatever name. From the similarity comparisons at these levels, the listener (and the analyst) may be able to piece together larger process relationships.

The SPV between two groupings, then, can be calculated by determining the similarity at no more than three hierarchical levels within rhythm, pitch (melodic and/or harmonic, as appropriate to the style), and/or texture; that is, constituting a "similarity space" of no more than a three by three matrix. Each of the three sub-spaces may include several aspects to be considered, each of which is conferred a similarity score between zero and ten:

Rhythmic similarity (total of up to 30 points):

- Similarity of grouping in or between any of up to three hierarchical levels (total of up to 30 points), or
- More clearly defined rhythmic motive similarity in or between any of up to three hierarchical levels (total of up to 30 points).

(NB: The analyst should try to void overlaps between these two aspects; that is, groupings and motives may be the same thing in some contexts, and should not be scored double as a result, since the perceivable similarity occurs within one or the other context.)

Pitch similarity (melodic and/or harmonic, as appropriate to style;[5] total of up to 70 points, though often fewer):

- The identity (such as world pentatonic, whole tone, or a *rāga*) and mode of the collection (such as world pentatonic mode one, or one of the diatonic modes).
- The transposition of the pitches (if any), and to which tonal level within the collection. Both the S number difference (measured as if the first occurrence defines S0) and the actual pitch proximity/range between the transpositions should be considered (see Deutsch 1999b:360).
- Melodic contour. Retrogression and inversion must be carefully considered, and generally should lower this score appreciably (see Deutsch 1999b:362). Here also, the balance of conjunct and disjunct motion should be compared.

(NB: As with rhythmic motives, it may be easier or more appropriate to consider the three aspects above as a conglomerate in more clearly defined motivic contexts, for a total of up to 30 points.)

- Overall melodic dynamism level, as determined by a general assessment of T values between melodic pitches; this should normally be assessed only when clearer similarities and/or motivic identities, as per above, seem to be absent.
- Chord type identities. CDVs (see Chapter 4) may or may not be helpful in making this comparison.
- Overall harmonic dynamism level, as determined by a general assessment of CDVs, TDVs, and/or HPDVs (see Chapter 4).
- Chord sequence root relationships, as well as relationships between reoriented S0s (that is, “modulations”) where relevant.

(NB: Root relationships, chord type identities, and transposition issues can overlap in some harmonic contexts, and various melodic and harmonic elements can also overlap significantly. Such circumstances must be handled contextually. Moreover, in many instances, motivic material is created from a fusion of rhythmic and pitch aspects; such motives then take on a higher order identity that aids in apprehension of the musical process. Nevertheless, the various pitch and rhythm features may still be separated out comparatively for similarity scoring.)

Textural similarity (total of up to 30 points) –

- The absolute value of the difference between the two groupings for each textural element in Tx(x,y,z) is determined, and the absolute value between that number and 10 is assigned. Finally, the values of all these factors are

[5] See Williams 2005 for a discussion of how deeply intertwined perception of and attention to melodic and harmonic elements seems to be.

> added, for a total point score of between zero and 30. So Tx(2,2,2) and Tx(2,2,2) have a similarity of 30 (100 percent similar); Tx(0,0,0) and Tx(10,10,10) have a similarity of zero (completely dissimilar); and Tx(3,0,0) and Tx(2,5,3) have a similarity of 21 (70 percent similar). However, one final adjustment may also be made in this total score by considering the level of timbral difference between the two groupings, something that would not otherwise be reflected in the Tx calculation. As noted earlier, such distinctions may be more or less dramatic depending on context.

Since only each context determines the total number of similarity points possible, the final overall SPV is then calculated by determining the percentage of similarity points out of the total number of points possible in the particular comparison. But how might such information be interpreted meaningfully? A literal repeat in the music would presumably have an SPV of 100 percent, for example. However, analysis that takes into account particular performance data might very well reveal a wider range of SPVs between such "repeats." The threshold at which repetition becomes variation and at which variation becomes contrast along the similarity continuum may be impossible to establish reliably. As with the traditional textural terms, the use of "repetition," variation," and "contrast" could be regarded as largely superfluous in this system of numerical similarity values. Still, without the distinctions they attempt to convey, and especially the idea of repetition interacting with some level of non-repetition, its seems very difficult to imagine the perception of coherent musical processes.

This dilemma may explain why Ockelford and Tenzer explore alternative classification strategies. As previously noted, Ockelford locates group relationships in terms of derivational level, a scheme in which there can be no absolute lack of similarity between neighboring groups without the musical process becoming incoherent (2004:56). Moreover, Ockelford frames the similarity continuum question using the concept of "salience," which is dependent on the orientation and expectations (cultural and personal) of each listener (2004:35–6). This simply means that the SPV method proposed here is a broadly interpretive one, in which many possible values can be expected to be determined. To the extent that the salient concepts are known for the musical culture from which various stylistic characteristics arise in a given music, these interpretive analyses can be more clearly culturally situated; alternatively, if the music in question can be understood to define or redefine such elements, these definitions can be used interpretively.

Tenzer reframes the question through rich appropriation of the mathematical/scientific term "periodicity" (2006a:22–31) in ways that usefully encapsulate the interactive processes of music by going far beyond the too-often narrowly exclusive association of musical periodicity with "repetition," and into the realm of how exposition, repetition, variation, and contrast may be "dynamically entwined with process" (2006a:25). As Tenzer further elaborates, some musics are more "isoperiodic" (more strictly repetitious of smaller units) while others bring repetition into more complex dialogue with "gradual change in melodic, harmonic, or some other dimension" of the music (2006a:29). But repetition is clearly the anchor in this (and, ultimately, in Ockelford's) conceptual framework.

A number of theorists (including Lerdahl and Jackendoff 1983; Temperley 2001; Ockelford 2004; and Rahn 1983) suggest that such determinations can be framed in terms of "preference rules," rather than in absolutes. Because different cultural interpretations are likely, it may therefore become incumbent on the analyst to establish some basic preference rules or at least principles, considerations that are most useful when contextually determined. More broadly, however, it is necessary to face the real possibility that cultural salience may not be determinable or separable, especially in global fusions. Ockelford (2004:45–7) suggests that parsimony and simplicity are likely to be the most helpful guiding factors:

> [W]e will tend to opt for structural interpretations whereby, other things being equal: lower levels of relationship are preferred to higher; simpler functions are preferred to more complex; perfect [derivational relationships] are preferred to imperfect; a lower degree of imperfection is preferred to a higher degree; parallel processing is preferred to non-parallel, both within perspective domains and between them; and fewer relationships are preferred to more. Frequently, there will be competing preferences. (2004:47)

Thus, yet again, the analyst must be free to make the appropriate determinations. For the purposes of the method proposed, the influence of such decisions could be meaningfully reflected in an adjustment to the percentage that each of the three large similarity categories (rhythm, pitch, and texture), or any of the subcategories within them, contribute to the final SPV. All things being otherwise equal, however, the calculation might normally be made with each category carrying the same weight.

Consider, for example, the two melodic phrases below, composed by the author for *shakuhachi*, each of which will be considered a grouping (based largely on the rhythmic placement of the longer note values) for analytical purposes in this instance:

Ex.5.1 Two phrases for *shakuhachi*

These two phrases could be compared texturally at Tx(0,0,0) and Tx(0,0,0); but, because of the timbral difference in the two *shakuhachi* registers, a slight similarity adjustment might be warranted, for a total textural contribution of 29/30 points or 97 percent similarity. The rhythms are identical, but at two different hierarchical levels (at 10 points each), suggesting a point value of perhaps 15/20 or 75 percent similarity; 10/20 seems too low here because of the exact duplication of rhythmic ratios, but 20/20 is too high due to the fact that the difference in hierarchy does require some processing attention. The pitch arrangement is a bit more complex. Both phrases are based on the *miyako-bushi* collection (10/10 points, with no further modality to be considered), but the second is transposed up a considerable distance to the S1 level of the first, perhaps suggesting 7/10 points. The melodic contour is identical, for 10/10, and there is no harmony; thus no further comparison is needed. Pitch similarity totals 27/30 or 90 percent. The SPV for these two phrases, then, is 71/80, or 89 percent similarity.

Does this result reflect a typical perception? The answer would appear to be murky. In one brief empirical experiment conducted for this project, in which 20 trained Western musicians were asked to give a rough estimate of the similarity percentage between the two phrases (without knowing anything of the calculation methods), the answers ranged from 45 percent to 100 percent with an average of 74 percent, making the proposed value of 89 percent seem high. It could be argued, for example, that in this case the textural similarity may be exerting too much influence on the final value, while the subtlety of the rhythmic relationship and the transposition factor may be exerting too little. The analyst is free to adjust the weight that each category contributes to the final percentage, but in the abstract near identity in the texture/timbre category should not be underestimated as a powerful "lower-level" similarity factor (see again, for example, Ockelford 2004:31).

There is, however, a further underlying question that remains as yet unanswered: in the vast territory between 100 percent similarity (that is, exact repetition) and zero percent similarity (if such a comparison is possible), at what thresholds do meaningful differences emerge? What is the real value, for example, of comparing a 45 percent similarity to a 60 percent similarity? Like the CDVs, TDVs, and HPDVs proposed for harmonic analysis, SPVs are likely to be analytically meaningful only in particular contexts, and most especially when they reveal dramatic differences or clear sequences of increasing or decreasing similarity in larger musical segments. Moreover, the issue of complexity and its concomitant effect on musical dynamism takes on further meaning in an analytical milieu in which similarity differences are vast (say, at least 50 percentage points apart), since the closer one comes to 100 percent similarity the less detailed processing is likely required to apprehend it; likewise, the closer one comes to zero percent similarity, the more processing is required. Further still, the sophistication both of musical memory and of previous musical experience, including local and long-term repetitive exposure to material and connections to previous prototypes in whole pieces and whole syntaxes/styles/genres/repertoires, becomes important in such processing; the more one has heard and the more one remembers, the easier it is to conduct comparisons among various learned categories. These considerations will in turn affect analytical decisions. Thus a broad and flexible system is needed to accommodate a wide variety of analytical contexts, so that analyses conducted at various levels of sophistication for various purposes and for various audiences are all valid. Once again, the main value rests in being able to conduct such analyses in relatively common terms.

The Golden Section (2/3), Arch Form (2/1) and Other Proportionalities

Before considering texture and process in a few example genres, a brief word needs to be said about "formal" proportionalities involving twos and threes. Whereas the ratio of 3:2 in pitch indicates that three periodic wave cycles of the higher-pitched note occur over the same duration as two periodic wave cycles of the lower-pitched note, and whereas the twos and threes of rhythmic grouping may be both sequential and simultaneous (at various hierarchical durational levels), proportional relationships of two and three between durational sections of a musical product take on somewhat different implications. In some respects, these latter are further manifestations of rhythmic grouping, but in other ways their durational relationship may not be as directly captured by that method (because of, for example, hyper-groups of mixed duration). To say that a section of music is shaped by a durational proportion of 2:1 is actually to say that two sub-portions stand in relationship to one subsequent sub-portion, for a total of three sub-portions: the first part constitutes 2/3 of the music while the second part constitutes 1/3. As is clear from the Fibonacci series (1–1−2–3−5–8−13–21–34, and so on), a similar proportion results when three sub-portions stand in relation to two subsequent sub-portions, for a total of five sub-portions, expressed as 3:2 (3/5 + 2/5), and so on: 5:3, 8:5, 13:8, and so on. Such proportions are strictly sequential, and all of them roughly approximate .6 or .66, the 2/3 point ("Golden Section") much discussed in Western aesthetics. A symmetrical piece with two roughly equal sections might be expressed as 1:1 (1/2 + 1/2). Thus for the purposes of discussing twos and threes in formal/process structure, and in distinguishing that discussion from the details of rhythm and pitch examined earlier, special interest resides in considering manifestations of 1:1 (expressing two) and 2:1 (expressing three, though, as just noted, a similar result occurs with 3:2, 5:3, and so on). Voloshinov discusses these proportionalities, and symmetry in art more generally, rightly noting that "the golden section is a symmetry of similarity of the parts and the whole," but also that "strict symmetry in art is perceived as static, or rigid, whereas proportion bears the idea of dynamics and life," and that "Nature itself seems to avoid strict symmetry and produce slight flaws in its ideal laws" (1996:110–11).[6]

That is, in many respects such proportionalities based on twos and threes are as much conceptual as they are real, but no less important. This may explain why, as already encountered above in *jo-ha-kyū* and binary and ternary "forms," the

[6] Benson (2006:312–58) echoes this view. Kak (2006) offers an equally complex analysis, one that echoes Mario Livio (2002) in its more skeptical view of the Golden Section as an aesthetic universal, but that also affirms a deeper neurophysiological basis for its aesthetic power.

conceptual proportionalities in music do not always conform strictly to durational proportionalities. Thus an A–B–A form is still tripartite even when the B section is considerably longer in duration than either of the A sections. Perhaps not much more needs to be said about these, except that they are important since their ubiquity further demonstrates the propensity of human beings to prefer limits and ratios based on twos and threes, while at the same time acknowledging that approximations of these models are also valid, and may in fact confirm the models as underlying the realities. This variability within clear conceptual limits may allow for a sense of freshness and growth (in nature and in art) without at the same time invalidating the models as analytically useful. Analyses in Chapter 6 will feature some use of such models.

Textures, Processes and Products in Representative Musical Contexts

Though the limitations of this study prevent detailed analysis of extended passages from multiple works in this chapter, further analysis and comment on texture and process will be made in the context of examples in Chapter 6. Meanwhile, a variety of representative (though by no means exhaustive) examples may be considered in the abstract from among the musics of the world.

One particularly interesting textural combination can be found in the Thai *mahōrī* ensemble, which is somewhat representative of other southeast Asian musics in its sophisticated approach to multiple simultaneous performance of a single melody. An overall Tx value for this music of perhaps (5,2,10) seems reasonable, due to the minimal pitch independence coupled with somewhat more rhythmic variation and the rich diversity of instruments typically used in the ensemble, including wooden and metal idiophones, plucked and bowed chordophones, an aerophone (flute), a small membranophone, and, often, a singer. Morton describes the effect and its polytimbral implications as:

> made up of a main melody played simultaneously with variants of it which progress in relatively slower and faster rhythmic units … Individual lines of melody and variants sound in unison or octaves only at specific structural points, … [between which] each individual line follows the style idiomatic for the instrument playing it. The vertical complex at any given intermediary point follows no set progression; the linear adherence to style regulates. Thus several pitches that often create a highly complex simultaneous structure may occur at any point between the structural pitches. The music 'breathes' by contracting to one pitch, then expanding to a wide variety of pitches, then contracting again to another structural pitch, and so on throughout. (1976:21)

Thus, the polytimbral features produce a dynamic synergy with the various (more similar) pitch/rhythm levels, requiring a particular (and significant) balance of aural processing in all three aspects. Morton (1976:2–4) also notes the historical cross-cultural influences in Indian, Javanese, and Thai music, and even hints at Chinese connections, perhaps explaining why this type of textural approach (often called "heterophony") with multiple timbres may be found throughout a wide region of Asia, and thus why Tx values may be more likely to fall within similar ranges for these musics—or that it might be noteworthy when they do not.

The melodically focused nature of Indian music also features a variety of distinguishing process characteristics, at both the micro and macro levels and in the relationships between the two. Many of these can be gleaned in the important Carnatic vocal genre known as the *kriti*, a Hindu devotional song that is also used as the basis for extended instrumental performances (much like standard jazz tunes are used for extended improvisation). Many of the most famous *kritis*, and the developmental techniques that stem from them, are credited to Tyagaraja (1767–1847):[7]

> who introduced into the kriti extensive melodic/rhythmic variations called *sangatis*. Before Tyagaraja, kritis were for the most part usually composed of only a few phrases, which would be repeated with slight variation; but with his use of sangatis, the kriti was expanded into a long, dynamic composition, often containing a climax replete with intricate motivic development. (Morris 2001:75)

Modern *kriti* performances in their simplest concert-like contexts typically involve three to five musicians (see Viswanathan and Allen 2004:18), including the melodic soloist (vocal or instrumental); sometimes a secondary melodist whose instrument is usually of a different timbre from the main soloist, and who normally echoes the main soloist with various levels of rhythmic independence; a musician playing the obligatory S0–S1 drone; and a *mrindaṅgam* (double-headed drum) soloist. Thus the range of timbral distinctions is fairly wide, while the number and type of independent pitch/rhythm elements is somewhat more diverse than in *mahōrī*, perhaps especially in the virtuosic role of the percussionist as well as in the independence of the two melodists from the drone pitches (and to some degree from each other as well) within the confines of the *rāga*. The Tx value for a situation thus described might hover near (8,4,9), producing a Tx difference between the Carnatic and Thai ensembles of 25/30 or 83 percent textural similarity in this instance.

But, as suggested, it is in the type of melodic development that the *kriti* performance is likely to differ more from certain other major genres.[8] Morris

---

7 Analysis of brief excerpts from the *kriti Vidulaku*, by Tyagaraja, is featured in Chapters 2 and 3.

8 Indeed, a separate volume would be needed to properly explore types of melodic development in various world music genres. Only a very few representative examples can be touched on in this study, but it is hoped that these provide a glimpse into how the analytical methods suggested herein might be put to more extensive use.

offers a detailed study of *sangati* developmental processes in two *kritis*, noting that these are analytically (and, by extension, perceptually) challenging because they are on the whole more transformational than merely variational:

> [R]hythmic, melodic, and other modifications complicate the profile of the music so that each time a new sangati is played, the relative positions of rhythmic stability and repose within the tāḷa move and eventually exchange. These transformations are more complex than those found in similarly structured passages in be-bop jazz and in the music of Steve Reich … Within the syntactic constraints of rāga and tāḷa, we [witness] a number of intricate processes of variation involving prefix, suffix, insertions, rhythmic permutation and reconfiguration, contour transformation and affiliation, and the like. (2001:78, 89)

Morris's complexity assessment is all the more true since each subsequent *sangati* is retroactively comparable to all those that come before it. His analysis of *sangati* sequences uses rhythmic grouping techniques similar to those proposed in Chapter 2 of this study (though on one hierarchical level only), while his examination of the pitch process focuses on various levels of anchor tones (though not precisely along the same lines as in Chapter 3). This fortuitous orientation makes similarity comparisons as suggested in this chapter rather easier (though the music is not shown here): the SPV of phrase two to phrase one of Morris's first *kriti* example, *Karpagame* (2001:79), is 99 percent; the SPV of phrase five (precisely the middle of the series) to phrase two is 89 percent, and the SPV of the ninth (final) phrase to phrase one is 65 percent. These snapshot values tend to confirm the "transformational" label assigned by Morris to this sequential developmental process.

At the same time, this development takes place within the single opening section (*pallavi*) of a larger five-part process in which the sections have other similarity relationships at different levels. On the surface, the (typical) repetition in *Karpagame* of the very first line of the *pallavi* (the "pallavi phrase") at the end of the second section (*anupallavi*) and also after the third and fourth sections (*caranams*) are complete, coupled with yet another recurring unit that Morris calls the "return phrase" (2001:76–7) appearing at some of these same structurally important points, helps to draw the piece together into a more coherent whole. At more subtle levels, a number of other factors create both distinction and similarity between the five sections (the last of which is an abbreviated repeat of the first section). As is typical, for example, the *rāga* and its transposition as well as the *tāḷa* remain constant throughout the piece. The rhythmic motives (apart from the recurrences of the "pallavi phrase" and "return phrase") are rather different in the *pallavi*, *anupallavi* and the two *caranams*, but much more similar between the two *caranams*, while the second *caranam* rhythm also contains an independent instance of the 3+3+2 pattern that dominates the "pallavi phrase." The *caranams* are further set off from the *pallavi* and *anupallavi* as more syllabic in their text setting, another example of a "lower-level" grouping distinction similar to amplitude, range, and articulation.

Thus, again, grouping (in this case, the five sections) and similarity measures are different but interrelated. An analysis of the defining material from each section (see Morris 2001:77) yields possible similarity comparisons of, for example,

- anupallavi to pallavi: 71 percent
- caranam one to anupallavi: 73 percent
- caranam two to caranam one: 87 percent
- caranam two to pallavi (to reflect the cyclic nature of the process): 74 percent

These values would all drop slightly if some expected similarity factors were given less weight; this might seem an obvious conclusion, but the reason to do so would be to attempt to reflect a level of subtlety in similarity and difference that better captures stylistic expectations. That is, Indians listening to the *kriti* wouldn't normally expect the *rāga* or *tāḷa* to change, and so the fact that they would not might not be as relevant a similarity factor in this context. Even still, however, the relative SPV levels between sections would remain about the same. Clearly, in a relative sense, the traditional labeling of *Karpagame* as A–B–C–C'(–A') remains fairly accurate at the largest level, but does not reflect the level of coherence very well. At the same time, some of the most important process dynamism lies in, for example, the transformational development of the *pallavi* in comparison to the cyclic development of both the sum and various subsections of the piece (through recurrence). This, then, may be an example of what Tenzer (2006a:29) calls a "linear composition in a periodic context," a term he applies to other South Indian music. Attempting to determine SPVs, however contextual or imperfect, can help tease out such insights.

A different type of process complexity can be seen in what has traditionally been labeled "polyphonic" music, two examples of which are Aka (Central African) vocal/choral events and some of the keyboard music of Johann Sebastian Bach (1685–1750). Brief examples from each of these will be examined in more detail in Chapter 6, but here it is useful to consider how each embodies more of a focus on rhythmic and melodic independence than on timbral distinction. That is, while Aka singing will include many different human voices, these fall within a relatively narrow timbral range, while the Bach might be played on an instrument such as the harpsichord (or, in modern performances, on the piano) that is also relatively monochromatic. At the very least, these contexts would not be perceived as multitimbral compared to the Thai and South Indian examples previously discussed.

Temperley's study of the perception of contrapuntal independence (2001:85–114, 224–8), while not explicitly separating the effect of rhythm and pitch as in this proposal, offers a number of useful perspectives, including reminders of the importance of proximity (both temporal and pitch); a preference for grouping events into as few distinct streams as possible; and a preference for independent pitch streams not to cross. The closer the music hews to these principles, and the more independent the simultaneous rhythmic and pitch profiles are, the more truly polyphonic the music will be; or, in the terms of this study, the greater will be the complexity factor resulting from simultaneous rhythmic and pitch independence. The "simultaneous" modifier is important here, since much polyphonic music makes use of non-simultaneous imitation. Such imitation is important to similarity perception at one level, but the independence of simultaneous lines is what determines texture in the sense meant here.

The ways in which the independence of the melo-rhythmic lines is achieved varies between the two musics in question. Bach, for example, seems to rely more on imitation and derivation outside of simultaneities, whereas Aka counterpoint (like many African musics) makes more explicit use of "hocketing," in which independent lines also interlock to form new Gestalts.[9] Moreover, the pitch portion of the process analysis in Bach requires attention to harmony, whereas that is not a deliberate structural feature of Aka music. This is important texturally because the design of the melodies in Bach are heavily influenced (if not absolutely determined) by their underlying harmonies, with the placement of melodic tones that are not part of the prevailing harmony carefully controlled.[10] Despite such differences, however, these two musics (as understood here prototypically) can both be assessed as operating within a Tx range of around (9,9,0), only 30 percent similar to the Thai *mahōrī* profile posited earlier.

It is also interesting to note that contrapuntal musics of the type just considered tend to exhibit a somewhat broader range of textural densities/complexities within single pieces or events. In many cases of both Aka polyphony and the formal counterpoint of Bach, for example, the music will begin with a solo melodic presentation of important material that approaches Tx(0,0,0), with the number of subsequent simultaneous independent melodies often waxing and waning over the course of a single piece. This is especially clear in four- and five-voice fugues by Bach, in which the number of voices builds during the opening expositive section, and then often drops to only two or three (if only momentarily) in later sections and subsections. According to one transcription provided by Fürniss (2006:170–73), something texturally (though not imitatively) similar to a fugue happens at the beginning of a typical Aka piece.

---

[9] For an extensive (and sometimes alternative) analytical discussion of Aka music, complete with detailed transcriptions, see Fürniss 2006. Another very useful example of hocketing technique can be found in the music of Andean *zampoña* (panpipe) ensembles, especially in the genre known as *k'antu* from the *altiplano* (see Schechter 2005:270–74).

[10] On a related note, Huron (1991:135) discusses the perception of vertical intervals in the counterpoint of Bach, noting that "Bach's avoidance of tonally fused intervals is consistent with the objective of maintaining the perceptual independence of the contrapuntal voices," where "tonal fusion" is the result of two simultaneous tones being perceived as partials of a single complex timbre; such is an interesting strategy in comparatively less timbrally diverse contexts.

The broad survey offered in this section concludes with two example genres that seem maximal in textural complexity according to the rubric suggested here, though in slightly different ways: the interlocking multi-ostinati of West African traditional music and music of the New Orleans Dixieland-style jazz combo. Both of these combine high levels of simultaneous rhythmic and pitch independence with significant timbral distinctions, perhaps closely approaching Tx (10,10,10). In Ewe *Agbekor*, for example, variously sized drums are combined with the double-bell *gankogui*, the gourd-rattle *axatse*, and a collection of singers and dancers; whereas the New Orleans-style core ensemble (as eventually constituted in Chicago in the 1920s and after) is smaller, featuring three soloists on Western wind instruments (cornet or trumpet, trombone, and clarinet) along with a "rhythm section" that can include piano, guitar, banjo, drums, and a bass instrument (see Ostransky 1978:36). Nketia (1974:111) notes that timbre, texture, and complexity are closely interrelated in African music; the same could be said for New Orleans style. In contrast to Thai *mahōrī*, for example, the multiple timbres of African music help to set rhythmic patterns off from one another (which contributes much to what could be called a "kaleidoscopic" effect; see Nketia 1974:138), whereas in *mahōrī* (and similar musics) the multiple timbres help to set the various simultaneous melodic versions off from one another. These two processes are related by the concept of rhythmic independence levels, but the difference in the role of timbre is still worth noting.

Ostransky (1978:36) describes the melodic independence of the three core soloists in New Orleans style: "The cornet or trumpet played the lead, staying close to the melody. The trombone punched out and defined the harmony, while the clarinet embroidered and embellished a line above—the three voices creating the impression of three independent parts all against the steady, unaccented beat of the rhythm section." Likewise, Locke (1998, 2005) demonstrates a great deal of independence of parts within Ewe *Agbekor*, which is in one way emphasized by call-and-response processes (Locke 2005:85). That this was also a feature of New Orleans style is confirmed by Berry (1988:7): "One genius of ensemble jazz was its distillation of call-and-response into instrumental dialogues, as in the early [Louis] Armstrong-King Oliver recordings. From there it was not a far leap to Louis's eloquent horn replies to the vocals of Bessie Smith and other blues singers."

One of the textural/process differences between West African and New Orleans style, though, lies in the type of periodicity each music emphasizes: a harmonic progression (often 12-bar blues or a variant) in New Orleans style, and rhythmic or melo-rhythmic pattern in West African music. Thus Tenzer (2006a:27–9) might call the former more "isoperiodic" (based on smaller repetitive units) and the latter more "sectionally periodic" (with clearer distinctions at larger structural levels). This difference becomes important in process analysis, not only because of the different levels at which groups might be delineated and compared, but also because of the prominent role of harmony in one music and not the other. Such differences can make comparison more complex, since the murkiness of separating melodic and harmonic pitch perceptions noted earlier could obscure the similarity comparisons of motives and progressions.

Moreover, the role of improvisation in the developmental process of these musics is also of significant interest; as Gridley and Rave (1984:46) note:

> improvisation was not very extensive in European music of the late-nineteenth century—at least, not the kind found in most early small-group jazz—nor is it very common in West African music. Although soloists in some West African ensembles vary their lines from performance to performance to the extent that we can legitimately label the results as being partly improvised music, this in no way begins to approach the melodic complexity of improvisation that typifies the extent of variation in the lines of early jazz [horn soloists]. There is a tradition for more elaborate improvisation among West African drummers that should not be overlooked, although it is not clear whether any connection can be drawn between such drumming practices and the improvisation of jazz [horn soloists]. It becomes especially problematic to presume an African connection of this sort when we remember that West African singing and horn work are not filled with freshly invented lines.

Yet Locke (1998) asserts that improvisation is an important part of, for example, the *Agbekor* subgenre of *Drum Gahu*.[11] More specifically, then, the melodic improvisation that is a large part of New Orleans style takes place within the larger periodicity of the harmonic progression, whereas in Gahu the variations must be far more limited within small and firmly established rhythmic motives so that those motives can retain their identity. An effective process analysis of these two musics, then, would be deeply dependent on applying similarity relations to the appropriate grouping levels, and on explaining how comparisons between these levels might (or might not) be made. A larger question identified earlier arises once again, therefore: how effective can such cross-cultural analyses be when the details of each music are not previously known? In this particular case, observation of the music itself makes plain at which levels improvisation seems to be operating, but the question remains a fair one. Certainly, foreknowledge of each music aids comparative analysis greatly, assuming the analyst can be open to comparisons not apparent in each context alone. Yet a great deal could still be gleaned without such knowledge, following the exploratory methods suggested in this study. That is, the sound of the music is what it is. It is the cultural interpretation of such findings that needs to be approached with extreme care (or avoided altogether) in the face of less specific cultural understanding.

---

[11] See Chapter 2 for an analysis of some aspects of *Drum Gahu* rhythm.

Conclusion

Perhaps one lesson to be drawn from the foregoing discussion is that comparisons between musics with more complex textures also often necessitates more complex comparative analysis. More complexity requires more interpretive decisions to be made in the realms of both grouping and similarity measures. In the end, the analyst cannot completely escape his or her experiences and orientations. But this is precisely the advantage of having a common set of methods; the work of each analyst can be compared more directly and understood more coherently. Texture and broader processes, as has been said, constitute the highest and most interpretive level of analysis, since they require assessment of both local and global materials and relationships (in the non-cultural sense) in and across the musics at hand. The next chapter attempts to demonstrate the comprehensive possibilities of such methods.

This page has been left blank intentionally

Chapter 6

Global Analytical Examples: Comparisons and Connections Across Musical Cultures

Introduction

Having proposed concepts and methods for examining rhythm and pitch, along with textural and process considerations, some of the connections and synergies of these elements may now be explored more "globally" in a variety of musical contexts. Here, as in the rest of the book, "global" means both applicable to a wide variety of music cultures and useful for illuminating the synthesis of such cultures in single works, where "cultures" may refer to any number of differences across geography, time, and/or style.

Indeed, this study has from the beginning made varying degrees of reference to rhythm, pitch, texture, and process operating in tandem; the examples and analyses that follow attempt to continue and expand this trend, highlighting comparisons between musics usually considered culturally and/or stylistically disparate as well as more recent musics that display what might be called qualities of "global fusion." At the same time, limitations of length, scope, and availability make necessary particular efficiencies and trade-offs with regard to the examples analyzed herein, though it is hoped that the procedures demonstrated might be imagined as applied to more substantial works, as well as to styles and genres not directly represented. These goals will be pursued by comparing several shorter excerpts, while also attempting to reference larger and more complete sections and processes. In all, 15 examples of varying length and scope will be examined in various comparative ways, beginning with 5 melodically-focused excerpts; proceeding to 4 excerpts with more diverse harmonic, textural, and process implications; and ending with 6 examples of global fusion that reflect aspects of the approximately 75 years leading up to the time of this publication. These 15, in combination with the many excerpts offered in previous chapters, represent an attempt to demonstrate that the proposed methods could be usefully applied to a wide, though not exhaustive, range of well-established musics worldwide.

This chapter also aims for a somewhat more consolidated symbolic layout. Here, as in Chapter 2, rhythmic groupings are indicated by slurs for twos and brackets for threes, with all relevant hierarchical rhythmic levels now condensed below the staff for clarity. Melodic pitch analysis is indicated above the staff, while harmonic values are of necessity distributed across and below various parts of staves. While a few other symbolic annotations appear as appropriate, most of the actual analysis takes the form of prose commentary. (All of the symbols and abbreviations presented here are drawn from the previous chapters without further definition). Moreover, not every element of every excerpt is analyzed; this is to demonstrate both the flexibility and the importance of attempting to form salient analytical strategies and reduce visual clutter to the extent possible, rather than slavishly addressing every aspect.

Finally, a word needs to be said here about why only the 12-tone chromatic pitch collection is used for analysis in this chapter (except for one instance in which an attempt will be made to bring *rāga* tuning theory into play). As noted in Chapter 3, the use of 12-EDO as the basic conceptual collection continues to become increasingly standardized (for better or worse) across the globe, and especially in musics that attempt to bring together disparate elements from multiple traditions. At the same time, a great deal of "ornamental retuning" takes place when performances include voices and instruments that have wider pitch flexibilities, even when such voices and instruments are combined with instruments of fixed pitch, especially acoustic or (more commonly) electronic keyboards. It has already been shown that, in many cases, these tuning flexibilities do not have a sufficiently strong effect on tonal dynamics to necessitate their inclusion in analysis. At the same time, the analyst is certainly free to explore the possibilities they may represent in any given instance, on the basis of known theory and/or though spectral analysis of recorded performances, as was demonstrated in Chapter 3 and will be briefly reiterated later in this chapter. For the overall purposes of these examples, however, the 12-tone chromatic collection (though not always 12-EDO) will be deemed a generally sufficient framework, since, with the exception of the very first example below,[1] Western chromatic influence is amply evident.

Five Melodically-focused Examples

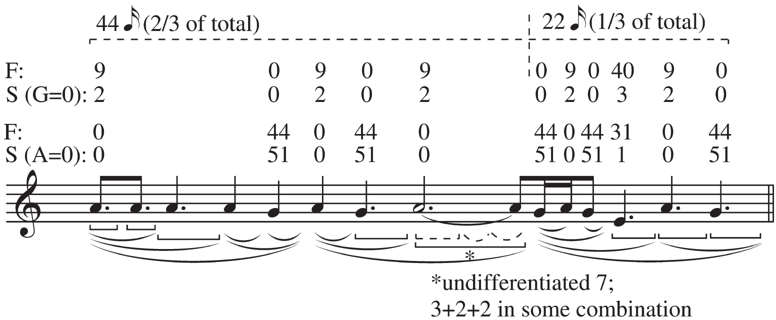
Though a melody with only three different pitches, the Central African Aka song fragment in Ex.6.1a represents a fascinating study in possible tonal ambiguity under this analytical system. While the ubiquity of the pitch A is most likely to result in its perception as S0, orienting the collection around G as S0 makes some acoustic/theoretical sense as well. Interesting too is the moment when G leaps down to E, for if G is S51 then the tension of the leap would be perceived as much greater than if only S0, S2, and S3 were involved (notwithstanding the fact that S51 would then resolve structurally to S0). Moreover, under the S0=G hearing, the leap to S3 (E) would provide the most tension, however subtle, and at or near the locus of the most elaborate rhythm and lowest sounding pitch. It is also worth noting that this figure is periodic, so that the G would "resolve" to the A each time the cycle begins anew; here again, though, the ambiguity of whether such movement is really a resolution remains intact. For more clarity, the T number

[1] Fürniss (2006:169) provides a brief but helpful discussion of the issues surrounding pitch representation in this example.

shape of the melody in S0=A—0, 0, 0, 60, −42, 60, −42, 60, −42, 60, −37, 22, 60—can be compared to that in S0=G—0, 0, 0, 7, 11, 7, 11, 7, 11, 7, 10, 22, 7; this shows that the melody has much more dramatic shape in S0=A, and a much more stable one in S0=G. But which analysis is more musically illuminating?

More information is needed. In fact, the fragment occurs in a larger context in which the pitch D is both the highest and lowest note sung, and in which C also subsequently appears. This suggests that the pitch superset is in reality world pentatonic mode three (D–E–G–A–C–D in this transposition), in which S0=D, S1=A, S2=E, and S52=G, and thus in which G could not be considered a point of tonal/melodic release (see Ex.6.1b). Though the S numbers would each then increase by one, the internal tonal dynamics suggested by the S0=A analysis above would not change at all (that is, the T number shapes are identical), except that having a clear S0 involved is almost always likely to result in a more resolved aural impression.

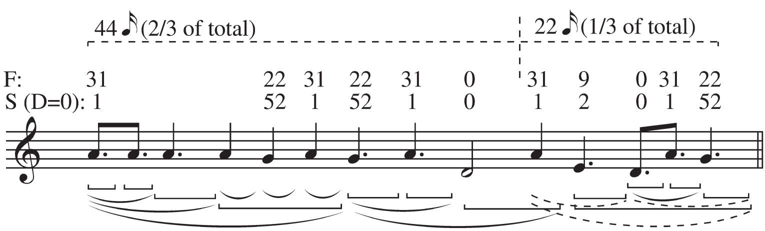
Ex.6.1a Central African Aka melody lead phrase (adapted from Fürniss 2006:170)[2]



It is important to remember that the rhythmic analysis in Ex.6.1a is but one interpretive possibility. For example, both the last three dotted quarter notes and the three quarter notes early in the excerpt suggest groups of three overlapping with groups of two. Indeed, at certain points later in the song (according to Fürniss's transcription), the second to last dotted quarter is replaced by two dotted eighths, resulting in a stronger impression of triple grouping and a concomitant reinterpretation of the preceding groupings (see Ex.6.1b).

Interestingly enough, however, both versions of the phrase can be understood as representing a 2/3–1/3 division at the higher structural level, with three large groups of sixteenth notes and third-level gestures divided at the end of the longest note. Some features of the second version do not support this higher grouping as well as the first; for example, a reasonable case could be made for dividing before the low D instead of after it, resulting in a more even durational proportion of 6/11–5/11 and a grouping of 3+2 at the highest (fourth) level. However, because the second version is heard only after the first version has been sung three times, the proportional characteristics of the phrase are aurally well established by that point. This kind of similarity at higher levels may help explain in part why the two variations seem relationally coherent. The actual SPV could be calculated as high as 78 percent: with slightly less than the first half of each being identical in both rhythm and pitch, though grouped a little differently because of what comes next, the rhythmic score could be set at 10/20, while the pitch score would begin with perhaps 8/10 for the collection similarity (the first example consisting of a pitch subset that is 75 percent of the second, though more ambiguous with regard to S0) and a pitch contour score of 7/10 (since the contour does vary noticeably in the middle, but returns to near identity at the end). In addition, texture would rate 30/30, and an additional 7/10 could be assigned for the overall large three-part grouping noted above.

Ex.6.1b Aka melody lead phrase, second version (adapted from Fürniss 2006:171)[3]



A very different fragment (Ex.6.2 below), this one from the *Dance of Fury for the Seven Trumpets* movement of *Quartet for the End of Time* (1941) by the French composer Olivier Messiaen (1908–81), is useful for contrast to the Aka phrase because of its brevity, disjunct pitch contour, complex rhythmic conception, and texture of very nearly Tx(0,0,0). In this case, the entire ensemble plays the same pitches and rhythms simultaneously (though in different octaves and with rather different timbres), and the pitch collection is clearly conceived as 12-EDO chromatic (only B is missing). At the same time C may reasonably be considered to be S0 because of its repetition and its place at the beginning and end as highest and lowest pitch. This orientation seems to be reinforced by the very first leap down to G (S1).

As expected, pitch, rhythm, and process considerations operate in tandem to clarify analytical choices in this case. The surface-level (sixteenth-note) rhythms could be grouped at the next (eighth-note) level in different ways, but the grouping

Ex.6.2 Messiaen, *Dance of Fury for the Seven Trumpets*, bar 12[4]

F: 27 4 40 31 18 9 49 35 18 44 31 0 40 13 35 27 44 40 0 27
S (F♯=0): 6 48 3 1 4 2 5 49 4 51 1 0 3 50 49 6 51 3 0 6

F: 0 31 13 4 44 35 22 9 44 18 4 27 13 40 9 0 18 13 27 0
S (C=0): 0 1 50 48 51 49 52 2 51 4 48 6 50 3 2 0 4 50 6 0

proposed here reflects pitch features that in turn reinforce proportionalities approaching 2/3 (0.66). It is on the A♮ that the melody is suddenly much more focused on lower S numbers (that is, more consonance), and then comes to rest on the final long C, resulting in sixteenth-note segments of 19–13–8 as well as third-level groupings that define these segments. Other such confluences can be seen in the way the tonal tension of the high S numbers in the opening gesture corresponds with a flurry of sixteenth notes; likewise, the surface rhythmic values become more regularly duple just as the tonal tension is lessening (again, starting on the A♮).

Yet here again, in the context of the entire movement, C is not necessarily the best candidate for S0, despite its clear place in this phrase. Indeed, throughout the piece F♯ is presented as much as or more of a "tonic," and the movement in fact ends on an F♯ of long duration. Reorienting the phrase analysis so that S0=F♯ (as shown in the upper set of numbers) yields some interesting features, including the fact that higher and lower S numbers are noticeably more evenly mixed. At the same time, the most proximate concentration of higher S numbers in this orientation occurs at the beginning of the second segment, whereas the opening gesture is more consonant. Thus clear distinctions remain between the three subsections of the melody, only in a more or less opposite tonal orientation to that of the S0=C analysis.

The T-number shapes of the two analyses are interesting as well. For S0=C, the T sequence is 23, 68, 7, 16, 7, 16, 37, 84, −20, 57, −20, 57, −20, 30, 7, 22, 50, −31, 21; whereas for S0=F♯ it is 68, −27, 7, 16, 7, 16, 57, −18, 74, −37, 22, 16, 74, 30, −34, 63, −44, 10, 33. Both shapes are fairly dramatic in the interspersion of tension and release, and both have strong resolutions near the end. S0=F♯ includes lower T numbers in the aggregate, but not by much. Overall, the conclusion could be drawn that the local melodic dynamics are roughly equal for the two orientations, with the significant caveat that the first one features its S0 much more prominently than the second.

In both the Aka and Messiaen examples, the analysis demonstrates how features of rhythm and pitch correspond in creating musical shape according to comparable principles, yet in noticeably different ways. Comparing, for example, the first Aka

4 Reproduced by kind permission of Editions Durand, S.A.

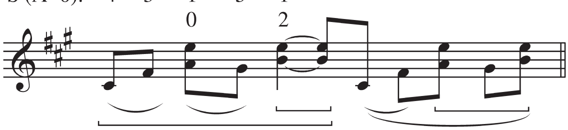
fragment (Ex.6.1a) to the Messiaen fragment could be seen as reflecting an SPV of only 41 percent: perhaps 5/30 for the larger tripartite grouping, but otherwise not similar rhythmically, and not laid out according to similar proportions; 0/20 reflecting a complete lack of pitch collection and contour similarities; but 28/30 for textural considerations.

A third and yet again rather different brief example, the repeating core material from *Violin Phase* (1967) by the American composer Steve Reich (b.1928), illuminates further the varied operation of similar underlying musical principles while also offering opportunity to discuss their extension. The work as a whole also represents a good example of a relatively recent global fusion of African, Asian, and European elements and sensibilities.

Indicated beaming notwithstanding, the pitch contour of the excerpt presented here virtually ensures that the measure is perceived aurally as a 2+2+3 motive, followed immediately by a truncated 2+3 version of itself; hence the rhythmic groupings noted below:

Ex.6.3 Steve Reich, *Violin Phase*, bar1[5]

S (E=0):	3	2	52 0	4	0 1
S (F♯=0):	1	0	51 50	2	51 52
S (A=0):	4	3	1 0	5	1 2



This in effect divides the core material into seven eighth notes followed by five eighth notes, resulting in proportions of 0.58 (7/12) and 0.42 (5/12) respectively (or 0.71 between them) rather than the ratios approaching 2/3 (or 1/3) in the previous examples. It is interesting to note that lengthening the held dyad at the end of the first motivic iteration by only one eighth note (and the entire periodicity to 13 eighth notes) would create the latter "expected" proportion, yet would at the same time also destroy the clear character and intrinsically balanced relationship achieved by having both motive versions end with a group of three.

The arrangement of pitch is no less intriguing. All three S0 options (A, F♯, and E) are very reasonable possibilities, though based on different aspects. S0=A seems the most elemental overall, due both to the composer's use of the three-sharp key signature and to the very low S numbers involved, yet several expected tendencies are thwarted: the resolution of S3 (F♯) to S1 (E) is complicated aurally by an octave displacement and by the simultaneous move to S0 (A); S5 (G♯) does

5 *Violin Phase*, by Steve Reich. Copyright © 1979 by Universal Edition (London) Ltd., London/UE161185. All Rights Reserved. Used by Permission.

not follow its strongest tendency to S0; and neither pitch of the S1–S2 dyad at the end of the motive resolves to the doubly expected S0. Thus, in this S0=A reading, the motive remains in a perpetually unresolved state.

Yet the alternate option for three sharps, S0=F♯, presents its own analytical anomalies: though a strong S1 to S0 resolution marks the beginning of the motive, it ends with the highest level of unresolved tonal dissonance, the S51–S52 dyad. And, while a modicum of tonal tension is released in the half-step movement from S50 to S2, the expected continuation on down from there to S0 is awkwardly delayed by considerable disjunct motion and durational and motivic separation. More generally, F♯ simply does not seem appropriately situated and emphasized so as to be a convincing S0 (unlike A, which at least forms the expected bottom of the S0–S1 dyad in the first analysis).

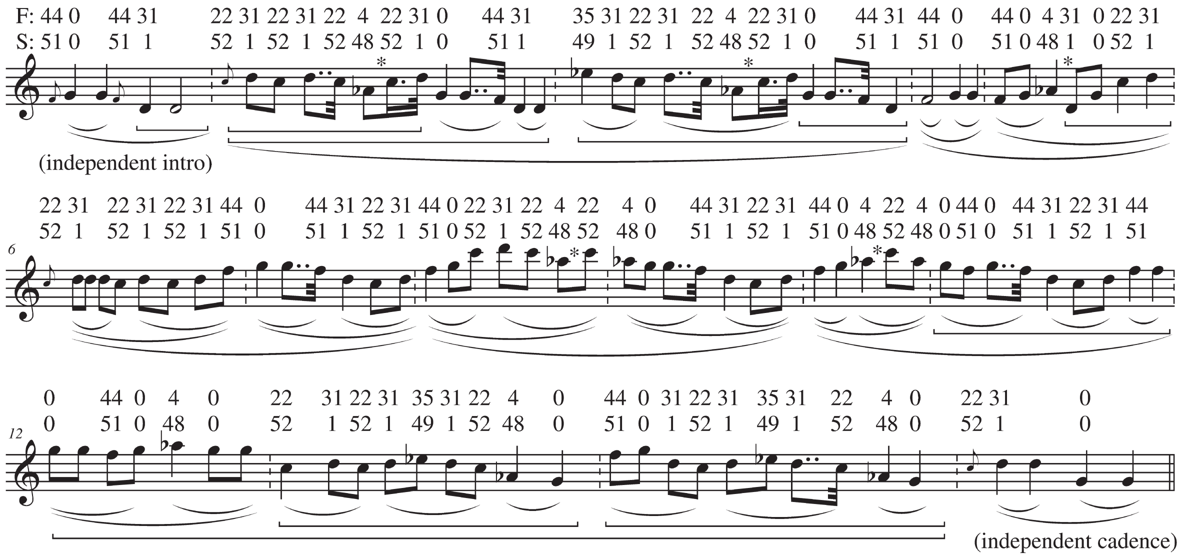
The absence of any occurrences of D or D♯ leaves open the possibility of S0=E, and indeed the S52 to S4 motion as well as the motivic ending on an S1–S0 dyad adds support to such an interpretation. Here, though, the unresolved S3 (C♯) at the beginning, followed by the awkwardly displaced S2 to S0 leap, detract significantly from S0=E stability.

What then is one to make of this state of tonal affairs? Perhaps the best answer is that this music constitutes a very good example of something touched on in Chapter 3: pandiatonicism, a situation in which the diatonic collection is used in ways that obscure a clear S0. In this sense of tonal ambiguity, the Reich is somewhat comparable to the first version of the Aka phrase, and, surprisingly, at least as tonally enigmatic as the extremely chromatic Messiaen.

Indeed the sense of pandiatonicism in *Violin Phase* is further reinforced as the full composition unfolds over some 15 minutes, during which the core measure is increasingly duplicated and offset from itself ("out of phase" is Reich's term), creating a kaleidoscopic swirl of pitch and rhythm that is not unlike the texture of Aka singing and, apart from the fact that only violin timbres are involved, also rather like the West African multi-ostinato discussed in Chapter 5. More extended examples of this same textural approach with multiple timbres are found in Reich's works for multiple instruments, notably *Music for a Large Ensemble* (1978) and *Tehillim* (1981). This is in contrast to the complete Messiaen *Quartet* movement, which remains at or near Tx(0,0,0) throughout.

The process result of *Violin Phase* is very important, because eventually the main performer is called upon to reinforce certain patterns that result from the phasic interactions noted above. In a fascinating twist, each of these resultant patterns is much more clearly oriented around S0=F♯ in its tonal dynamics. This result in some ways represents the mirror image of the Aka example: whereas the resultant patterns in the Reich emerge as more clearly tonal melodies situated in a continuing (and aurally complex) pandiatonic context, the Aka opening phrase (which is sung throughout by the group leader and is the only texted portion of the music) remains a more tonally ambiguous and yet aurally prominent example in the midst of a clarified context.

Ex.6.4 Opening excerpt from *Rokudan* (Japanese traditional)



The final two excerpts in this section (Ex.6.4 and 6.5) demonstrate an interesting relationship in their use of the pentatonic collection *miyako-bushi* (with its ascending *min'yō* inflection), which features the ubiquitous anchor tones at S0 and S1 along with two *meri* (lowered) notes that provide especially strong expressive tendencies toward the anchors. At S52 and S51, the other two pitches in the collection provide considerable melodic tension; at the same time, they have more neutral resolution tendencies toward the pitches on either side, with perhaps a slightly stronger tendency toward the anchors that are in closer proximity.

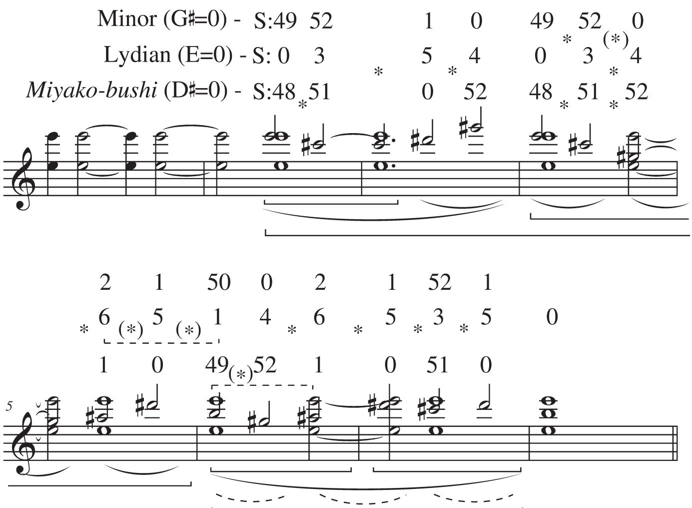
The typically complex interplay of this inflected mode is explored in the traditional Japanese composition *Rokudan* ("Six sections"). Written originally to feature the *koto* (Japanese zither), this melody came to be performed on a variety of instruments. The relatively self-contained first *dan* (section) is analyzed above in a traditional arrangement for *shakuhachi* (bamboo flute), with S0=G.

Rhythmic groupings beyond the third level are more difficult to determine here; however, this particular section does appear to have individual "bookend" measures on either side of a 13-bar core (bars 2–14 above) that falls reasonably well into 2+2+2+2+2+3. Beyond that, pitch range and motivic recurrence suggest possible elided/overlapping groups. For example, bars 6–7 could be seen as belonging both to a larger group of three from bars 2–7, by virtue of range, and to a larger group of three from bars 6–12, by virtue of the double-dotted motive in bars 7, 9, and 11. Likewise, the otherwise "orphaned" group of bars 12–14 could be seen as part of a larger overlapped two in conjunction with bars 10–11. This sort of ambiguity may contribute to the "mysterious" effect of other *shakuhachi* pieces, such as *Koku reibo*, noted in Chapter 2.

The pitch arrangement hews remarkably close to the expected tendencies of the collection, though a couple of interesting exceptions are present. While the *min'yō* inflection dominates here, even in some descending patterns, the *miyako-bushi* feature (E♭ *meri* to D) is integrated three times, to strong effect. The figure involving A♭ *meri*–C–(D)–G is a recurring motive throughout the whole composition, and demonstrates a delayed structural resolution: in all instances marked above with an asterisk, the A♭ *meri* moves against its strong tendency (and, in four of the five instances, leaps to the very unstable S52), but then resolves down to the G in very close proximity. The example in bar 5 is interesting in that the A♭ *meri* leaps to an anchor (S1), but not the most proximate one (that is, S0); moreover, the delayed resolution is followed immediately by a precipitously disjunct ascent to S52, clearly meant to create melodic tension as it begins the rise toward a passage in the higher pitch range. This moment is bolstered by the juxtaposition of a rhythmic three with the twos on either side. Overall, the constant interspersion of S51 and S52 with S0 and S1 respectively creates a very dynamic pitch matrix that is balanced by the proximity of those pitches in the collection. It is interesting that resolution delays are avoided entirely in the last several bars of the section, enhancing its stability.

By way of comparison, a more globally integrated and ambiguous use of inflected *miyako-bushi* can be seen in the excerpt below from *La cathédral engloutie* (1910) by Claude Debussy (1862–1918):

Ex.6.5 Reduction of Debussy, *La cathédral engloutie*, bars 6–13



The interplay of *miyako-bushi/min'yō* at S0=D♯ with the additional double tonicization of E and G♯ creates an especially rich tonal dynamic here. Each of the three orientations presents both merits and challenges analytically, with less-resolved sequences again marked with asterisks. The repetition and cadential placement of the pitch E cannot be ignored, but the tonal dynamics for S0=E are noticeably more dissonant than for the other two. On the other hand, orienting S0 on G♯ produces more stable tonal dynamics even as G♯ itself is not strongly placed or emphasized musically. Meanwhile, the core melody in isolation also follows the linear expectations of *miyako-bushi/min'yō* fairly well, with one notable instance of the E *meri* left unresolved and a delayed resolution the other *meri*, B.

Though moving in rather slow units, the rhythmic plan here is no less dynamic, with superimpositions against the meter accomplished by ties. Bars 6–7 of the excerpt (11–12 of the piece) demonstrate the ambiguity of the rhythms against the metric implications that flow freely between 2+2+2 and 3+3 at different levels. While the first bar fits well into a group with the bars preceding it (not shown here), it is nevertheless remarkable how this section can be understood similarly to the *Rokudan* section shown earlier, in that both have bars that "bookend" the core material.

The question of how much Debussy intended this passage to reflect Japanese music need not be answered here, though certainly *Japonisme* (Japanese influence on Western, especially visual, art) of the kind described by Wichmann (1981) would have been swirling thickly around the Paris of Debussy's day. What is important in this instance is how, consciously or otherwise, some of the inherent expressive powers of *miyako-bushi/min'yō* can be seen to contribute integratively to the musical effect, just as certain African elements seem not coincidentally woven into the textures of Steve Reich.

Four Examples with Diverse Harmonic, Textural and Process Implications

The reader will no doubt recognize in the section that follows the difficulty of choosing a few manageable examples with pitch implications beyond the melodic that are also more diverse texturally and offer opportunities for broader process discussion. That three of the four presented here are from the Western art music tradition, and that only two of the four represent cultural hybrids, should not diminish their suitability, for, in the aggregate, all four arise from different milieus of time, place, and sensibility. Once again, it is important to remember that examination of music "across cultures" need not preclude sub-genres from single traditions. That is, a global music theory ought to be useful at both macro- and micro-comparative levels, in a wide variety of contexts.

Ex.6.6, a self-contained phrase group from the second movement of W.A. Mozart's *Piano Concerto, K. 488* (*c.*1786), then, offers considerable opportunity for more fully integrative analysis.

The metrical structure of two groups of three in each bar is articulated plainly throughout in the accompaniment. The same grouping is mirrored by the melody as well, except in bars 2 and 3, where a mix of other durational shapes are superimposed by use of disjunct leaps and ties. At the third level, however, these resolve back to the large two that also defines the subsequent pair of phrases. The melody and harmony are, as per the style, highly integrated in terms of the overall pitch collection, while at the same time constituting an extremely complex interactive state of affairs due to the placement of melody notes that sometimes reinforce and at other times obscure the harmonic progression. The overall process space of this excerpt consists of a large group of three, each portion of which may be understood as a group of two, thus articulating a kind of grouping inversion relative to the metric level. The texture features a single clear melody and subordinate accompaniment, while timbral distinctions are essentially inconsequential since only the relatively monochromatic piano is used.

The first phrase (bars 1–4), as suggested above, offers the most to comment on with regard to the interactivity of pitch and rhythm. Melodically, the superimposed groupings against the meter in bars 2–3 correspond to increased dynamism of pitch as well, in terms both of S-level dissonance and precipitous contour. Indeed, Mozart exploits the full dynamism of the chromatically inflected Western "minor scale" to great effect, both structurally and locally. It is useful in this context to remember that the second pitch of the scalar configuration (S2, G♯ in this example) serves as a kind of secondary anchor, even as it tends itself to resolve (rather

Ex.6.6 W.A. Mozart, second movement theme from *Piano Concerto, K. 488*

strongly) to S0. Moreover, while the third scale degree in minor keys (S50, A in this case) is not an anchor, it does sometimes serve as an intermediary locus upon which the fourth scale degree (S52, B) may resolve due to proximity (and a slightly lower S number), after which the third degree itself tends to fall toward the second degree and then to S0. The dynamics of this are explored in this first phrase as the high A leaps dramatically down to B, but is also heard to resolve in its own pitch range and in close proximity to the G♯, as expected. The G♯ in turn leaps to the B, but eventually resolves in the same range to F♯ (S0, bar 3). Meanwhile, the B is prolonged and grouped across the bar line, resolving to the slightly less dissonant A before the latter leaps up precipitously to the aforementioned structural S0.

These melodic moments correspond to some of the most dramatically juxtaposed harmonic progressions in the example, in terms of HPDVs. The HPDV between bars 1 and 2 is calculated using voice-leading from the high A to both the subsequent B and G♯, since the latter is heard structurally while the former is important to the expressive melodic angularity. This same G♯ is a common tone between the two chords in bar 2, making it S0 in the first chord of that bar and S1 in the second, and eliminating it from the HPDV calculation; likewise, the melodic F♯ in bar 3 is treated as a common tone, but since the root of the new chord is G♯, the movement from F♯ down to G♯ is calculated in the HPDV. Though the situation with voice-leading is a bit more complex, the chord in the second half of bar 3 is treated for CDV and TDV purposes as identical to the chord at the beginning of bar 2. Meanwhile, in the progression to bar 4, the last chord tones sounding in bar 3 are used for the calculation, and both the G♯ and the D at the end of the bar 3 melody are understood as moving to the melodic F♯ in bar 4 (similar to what occurs between bars 1 and 2). Finally, the melodic ornamentation in bar 4 is ignored in terms of HPDV voice-leading. That these issues arise even in a relatively simple texture highlights the strong need to consider the harmonic and melodic movement from an interpretive rather than a merely mechanical perspective.

An equally involved set of pitch relations unfolds in the second phrase (bars 5–8), though without the same level of rhythmic dynamism. Harmonically, Mozart obscures the cadences in bars 6 and 8 by delaying the resolution of the melody pitches in the chords on each downbeat (indicated by double asterisks in the example). Moreover, in the case of bars 5–6, the S0 might be imagined to shift to A, which would significantly alter the pitch analysis toward a higher level of momentary consonance; yet this shift is far from clear and has thus been avoided in this interpretation. These harmonic complexities are accompanied by a very high level of expressive dynamism in the melodic sequences, including the leaps from S49 to S47 (before resolving to S1, as expected) in bars 1–2; the precipitous leap from S52 up to S50 and a subsequently uneven descent in the second half of bar 7 (including the unresolved S5, E♯); and the highly affective movement in bar 8 from S52 to S4 (again as strongly expected) followed by the surprising continuation on down to S50 as the chord moves simultaneously to a low CDV and a high TDV.

An even greater deal of tonal tension is created in bars 9–10 when G♮ (S48), B (S52), and D (S49) are extended, and where only the G eventually (structurally) resolves to F♯. At the same time, as the third phrase comes to a close, the harmonic dynamics move strongly toward resolution. Overall, one realizes that the resolution of S49, one of the strongest tendency tones in the inflected minor collection, is delayed or left incomplete several times in this melody. The cumulative expressive effect of Mozart's manipulation of these tonal dynamics is rich indeed, and in ways that are commensurate melodically to those of *Rokudan*, due to the powerful tendencies surrounding half steps. Harmonically, the final phrase brings a strong sense of resolution as reflected in the precipitous decline in HPDVs.

Another relatively self-contained example that offers manageable opportunity for synergistic analysis at both micro and macro levels is the Peruvian traditional song *Flor de Sancayo*. The entire piece consists of vocal and instrumental repetitions of the material shown in Ex.6.7. Only single instances of each harmonic pitch are included in the calculations here, due to the free voicing in which the accompaniment is typically performed. For the same reasons, voice-leading is calculated between structural harmonic pitches rather than attempting to consider every non-harmonic melodic sequence.

This piece also represents an interesting global hybrid in its combination of the melodic/rhythmic style of older indigenous Peruvian music with European harmonies and other influences likely born of many centuries of Spanish colonial interaction (see, for example, Fletcher 2001:485 and following).

As noted previously, the reduction of clutter wherever possible is an important value in graphing analyses using this method. This is especially true when harmonic analysis is to be included. As a result, only the most illuminating groups, levels, and values are indicated here. For example, CDVs are not shown, since all the harmonies are well-established tertian structures.

What emerges rhythmically in the melody at the outset is the globally ubiquitous pattern of 3+3+2 at the lowest level, though it is hidden in bars 5–6; the asterisks denote a contextually interpreted division of the longer note. An important permutation of this is the inversion of the pattern (2+2+3) twice through at the highest level, though it is true that the 2+2 repeats at the beginning before going on to the first three. Another interesting feature is the broadening of the level of focus starting in the middle of the first bar, and continuing through the second bar; that is, each of the three subsequent twos is twice as slow. Finally, a pattern fragment of 3+2 is motivically supported at the second level in bars 1, 3, and 6, and at multiple levels in bars 12 and 13. Certainly, the surface rhythms throughout provide a high level of dynamism against the steady eighth- and quarter-note pulses, even as the latter itself includes metrical groupings of both two and three.

A considerable level of tonal ambiguity exists in bars 1–4 due to the harmony rather than the melody; S0=E better reflects the expected melodic pitch dynamics, while S0=G better fits the harmonic choices (though both orientations provide for a strong cadential moment moving from bar 3 to bar 4). This ambiguity (and, assuming E to be the final S0, its inherent S0–S50 tension) lessens noticeably in

Ex.6.7 *Flor de Sancayo* (Peruvian traditional)

bars 5–11 due to the clarity of bars 7–8 and 11, then disappears completely starting in bar 12, thus providing a kind of dynamic tonal shape for the whole piece. The harmonic progression that occurs first in bar 7 is especially interesting in its clear HPDV shape of 90–75–29 at the same time that the tonal orientation becomes clearer; the last two chords of this progression are used again in isolation to great effect in bars 14 and 17. Flexible melodic modality throughout (with the inclusion of C, C♯, D, and D♯), along with hints at world pentatonic modes three and four in the figure first heard in bars 7–8, provide further pitch dynamism.

Not unlike the Mozart example, *Flor de Sancayo* falls into a tripartite shape of roughly equal sections: bars 1–4 (a total of eight bars with the repeat), bars 5–11 (seven bars) and bars 12–18 (seven bars). In addition to the decreasing level of tonal ambiguity, the third section is delineated by a sudden brief change of texture, to Tx(0,0,7), in bars 12 and 15; the timbral portion of this value reflects the mixed vocal/instrumental ensemble that traditionally performs this piece, though it is also often played by a solo guitar.

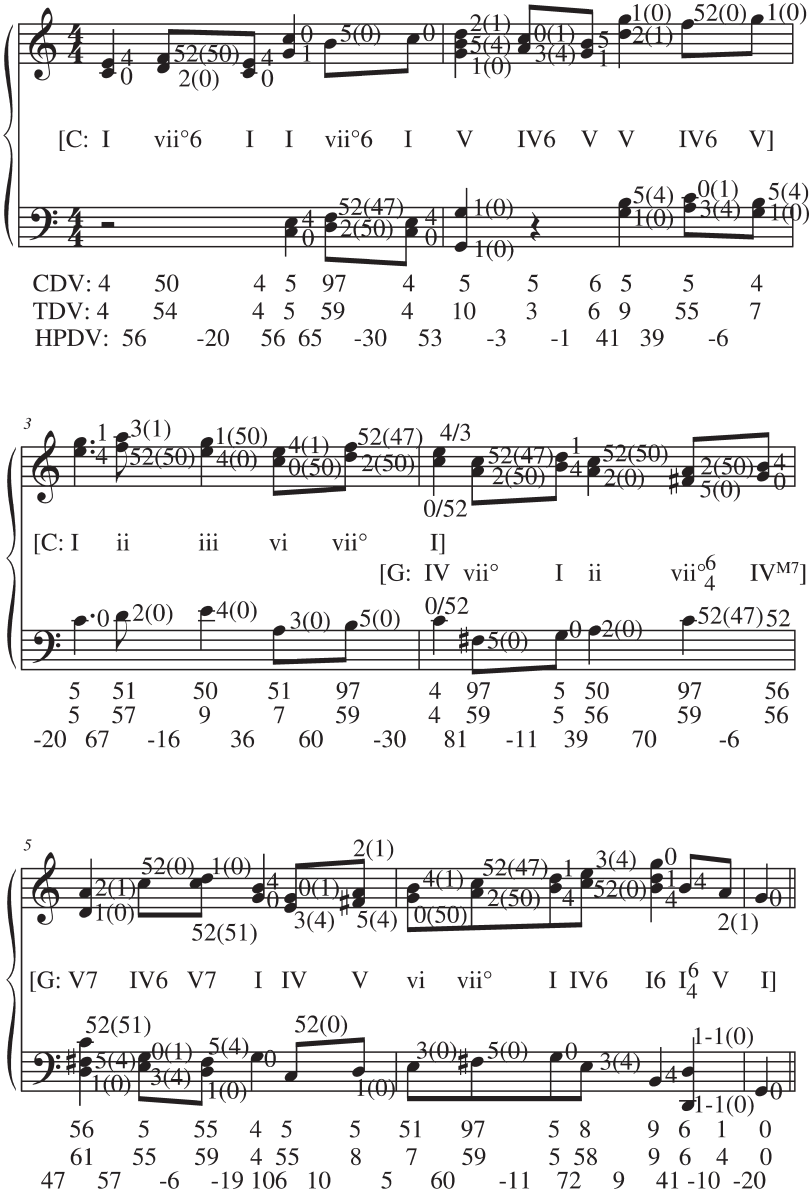
What might be a reasonable and useful analysis of the similarity level between *Flor de Sancayo* and the Mozart *Piano Concerto* excerpt? As already noted, texture, with the exception of timbral variety, could be seen as essentially the same. The textural contribution to the SPV would in this case, then, be 23/30 (see Chapter 5 for details on this calculation). Rhythmically, the two have little or nothing in common; even the lowest-level focus of each is different (that is, eighth-note versus sixteenth-note). Perhaps, however, the tripartite form of the highest level with roughly equal sections (phrases) ought to be reflected in a rhythmic SPV score of 2/30. The area of pitch, both melodic and harmonic, offers more for consideration. Both examples are based on "minor"-oriented diatonic modes (7/10), though of different transpositions (S2-related, E and F♯) and in slightly different ranges (2/10). The local melodic contours are essentially completely different, and no motivic relationships are evident (0/10). At the same time, the melodic pitch dynamism level of each is similar (10/10). Chord types and some root progressions are also similar (15/20), though the Mozart features somewhat more complex and dynamic harmonic relationships overall (6/10). Together, these aspects yield an SPV of about 48 percent. Clearly, these are markedly different styles, but not completely unrelated.

A third example that is built around Western harmony, but which features a rather different textural matrix can be seen in the *Invention no. 1* (BWV 772) for keyboard by J.S. Bach (1685–1750). The opening section (traditionally labeled the "exposition" in this genre) is presented below. Because of the textural complexity, the underlying harmonic structure is presented separately. S0=C at the beginning.

At first glance, the simplest rhythmic analysis of this piece, with its motorically even sixteenth and eighth notes, seems to consist entirely of continuous groups of two. However, to leave the analysis there would be to ignore a fascinating web of complex group and hierarchy relations that are largely defined by motivic development. Though the musician must certainly "feel" (and some would say "perform") the opening sixteenth rest, the fact that the piece begins sonically after

Ex.6.8a Bach, *Invention no. 1*, bars 1–7

Ex.6.8b Bach, *Invention no. 1*, bars 1–7, harmonic detail



that silence cannot be ignored. Indeed, Bach could very easily have started with a low G on the downbeat in order to firmly establish metrical regularity, yet he chose instead to emphasize the shape of the main motive (marked above with a bracketed "x"). Even in bar 7, as the motive is reiterated in the new pitch center (shown only partially here), the composer is careful not to imply that the downbeat is part of the motive by avoiding the obvious resolution in the left-hand cadential figure. Because the development of rhythmic motivic independence is so crucial to textural complexity in this case, a good deal of additional space is devoted initially below to rhythmic discussion, revealing that this music is every bit as rhythmically dynamic as, for example, many of the African, Indian, and Arabic examples considered elsewhere in this study.

Indeed, an intense rhythmic drama lurks beneath the surface of this piece, in the form of an inherent tension between two prevalent patterns: 3+2+2 and 3+2+3. Just as the main tonal tension (between S0 and S1, C and G) is established during the first presentation of the main motive (bars 1–2), so likewise is this main rhythmic tension revealed. Unlike the C-based tonality, however, this rhythmic tension is not clearly resolved by the end of the composition (see Ex.6.8e, with commentary, below). It is also worth noting that the least stable (coherent) rhythmic grouping patterns occur in bars 13–14 (not shown here), corresponding to the moments when the tonality of the piece is also furthest afield from S0=C.

The motive clearly consists of a rhythmic 3+2+2 at the lowest (surface) hierarchical level, a rhythmic shape that has strong implications for later grouping decisions. At the very least one is compelled whenever possible to replicate the same grouping wherever the motive appears intact, and, with the significant exception of certain freer passages (such as bas 3–4 in the right hand), that is not difficult to accomplish. Moreover, the second level shows strong coherence with the lowest level in articulating 3+2+2 in the opening bars. However, from a motivic perspective, the second level could very well be seen as demonstrating 3+2+3 there instead; thus the asterisks in Ex.6.8a indicate the dual possibilities of the hyper-groups that conclude these and other ambiguous patterns. This feature initially stems from the fact that the arrangement of conjunct and disjunct pitch motion within the motive itself offers significant guidance with regard to subsequent grouping: a rising three-note conjunct group followed by two disjunct groups of two. Though such delineations prove impossible to follow with absolute consistency throughout, they offer appreciable help in grouping the second-level eighth-note counter-motive that first appears in bar 1. Indeed, the conjunct-disjunct motion factor is the strongest justification for a mixed-duration group of three at the end of the counter-motive (marked above with a bracketed "y"), since it is essentially an augmentation of the opening three-note fragment, whereas the two eighth notes prior to that are disjunct. Thus is the ambiguity between 3+2+2 and 3+2+3 established at the second level from the very beginning, and recurs whenever recognizable versions of the motive and counter-motive appear intact (such as in bars 7–10 and 21 in the left hand, not shown here).

This rhythmic grouping tension also manifests itself elsewhere at the lowest (surface) level, particularly in the consistency with which 3+2+3 appears in sequential passages such as in the right hand in bars 3–4. The two examples below offer a way to see the issues in question more clearly. Both offer extrapolations of how the opening right-hand groupings might look if arranged metrically according to twentieth-century Western conventions; the first is more empirically accurate, while the second better reflects motivic distinctions (at the cost of altering some durations):

Ex.6.8c Bach, *Invention no. 1*, opening, first alternate notation

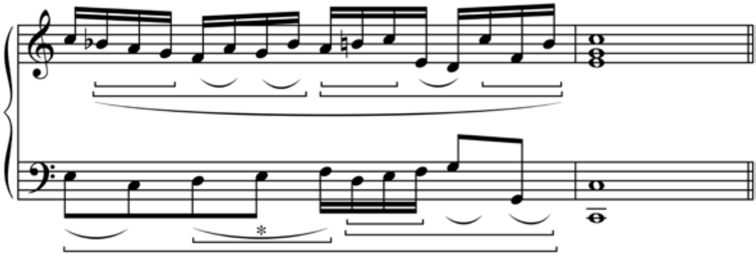
Ex.6.8d Bach, *Invention no. 1*, opening, second alternate notation

As suggested previously, this question is not easily resolved since it hinges on whether the analysis is guided more by durational empiricism or motivic understanding. Since the purpose of the present theory is to illuminate the complex web of relationships as thoroughly as possible, it is perhaps best to show both perspectives on the main analysis (Ex.6.8a), as is done here. 3+2+2 and its retrograde (2+2+3; see the left hand first level in bars 3–4, as well as the right hand second level in bars 5–6) may dominate slightly at a greater variety of levels.

Broader motivic concerns, and most especially the conjunct-disjunct shaping principle noted earlier, provide additional guidance of a sort that might support 3+2+3 groupings more robustly. This conjunct-disjunct principle operates rather loosely overall, as for example when it must be relaxed slightly with regard to the left-hand eighth-note figure at the beginning of bar 3; the figure seems clearly to represent the established counter-motive even though it does not begin with disjunct eighth notes (and in fact seems merely to be altered specifically for tonal reasons). Nevertheless, it is clear that the conjunct-disjunct idea continues to inform some of the most important grouping decisions as the piece unfolds. One example of this is the tail of the right-hand counter-motive at the end of bar 2 going into bar 3; the rising step followed by the falling third that constitutes either a mixed group of two or three there reappears several times, often in reverse and/or inverted (see the right-hand sixteenth notes in bars 3–4, for example), and proves to be consistently useful as an indicator of groups of three when the durations are not mixed. It is also this motivic fragment that drives the possibility of viewing the dotted eighth note in bar 5 (right hand) as an ornamentation within what would seem to be controversial mixed groups of three; that is, as if the dotted eighth and following sixteenth were simply straight eighth notes. Seen this way, the figure is identical in shape to the counter-motive tail in the right hand, bars 2–3, though just as clearly offers the same level of analytical challenge as to whether it should be seen as a two or a three. However, either choice produces the same hyper-grouping at the third level.

Intriguingly, the rhythmic grouping tension between 3+2+2 and 3+2+3 is never really resolved, as demonstrated by comparing the final simultaneous groupings in the right and left hands:

Ex.6.8e Bach, *Invention no. 1*, last two bars



Though it cannot be shown here in its entirety, the manageable length of this complete piece offers the opportunity to extrapolate further with regard to higher-level shapes. From the most straightforward process perspective, the invention is laid out as 3+2+2, which reveals a high level of coherence with the original motivic shape:

- 3 (the exposition of main material in bars 1–2; plus the episode[6] of bars 3–4; plus the cadential episode extension of bars 5–6/7)
- 2 (an episode in bars 7–10; plus an episode and cadential extension in bars 11–14/15)
- 2 (an episode in bars 15–18; plus an episode and cadential extension in bars 19–22)

Digging deeper into subgroupings reveals further interesting coherences as well as highlighting once again the basic tension between 3+2+2 and 3+2+3. For example, the right-hand third-level groupings in bar 1 through the beginning of bar 7 could be subgrouped as 2+2+3, resulting in the retrograde of the motive grouping:

- 2 (3+3; bars 1–2)
- 2 (2+2; bars 3–4)
- 3 (2+3+3, bars 5 through the first half of 7)

Overall, such findings further reinforce larger rhythmic consonance of a more sophisticated type (that is, the basic grouping tension being inherent at higher as well as lower levels), in contrast to the considerable rhythmic dissonance nearer the surface.

An exponential level of rhythmic complexity is generated in this piece by virtue of the simultaneous interaction of groups and hierarchies between the two hands. Indeed, simultaneous groupings never line up between the two voices at any level, even at cadential moments (though a case could be made for more inherent stability on the very last beat of bar 6). Certainly such rhythmic independence is a large part of what keeps the lines distinct, and justifies the first value in the textural analysis of Tx(10,8,0). That the pitch independence value is not assessed quite at ten, however, is due to the strong derivation of material from the motive and counter-motive, as well as a great deal of outright imitation throughout the piece. Finally, the choice of Bach to write the *Invention* for the essentially monochromatic keyboard informs the timbral variety score of zero.

[6] The traditional Western term "episode" is used here for convenience. As a somewhat self-contained process, it normally consists of sequentially transposed presentations of short pitch/rhythm motivic material, and/or serves to change the S0 pitch orientation. In Ex.6.8a above, for example, the episode in bars 3–4 displays both characteristics clearly, with an S0 shift to G, while bars 5–7 are somewhat freer but still drive sequentially toward the firm cadence on the new S0.

Turning to the melodic pitch material of these same motives and their development, one finds a level of both local and structural dynamism commensurate with that of the rhythm, though within the relatively subtle range afforded by the "major scale" collection. That the contour of the motive itself is bounded by S0 and S52 symbolizes this pitch dynamism at the basic structural level. This same S52, rather than resolving to S4 or S1 as expected, leaps down to S2, which itself in turn moves to S4 rather than immediately down to S0, the totality of which builds a strong pattern of micro-tension and release into the main material. Interestingly, the counter-motive is less dynamic in this regard, perhaps to avoid distraction from the main motive that it simultaneously accompanies.

Structurally, the motive includes an interesting feature by which S52 resolves to both of its expected targets, S4 and S1, in fairly close proximity (indicated by arrows in bar 1 of Ex.6.8a). This same structural feature, though in a different order, is indicated by the arrows in bars 3 and 6 in the right hand, both of which correspond to an identifiable inversion of the motive. It can also be seen at the eighth-note level in the left hand three times in bars 4–6, the first occurrence of which corresponds to the tonal climax of the example, with the extension of S52 and octave-displaced "resolution" to S1. The final version of this same sequence, at the penultimate cadence point in bar 6, is more stable without the octave displacement.

When the motive is transposed to other pitch levels, such as in bars 2 and 5, the operative S numbers (S1, S3, S5, and S0) form an almost exactly opposite tonal shape, with S0 at the apex. The two shapes resulting from motive, motive transposed, and motive inverted all come together in the left hand in bars 4–6, and in the extended right-hand sequence in bars 5–6.

Primary transpositions in this first section are to the S1 of the operative S0 (that is, from C to G and then G to D), which forms the main structural dynamic of the tonality; in Western theoretical terms, these transpositions are to the "dominant" level. At a higher structural level in the whole of the piece, the motivic transpositions in their clearest presentations form a sequence in the following order: S0–S1–S2–S1–S2–S3–S4–S5 (inverted, bar 13)–S0 (bar 19), which provides a strong tonal shape in itself, though it must be stressed that there are a number of less clear manifestations of very similar material interspersed with these, especially through the second half of the *Invention*. The introduction of what is essentially an S52-level moment of orientation in bars 18–19 and then again in the penultimate bar of the piece (the right-hand motive inversion during the first two beats of Ex.6.8e), is a clever higher-level tribute to the role of S52 in the tonal dynamic of the motive.

Due to the complex texture, harmonic progressions must be abstracted structurally (as detailed in Ex.6.8b), and, as a result, perhaps slightly imperfectly. Because of the shifting number of simultaneous harmonic voices, the HPDVs especially are best understood contextually. Moreover, sometimes chords that are strongly implied by functional expectation but that are not actually fully present must be considered, and an attempt made at consistency between similar musical moments. Consideration of CDVs is therefore useful in this scenario, even though they all conform to predictable chord types. Since this piece is clearly conceived in these Western harmonic terms, a traditional Roman numeral analysis is provided between the staves for comparison and reference.

The strong tonal shape of the motive, rising and falling both in contour and tension, is reflected in the analysis of its harmonic implications. Indeed, all the harmonic shapes tend to fall into more dramatic micro-level moments within groups of two or three chords, though the modulation that takes place starting in bar 4, and the concomitant moment of S52 tension on the extended C in the left hand (where S0=G) from the end of bar 4 into bar 5, can be seen in the TDVs. In many instances, the voice-leading is exceedingly difficult to capture, though Bach clarifies this element when it is most important, such as in the strong cadential sequence from the second half of bar 6 into bar 7.

Perhaps the most useful final conclusion to be drawn is simply that the rhythmic, melodic, and harmonic elements work together with a high degree of coherence here, while at the same time the complexity of the texture ensures a suitable level of ambiguity that adds freshness to the overall result. Comparison to the previous two examples suggests a level of rhythmic dynamism more in keeping with *Flor de Sancayo*, a level of integrated melodic/harmonic dynamism more similar to that of the Mozart, and a level of textural complexity that exceeds both.

A fourth example now follows that uses a rather different approach to pitch organization from the other three in this section, while combining some similar rhythmic and textural elements in different ways. In the realm of twentieth-century Western art music, Béla Bartók (1881–1945) stands as one of the clearest examples of a global composer because of his sophisticated integration of deep sensibilities from the Magyar folk music traditions of his native Hungary (themselves the product of mixed influences from the cultural crossroads of Central Asia) with Western European materials and processes. Antokoletz (1984) provides a helpful explanation of Bartók's musical cosmopolitanism within the European sphere, including the "East meets West" orientation inherent in the composer's background as a result of his direct ethnomusicological work. Antokoletz demonstrates vividly how Bartók's music offers a treasure trove of eclectic influences fused together in highly original but also widely varied ways. Nowhere is this more evident than in the *Fourteen Bagatelles*, Op.6, in which, for example, number nine mirrors the Tx(0,0,0) texture more generally common to non-Western musics, while number 13 features the accelerating micro-rhythmic figure found in Japanese *gagaku* (see Chapter 5). Two excerpts from number two of the set provide a number of interesting opportunities for interpretive analysis. The first, consisting of the last seven bars, is the more tonally straightforward of the two, while still offering considerable dynamism of both rhythm and pitch:

Ex.6.9a Bartók, *Fourteen Bagatelles*, Op.6, no. 2, bars 24–30[7]

As Antokoletz (1984) acknowledges in depth, symmetry, especially with regard to pitch structure, is a critical part of Bartók's style, and this is reflected in the chromatic main melody in the left hand during the first three bars of the excerpt above. (This same melody opens the piece as well.) The S numbers rise and fall, with the final resolution of S48 down to S0 constituting the expected cadence, but in this case it is the increasingly disjunct shape that is of as much or more note. The T number sequence, including the leap of more than an octave down from S2 to S48, which must in this context be accounted for, is −27, 21, 73, −21, 39, 84, 46, 1, 104, −44; while these are strongly affected by the S numbers, the general trend toward tension (with the strongest release at the end) is unmistakable. Moreover, this melody is presented against a right-hand backdrop that is both relatively static in terms of contour and quite consonant tonally.

Greater rhythmic dynamism at the surface level corresponds with the tonal and contour-related dynamism of the melody as well, before settling somewhat into the second level in bars 3–5 of the excerpt, and finally resolving to all twos at the end, at the same time as the tonality is also finally most settled. Analysis of the chord progression dynamics at the end confirm this ultimate cadential intent.

However, a word should perhaps be said about determination of the chord roots in this instance, since the root determination principles from Chapter 4 are not applied here with absolute consistency. That is, the root of the penultimate chord is determined here to be not clearly tertian, and so, according to the principles, is A♭ (bottom of the most consonant interval when the notes are rearranged as per the principles), whereas the root of the final chord does seem more clearly tertian, with a 3:2 structure that articulates a D♭ on the bottom (also the lowest sounding pitch), which is then seen as the root even though it would not be the root according to stricter application of the principles (instead, it would be A♭ again). This interpretation is, of course, convenient, as it corresponds to a structural root progression of S1 to S0.

That said, an important further pitch relationship inherent in this *Bagatelle* needs now to be brought up. Lendvai (1971) notes that Bartók most often favors a tritone axis (that is, S0–S6/47) among the symmetrical pitch axes available (based on complementary pairs of inverted intervals), in part because it divides the octave perfectly evenly. Assuming that D♭ is the ultimate S0 in this piece, then, the other pitch of the axis would be G. This is confirmed in a larger structural progression in which the S0 orientation of the five bars previous to the ones shown above is clearly G by virtue of being an exact transposition of the same material. Lendvai further notes that Bartók most often extends the axis structure to include the pitches a minor third away from the primary pitch on either side (that is, S3 and S50), which themselves form a tritone; in this case, then, the secondary axis is B♭–E. As discussed in Chapter 4, there is a tuning challenge inherent in this symmetrical 12-EDO structure (which, harmonically, would in Western terms be called a "fully diminished seventh chord") when translated to 53-EDO, requiring one of the internal intervals to be slightly larger (14 F numbers) than the other three (13 F numbers each). In order to retain the symmetry between the axis pairs, then, G will in this instance be designated as S47, and all tritone relationships will likewise retain this S relationship; this makes the S number difference within each axis pair the same, with D♭–G being S0–S47 and B♭–E being S3–S50, while also keeping B♭ and E the same distance from D♭ (13 F numbers each).

These observations are important to navigating the higher level of analytical challenge in the second excerpt below, from earlier in the same *Bagatelle* as Ex.6.9a. However, two additional symmetrical pairings must also be considered in this case, namely, B–E♭ and G♭–C. The two pitches in the first of these would be measured as S51 and S2, respectively, in relation to D♭, while also forming a

Ex.6.9b Bartók, *Fourteen Bagatelles*, Op. 6, no. 2, bars 6–11[8]

kind of inverse symmetry with the B♭–E axis. At the same time, G♭–C (S52–S5), is probably best understood simply as yet another tritone axis pair. All of the pitch analysis Ex.6.9b (and throughout the remainder of the piece not shown), then, is predicated on this expanded cluster of relationships.

The D♭–G axis is immediately important to understanding the harmonic implications of the cadence that occurs between the first and second bars above; thus, values are shown for both pitch orientations. Clearly, the strongest sense of tonal cadence arises from hearing G as S0, while the figures prior to that moment (and those in the five bars preceding this excerpt) are just as clearly oriented to D♭ as S0. The inverse axis of pitch dynamism shown at this first cadence point is echoed in the cadence at the end of the excerpt as well (within the G♭–C axis).

Meanwhile, starting in the second bar of the example, an extremely complex set of multiple tonal interactions ensues, both sequentially and simultaneously. This begins with a foray into the world of S0=E♭, which moves into an S0=B orientation by the fourth bar. However, the right hand (upper staff) of the third bar can be understood at least three different ways depending on how the B♭ quarter note in the descending figure is seen; if it is a point of arrival, then an E♭ or B♭ orientation seems to make sense. An E orientation, however, offers other analytical advantages, not the least of which is that it shows the figure as bound by the E–B♭ axis points. Moreover, it would allow the last four bars of the right hand to be understood as essentially an E–B–E tonal grouping, with a local shape of S0–S1–S0 (where S0=E).

The left hand (bottom staff) in these same last four bars, though, is much less clearly oriented. What is perhaps most striking is the way the harmonic dynamism of the chords remains relatively stable within each tonal reorientation as each unfolds. Two exceptions to this could be seen in what would be interpreted as cadential moments at the end of the third to last bar and the final bar of the example, which themselves suggest a larger structural G♭(F♯)–C axis. Indeed this axis is emphasized by the left-hand triad progression in the third to last bar, which also contains within itself the primary E–B♭ and G–D♭(C♯) axes in its voice leading (indicated by the lines and asterisk).

This approach to the analysis highlights a topic not broached thus far in this study, and one that seems relatively rare in world musical practice; that is, the idea of multiple simultaneous tonal orientations (or "polytonality" in Western terms). Some of the harmonies above are thus analyzed within more than one tonal orientation, to show alternate, sometimes even simultaneous, perceptions. The S relationships in such instances take on yet another level of importance, as here, for example, they tend toward the S0–S47 dynamic defined by the tritone axes. Thus, various polytonalities can have relatively more or less dynamic tonal implications. In this example, the symmetry of the tritone, which divides the 12-tone chromatic octave exactly in half, is embraced by Bartók as a defining characteristic intellectually. The question remains, however, as to what the acoustic implication of this choice is. Even within such a view, Bartók seems to acknowledge the value of providing more tonal stability at key points in the piece, such as the E–B–E right-hand relationship noted above, and the A♭–D♭ structural sequence that ends the piece (not shown, but discussed after Ex.6.9a above). That is, the tonal implications that have been put forth in this study can be extrapolated to many sequential and simultaneous levels, similar to sequential and simultaneous rhythmic hierarchies. Rather than obscuring their acoustic power, such arrangements actually harness them in ever more complex ways. Polytonality, then, is perhaps rather more like "hypertonality" than "non-tonality."

This Bartók example may also serve as a reminder of the delicate balance between perceptual dynamism and potential perceptual chaos. It is interesting that Bartók chooses less complex layering of rhythmic hierarchies in Ex.6.9b; indeed, there is little to be said about rhythmic grouping here beyond the one metrical shift to a three near the end. That this is the case just when the tonal complexity is at a very high level is not likely coincidental, and highlights the importance of attempting to glean the way in which various elements are managed within musical processes by musical creators. The greater the number and complexity of such elements, the greater the skill required both to integrate them effectively in the act of music-making and to organize their effect in the act of music listening. As has already been stated, this is where the right kind of analysis can offer considerable help. Each area—rhythm, melody, harmony, and texture—has its own dynamic, but each of these ebb and flow, reinforcing and competing with the others in the super-dynamic of the musical whole.

The Last Seventy-five Years of Global Fusion: Six Examples

As suggested in Chapter 1, an important reason to pursue a global music theory is to provide for more productive exploration of the musical hybrids that have, arguably, dominated the mid-to-late twentieth century and continue to do so into the twenty-first. Examples of these transcend categories such as "art music" and "popular music," which are on the whole becoming less useful. Nevertheless, the reader may recognize an attempt in what follows to choose examples that might carry remnants of such associations. That so many of these are American, or influenced by American musical trends, is not coincidental; in many ways America has been a leader in global musical perspective since at least the 1930s, perhaps because, as a relatively young culture of global transplants, it has been more naturally drawn to the pursuit of such a distinct identity. That said, any number of examples already presented in this study could be included here; instead, it is hoped that the relative contemporaneousness of what follows will further reflect a sense of the forward-looking freshness that characterizes "global music."

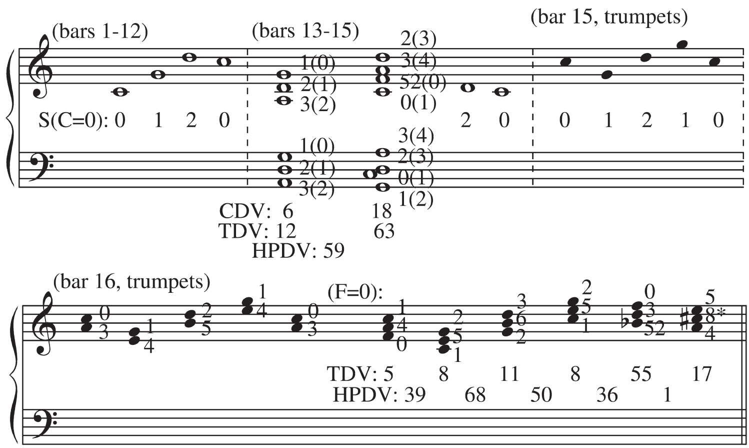
Few if any twentieth-century composers more deliberately and transparently sought East–West fusion than did the American John Cage (1912–92), who, beginning in the mid-1940s, forged an artistic way forward through embracing Indian spiritual-musical concepts, Buddhist philosophies, and ideas of chance connected with the Chinese I Ching (see Cage 1961:127, 158; and Revill 1993:91, 97,108). One of the first works to reflect some elements of this turn was Cage's Sonatas and Interludes for prepared piano (1946–48), a work that situates complex rhythms and pitch structures within a deeply and brilliantly conceived timbral world reminiscent of Southeast Asia. Perry (2005) provides a comprehensive and masterful analysis of the work, complete with extensive examples that need not be reprinted here, drawing together its global nature and commenting directly on the possibility of its sonic relationship with Indonesian gamelan (see Perry 2005:48, n15). Rhythmically the first movement features a 2+2+3 pattern at several levels; among the many pitch features of the same movement is a combination of subtle diatonicism with an F♯–A–B trichord that can be understood at least three ways: as a subset of world pentatonic mode two (as S0–S50–S52), as a subset of the diatonic collection (as S6–S3–S5), and as representative of Japanese *min'yō* inflection (as S1–S51–S0).[9] Many more of the pitch relations, however, are conceived only as fully integrated with both the rhythmic cycles of the work and the timbres generated by the piano preparations, as Perry points out (2005:36); specific timbral identities (a number of them inharmonic), then, would of necessity form an important part of similarity analysis in this work.

A very different composer whose music exhibits no less a global perspective than Cage is the Chinese-American Tan Dun (b.1957), whose works for screen (for example, *Crouching Tiger*, *Hidden Dragon*, 2000), stage (for example, the opera *Marco Polo*, 1996), and concert hall (for example, *Water Passion After St. Matthew*, 1999–2000) all reflect integration of foundational materials from Asian and Western sources at differing levels of subtlety. Nowhere is this more evident than in Tan's epic *Heaven Earth Mankind – Symphony 1997*, written to celebrate the transfer of sovereignty of Hong Kong from the United Kingdom to China. The linked movements titled *Dragon* and *Phoenix*, also excerpted as a separate concert work by the composer, contain ample evidence of Tan's global musical thinking, beginning immediately with the most elemental of gestures from the world pentatonic collection, arranged in 3:2 order (see Ex.6.10a). This usage is then expanded, and the tonal dynamism increased, through the introduction of S52, ending with a clever reorientation of that pitch (F in this case) to S0 while also developing harmonic identity via major triads built on melodically functional roots (including the reoriented S52 to S4 resolution). Moreover, although there are two different types of harmony in operation, the chords and progressions move within a similar range of tonal tension and release.

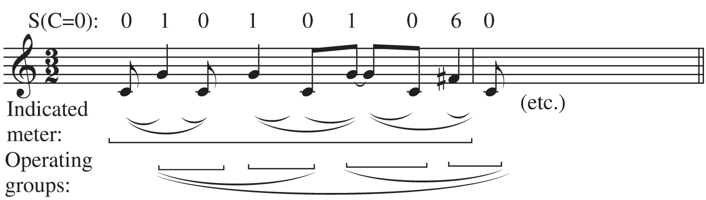
Tan commences a new, faster section of the movement in bar 25, introducing an ostinato figure in bar 34, as shown in Ex.6.10b below. This figure is notable both in its elementally Lydian flavor (still reflecting foundational diatonic 3:2 thinking, as demonstrated in Chapter 3) and in the rhythmic dynamism created by the superimposition of grouping structures different from the indicated meter. The "offset" groupings indicated here are the result of the principles discussed in Chapter 2, confirmed by various accents implied in the full score.

[9] See Perry 2005:42, and 44–5, to which the reader is invited to imagine the concepts from this study applied.

Ex.6.10a Tan Dun, *Dragon and Phoenix*, bars 1–16,[10] structural reduction of motivic and harmonic developments



Ex.6.10b Tan Dun, *Dragon and Phoenix*, bar 34, ostinato figure



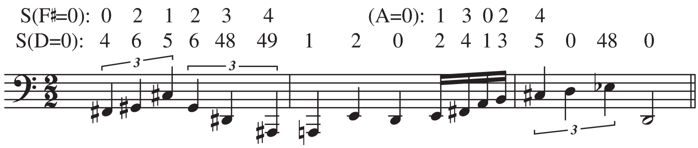
This figure is transposed up the 3:2 stack, reorienting to S0=G, in bars 44 and following. Meanwhile, in bars 41–3, Tan introduces a melodic sequence in a new and complex tonal dynamic revolving around S0=D (world pentatonic in bar 42), with secondary S0 orientations on F♯ and A (both also world pentatonic) and a few excursions into higher S numbers that add dynamic shape.[11] While the S48–S0 resolution at the end of the passage is very strong, the octave displacement could be seen as converting what would be a T number of −44 to +9, demonstrating the importance of taking the level of melodic conjunctness or disjunctness into account:

---

10 Ex.6.10a–f, adapted from: *Dragon and Phoenix*. From *Symphony of Heaven, Earth, Mankind*, by Tan Dun. Copyright © 1997 by G. Schirmer, Inc. (ASCAP). International Copyright Secured. All Rights Reserved. Reprinted by Permission.

11 It would not be unreasonable, however, to imagine analyzing the D♯ and A♯ in bar 41 as S7 and S8 respectively, which would further reinforce a more direct 3:2 structure.

Ex.6.10c Tan Dun, *Dragon and Phoenix*, bars 41–3, melodic figure

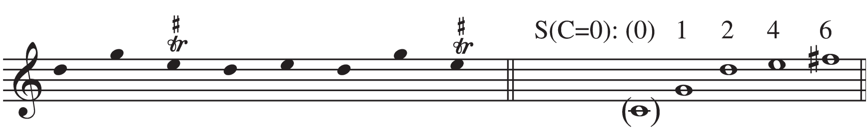


A similar combination of world pentatonicism and chromaticism defines the melodic lines starting around bar 62, and continues into a slower, climactic section at bar 109. Shortly after commencing another new section at bar 129, Tan introduces an ostinato figure starting in bar 133 that combines an exact rhythmic diminution of the one in bar 34, with the fundamental 3:2 stack laid out at the beginning of the piece:

Ex.6.10d Tan Dun, *Dragon and Phoenix*, ostinato figure in bars 133 and following

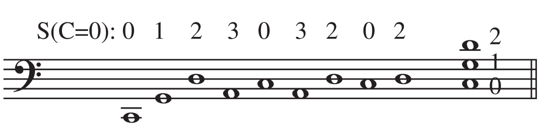
As this ostinato continues, the C–G orientation also comes to dominate the melodic structure of bars 138–40 which, as the next example shows, can be understood as elemental to both pitch centers:

Ex.6.10e Tan Dun, *Dragon and Phoenix*, bars 138–40, structural reduction of melodic material



This material is developed further into bar 197, where S0 shifts to F, and a subset of the same motivic pitches continues (F–C–E, S0–S1–S5). The final

Ex.6.10f Tan Dun, *Dragon and Phoenix*, bars 224–end, structural reduction, including final bell chord



section of the linked movements (bars 224 to the end) returns to S0=C, uses the most foundational world pentatonic subset of S0–S1–S2–S3, and ends with a very consonant chord (CDV/TDV=3), as Ex.6.10f above demonstrates.

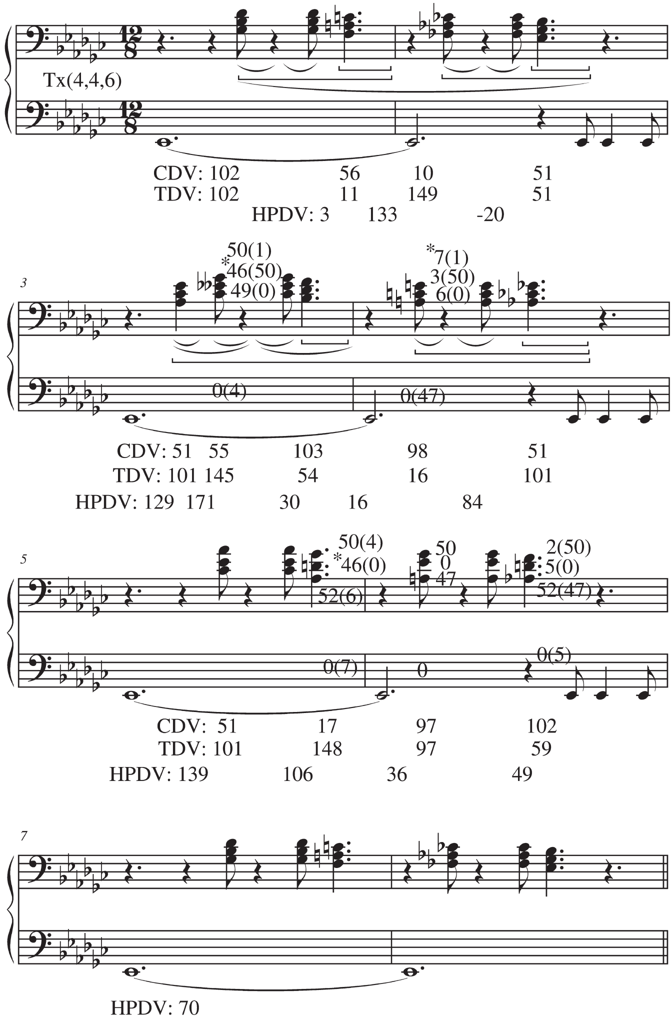
Thus Tan integrates Western neo-tonal characteristics with world pentatonicism, while also bringing a variety of complex rhythmic dynamics into play. Another feature of the work not shown here is Tan's interpolation of the "Ode to Joy" choral theme from Ludwig van Beethoven's *Symphony no. 9*, which further reinforces an intercultural perspective musically, poetically, and historically.

Outside of the Asia-focused East–West fusion suggested by the examples above, African-American jazz stands as one of the most historically well-established and dynamic global musics of the last hundred years. One composer whose music exhibits an especially high level of integrative sophistication is Edward "Duke" Ellington (1899–1974), who boldly blurred the lines between art music and popular music long before such blurring held the sort of cachet it does as of the time of this writing. Ex.6.11, an excerpt from one of Ellington's commercial jazz pieces, *Ko Ko* (1940), brings together a standard 12-bar blues structure and a more chromatically complex approach to jazz harmony.

The rhythms in the excerpt are shown as they would be performed (that is "swung") rather than according to the originally published notation, and, interestingly, reflect the 3+3+3+3 metrical structure that underlies at least three common, dance-related West African timelines (see Agawu 2003:74–5). This creates a rather complex state of affairs with regard to groupings, since the upper-staff triads (played by trombones in the full arrangement) are superimposed rhythmically on this meter in such a way that the duration of the quarter rest between the first two triads of each figure is divided and shared with the triads on either side. The variation of this main figure in bar 3 adds yet another layer of grouping tension, one that corresponds to a significant rise in harmonic tension as well (discussed below). This sophisticated grouping approach, while not the only possibility, is perhaps the most straightforward explanation for the "syncopated" feeling of the figure against the implied meter.

Meanwhile these same triads constitute varying levels of harmonic tension and release, especially in combination with the constantly-sounding low E♭. Except for two instances in bars 5 and 6, the chord root (as determined by the method noted in Chapter 4) is located at the bottom of each triad in the upper staff. This, along with the necessary tuning adjustments (indicated with asterisks), partially accounts for some of the disparities between CDVs and TDVs.

Each two-bar phrase represents a component of the larger structural S0–S52–S1–S0 blues progression (that is, "i–iv–V–i"). The dynamic shape of this larger progression can be seen by simply adding the HPDVs for each two-bar phrase: 116, 430, 330, and 186 respectively. Meanwhile, each of these phrases also constitutes a harmonic shape in itself, with the descending chromatic triads (except for the rise in bar 3) creating slightly different rising and falling tension/release patterns from phrase to phrase; these shaping differences contribute to slightly lower SPVs between the phrases than might be expected from other factors. For example, Ex.6.11 “Duke” Ellington, *Ko Ko*, bars 1–8[12]



were bars 1–2 and 5–6 to have more similar harmonic consonance/dissonance patterns, the SPV between them might be as high as 88 percent (rhythm 30/30, pitch collection 10/10, contour 9/10, chord types 7/10, harmonic dynamism 8/10, chord root sequencing 3/10, and texture 30/30), rather than the 80 percent they actually represent (based on the same values as the previous analysis, except for chord types and harmonic dynamism each at 3/10).

The Tx matrix indicated stems from a view of the two staves as being independent, but with the bottom staff essentially non-rhythmic (with held notes) for much of the time; from the way the top triads move in and out of sync with the low, held E♭; and from the fact that the trombone timbres (the triads) are reasonably distinct from that of the baritone saxophone (the low E♭). There is little in the way of melody here, and certainly nothing independent from the harmonic voice-leading.

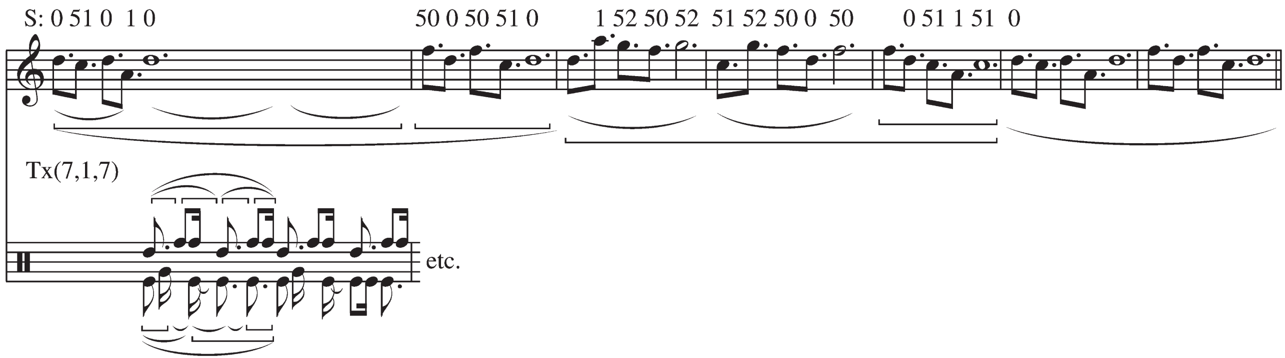
A fourth set of examples arises from the work of accomplished Indian violinist, composer, and improviser Lakshminarayana Subramaniam (b.1947), specifically from the aptly named recording *Global Fusion* (1999), reflecting his training and activities in both Indian and Western traditional musics as well as wide understanding of jazz and eclectic world influences and techniques. Two movements in particular offer clear examples of fully integrative global musical thinking: *Blue Lotus*, a study in blending Chinese materials and sounds with modern Indian influences, and *Gipsy Trail* (sic), a subtle combination of Indian and what might be Andalusian (Spanish/Arabic) flavors, all in the context of improvisatory processes and textures that borrow from African-American jazz roots. Three excerpts from *Blue Lotus* appear below.[13] In order to capture the free-flowing rhythmic groupings, meters and their changes are not indicated. Subramaniam here explores the timbral differences between the violin, which he plays in a Carnatic ornamental style, and the *erhu*, a Chinese chordophone; in the first example, both instruments play in nearly strict unison (top staff) against the *mrindaṅgam* drum part on the bottom staff, while in the second and third excerpts the *erhu* part occupies the top staff and the violin the bottom, with the drum part omitted.

These three excerpts, which follow sequentially in the music (the first two uninterrupted), represent a progression of textural development. The drums are ubiquitously accompanimental (and rhythmically and timbrally quite independent) throughout, whereas the *erhu* and violin increase in independence through the sequence. The G string of the violin has been tuned down in order provide for the low D and F (S0 and S50), making its range (and, to some degree, its timbre) more commensurate with that of the *erhu*. However, the choice of a pitch independence value of five in the Tx assessment of Ex.6.12b is a difficult one, due to the structural

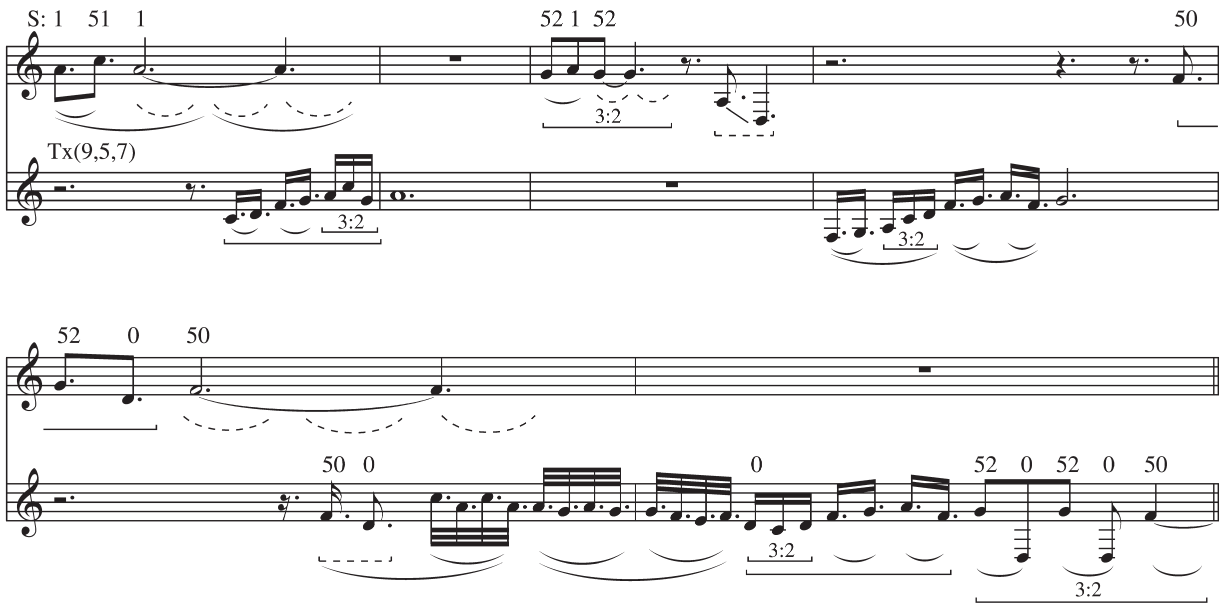
---

[13] *Blue Lotus* and *Gipsy Trail*. From *Global Fusion*, written by L. Subramaniam. Copyright © 1999 by L. Subramaniam. All Rights Reserved. Used by Permission. Transcribed by the author with the kind permission of Mr. Subramaniam. These excerpts are delineated by the time in which they occur on their individual CD tracks.

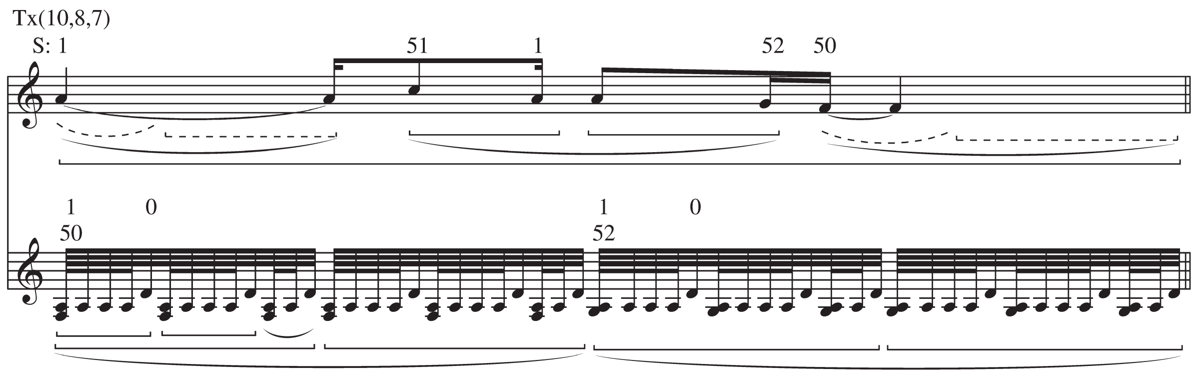
Ex.6.12a L. Subramaniam, *Blue Lotus*, 6:14–6:42



Ex.6.12b L. Subramaniam, *Blue Lotus*, 6:43–7:1



Ex.6.12c L. Subramaniam, *Blue Lotus*, 7:44–7:50



similarities between the *erhu* and violin and the fact that they are not simultaneous but rather occur in a call and response format. Certainly, by the time Ex.6.12c begins, the two instruments are fully independent in nearly every respect: rhythm, pitch shapes (though within the same collection), and range.

While, as noted above, meters are not indicated, use of the unusual dotted-note values in the transcription helps to clarify some rhythmic distinctions between the melody and the *mrindaṅgam* part in the first excerpt; this same approach is carried forward in the second example, but is not needed in the third, where the rhythmic divisions are less complex. Ex.6.12a shows the strongly dissonant surface rhythms in the *mrindaṅgam* that nevertheless resolve into the same twos as the melody at a higher level. The groupings above the *mrindaṅgam* staff are more metrical, while those below reflect actual musical gestures. That is, there is plenty of dynamism within the *mrindaṅgam* part itself, and a second layer of dynamism in the interaction of the *mrindaṅgam* with the melody. The melody itself harbors dynamism at levels further from the surface.

Ex.6.12b exhibits a different sort of rhythmic dynamism between the interactive melodic elements (apart from the omitted drums); each gesture is somewhat level-independent, and triplets are effectively superimposed at one micro and one macro level, adding another layer of grouping complexity. The overall effect is a freely responsive one between the soloists. In Ex.6.12c, the violin (bottom staff) functions more like the *mrindaṅgam* in providing surface dissonance. Yet even between the two instruments a very different higher-level grouping results in the sense that they are far less synchronized than in other sections of the piece, essentially existing in independent time frames.

Pitch dynamism is robust within the relatively narrow range afforded by the world pentatonic mode two collection used exclusively here (except for the one brief E in the last violin phrase of Ex.6.12b). The first excerpt features a balanced mix of resolved and unresolved tendency tones at the local level, with the notes of longer duration following clear resolution patterns at the structural level, such as the sequence of dotted half notes S52–S50–S51 that then resolve to the S0 dotted whole note near the end.

Ex6.12b likewise includes a similar structural sequence of S1–S52–S50 formed by the ends of both the *erhu* phrases and the violin responses, with some release to S0 in the last violin gesture. A more dynamic shape in that same final moment, though, is formed from S52 leaping down twice to S0; what would normally have been a T value of −30 becomes instead a value of 23 because of the leap that exceeds an octave (an extra 53 "points" added to the value). Likewise, the already less-resolved cadence at the very end of the phrase, from S0 to S50 with what would be T=68, becomes even more acute with the extra octave leap (to T=121). However, the clear structural resolution in the same range of S52 to S50 (T=7), as expected within the collection, mitigates these factors to some degree, and may be compared to the simpler version of the same figure that occurs at the end of the previous *erhu* phrase.

Ex.6.12c is interesting in that the second half of the bar has a higher level of unresolved pitch material than the first half in both instruments, while the rhythmic complexity is spread more evenly throughout. At the same time, it seems fair to say that the moments of highest rhythmic and pitch dynamism in the *erhu* part (top staff) occur in the middle of the bar as it moves toward the second half, while only the pitch tension increases in the violin part at the same time (albeit in the context of surface rhythms that are already quite dynamic).

The two excerpts from *Gipsy Trail* that appear below (this time drawn from very different parts of the piece according to the timing in which they appear) offer the opportunity for a modest attempt at reflecting possible tuning issues arising from *rāga* theory (see Chapter 3 for more context). Moreover, a great deal of sliding between pitches, which is itself an important manifestation of Indian śruti theory, is not reflected in these transcriptions. In the case of *Blue Lotus* above, the traditional śruti tuning of the world pentatonic mode two pitches would actually be the same as analyzed. However, the case of *rāga Vakulābharaṇam* that constitutes the pitch collection for *Gipsy Trail* might differ somewhat from a 12-tone tuning on three pitches, those represented here as E♭, F♯, and B♭ (where S0=D). That F♯ and B♭ are the *vādī*/*samvādī* (that is, stressed) pitches in this instance (see Kaufmann 1976:109) is important, as is the resultant fact that each could provide a different level of dynamism than expected; that is, F♯ would normally be S4, but could be imagined here as S45; B♭ would normally be considered S49, but could be conceived here as S8; and E♭ would normally be thought of as S48, but might instead appear at S7.[14] Further discussion of these matters is provided below in the context of the broader analysis.

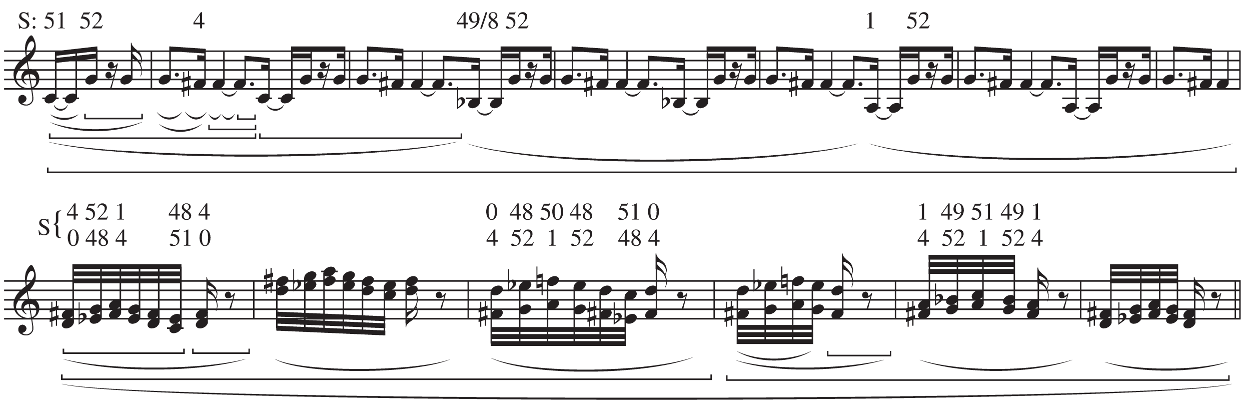
No drum is involved in Ex.6.13a, though the bass-range drone/ostinato continues throughout, adding a measured backdrop against which the melodic phrases flow freely. A wordless voice part occupies the top staff, while the violin response and the drone appear on the bottom staff. The approach is similar to the call and response texture of Ex.6.12b above, though the melodic phrases are more extended. In very similar ways, the complexity and independence of the gestural rhythmic grouping shapes (each of which is in itself rather freely interpreted in the analysis as in the performance) contributes to a sense of improvisatory freedom. Here especially, the undifferentiated groups of 5, 7, and 11 are essential to conveying the sense of proportionality, but perhaps contribute less to the momentary perception of rhythmic dynamics, especially at lower levels; in that sense, this example shares some of the characteristics of the *shakuhachi* piece *Koku reibo* presented in Chapter 2. As in Ex.6.12b above, the use of triplets at two levels adds to the flexibility of this result, as does the accelerating *gagaku* gesture in the fourth bar of the excerpt.

---

14 Interestingly, the E♭ and B♭ could be considered close to the neutral second and neutral sixth, respectively, as in Arabic *maqāmāt*, though the values S8 and S45 are slightly lower in pitch than expected for these. This is relevant because of the Andalusian stylistic overtones of the piece.

Ex.6.13a L. Subramaniam, *Gipsy Trail*, 1:12–1:50

Ex.6.13b L. Subramaniam, *Gipsy Trail*, 10:51–11:12



The rhythmic profile of Ex.6.13b is, however, very different in that a steady, faster tempo is articulated and reinforced with a simpler drum pattern (not shown here). Two sets of clearly delineated (grouped) rhythmic gestures are presented. The first of these is repeated six times in the first line of the excerpt above, while the second is shown on the second line only once, but is repeated twice more in the recording (creating another grouping of three at what would be the fifth level, matching that in the first line). Both of these rhythmic motives involve complex combinations of twos and threes at multiple levels, creating a significant amount of surface dynamism. In the second line, the groupings/motives are further reinforced by being presented in absolute rhythmic unison by violin, guitar, and drums.

Meanwhile, the expressive complexities of the pitch collection are used to considerable effect motivically as well. With regard to the tuning issues discussed above, spectrographic analysis reveals the B♭ to be consistently between S49 (792 cents) and the otherwise predicted S8 (815 cents), though it also occurs once at S37 (775 cents). Meanwhile, F♯ is consistently found at or slightly above S4 (408 cents) rather than the predicted S45 (385 cents). Moreover, the single clearest instance of E♭ (voice, bars 2–3 of Ex.6.13a) is tuned between S48 (91 cents) and S7 (113 cents). These varying values do not change the expected resolutions of the pitches, but do theoretically alter the strength of their pull toward the proximate anchor tones. At the same time, such findings suggest that a mixture of 12-tone chromatic and śruti-based tuning is at work in the ears of the performers. Because the pitches go by so quickly in the second-line figures of Ex.6.13b, and involve guitar, the values there are for the sake of simplicity reset to 12-tone equivalents.

Ex.6.13a confirms the importance of F♯ (S4), and of the expected S1 (A), but also interestingly emphasizes C (S51) as cadential. The violin phrase that appears immediately after this excerpt ends on F♯, making the cadential sequence S51–S1–S4 against the ever-present S0–S1 drone; this perhaps helps to explain why F♯ (which is, recall, *vādī/samvādī*) is consistently tuned to the more consonant S4 rather than the predicted but more tonally tense S45. Meanwhile, F♯ is emphasized agogically in the first line of Ex.6.13b as well, preceded consistently by S52 and thus providing a strong resolution, while the lower-note structural sequence consists of S51–S8/49–S1, a different but no less clearly resolving tonal pattern.

Each of the micro-figures in the second line of Ex.6.13b end on the very consonant S0–S4 or S1–S4 figure, while the TDV sequence (not shown on the music) in the same section moves in a very precipitous and dynamic back and forth tension-release pattern; the first bar of the line consists, for example, of TDVs of 4–100–5–100–4–50–4.

Finally, the textural change from the first to the second line of Ex.6.13b is worthy of note, in that it moves from Tx(7,1,7) (same as Ex.6.12a above, this time with unison voice and violin accompanied by separate drum) to Tx(1,5,10) as the performers (violin, guitar, and drums) align into rhythmic unison.

Overall, then, these pieces from Subramaniam's *Global Fusion* demonstrate especially clearly how both commonalities and dynamic differences between musical/stylistic elements can be integrated into a successful whole, in part by focusing as much on the interplay created by the dynamics between the selected rhythmic, pitch, textural, and larger process elements in new configurations as on how these same dynamics might unfold in their original contexts.

Yet another, perhaps more subtle, manifestation of fusion in popular music has come in the form of "progressive rock,"[15] not least from British bands such as Yes and Genesis in the 1970s to Radiohead in the early 2000s.[16] An excerpt from the Radiohead song *Everything in Its Right Place* from the album *Kid A* (2000) demonstrates a number of interesting characteristics:

Ex.6.14 Radiohead, Everything in Its Right Place, bars 6–9[17]

15 For a good summary, see Palmer 2001.

16 According to journalist Andy Gill (2011), the members of Radiohead shun the "progressive" label, but even some of their most recent work, such as *Bloom* and *Feral* from the 2011 album *The King of Limbs*, reflects many of the stylistic markers from that earlier genre.

17 *Everything in Its Right Place*. Words and Music by Thomas Yorke, Jonathan Greenwood, Colin Greenwood, Edward O'Brien and Philip Selway.

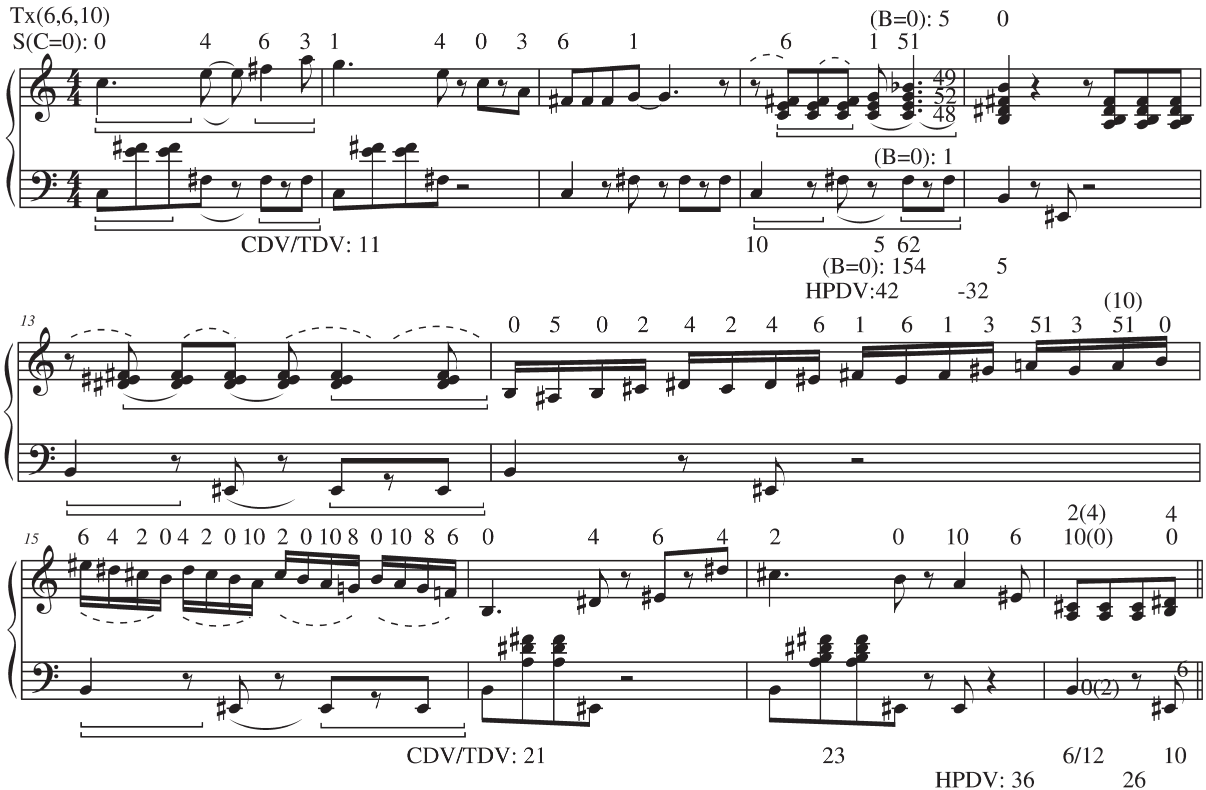
The metrical structure of each of the two phrases (2+2 followed by 2+2+2, for a larger 2+3) is itself somewhat atypical for rock genres in its lack of duple construction, but even more complex are the groupings superimposed over it at lower levels, not to mention the entrance of the simple vocal melody (top staff) in its own grouping space late in the cycle. The overall effect of this combination is considerably more ambiguous than in, for example, Ellington's *Ko Ko*.

Also less like *Ko Ko* are the harmonies here, which are more limited, operate in a fairly narrow dynamic range, and have a clearer and more consistent shape as they rise to the end of each phrase and then drop back to the next. (Here, as earlier in *Flor de Sancayo*, chord doublings are ignored in order to avoid skewing contextual harmonic values.) Nevertheless, some ambiguity ensues as the S0 triad (on F) does not appear until bar 8 of the song (bar 3 of the excerpt), in an established context in which the C major triad might very well be considered S0. That F is meant as S0 is confirmed both by the key signature ("F minor") and the structure of the vocal melody fragment. Nevertheless, the effect is striking in that F can easily be heard contextually as a strong S52 in relation to an S0 of C. The appearance at the end of each harmonic cycle of E♭ instead of E♮ mitigates this impression somewhat, as it decreases the tonal strength of the C triad, but it also weakens the pull toward F as S0 that E♮ might provide. Thus, as with the rhythmic groupings, some disorientation of pitch function seems intended here, perhaps meant as ironic comment on the song title.

Meanwhile, the timbral foci in this section of the song are somewhat clearer, with an electric piano sound accompanying the solo voice, though a number of sound effects (not reflected above) are also present in the design. This in turn contributes overall to a somewhat less complex textural effect. Within the accompaniment, little rhythmic independence is evident, and the chord progression voicing moves along in essentially parallel fashion. As noted above, the solo voice does seem to be more in its own space rhythmically, but conforms closely to the harmonies while at the same time offering perhaps the clearest independent reference to an S0 of F.

Finally, music for the media genres that now dominate so much of cultural life worldwide, such as television, film, and computer/video games, all delivered across multiple platforms, exhibits perhaps as strong a sense of eclectic globalism as any other. Nearly every composer now feels free (or obliged) to make reference to a panoply of world styles, even when no other reference to the concomitant culture appears "on screen." The work of prominent rock musician turned film composer Danny Elfman (b.1953) demonstrates this trend clearly. Among the many examples is Elfman's music for the 2003 film *Hulk*, which integrates Arabic and East Asian materials and textures with twentieth-century Western art music even though the subject of the film is far removed from any non-Western cultural milieus.

Ex.6.15 Danny Elfman, *Theme from The Simpsons,* bars 8–18



Ex.6.15, an excerpt from one of Elfman's most successful pieces, the opening theme music for the animated television series *The Simpsons*[18] (1989), demonstrates a more subtle but no less eclectic approach. The 3+2+3 dominant rhythmic pattern provides prominent dynamism against the metric evenness throughout, seen above especially clearly in bar 15, though it also interacts with other patterns, such as in bar 11.[19] This main pattern combines with certain orchestrational choices (not evident here), such as the use of bongos on fast rhythmic patterns and a high trumpet flourish, to suggest a subtle Latin American flavor, which is interesting since none of the Simpsons main characters reflect that cultural heritage. The phrase-level groups are, like the meter, based on twos throughout the whole composition, with the exception of the very last one (not shown here), which is 3+2.

Meanwhile, the main theme pitch sequence (bars 8–10) has a subtle but noticeable shape, especially across its first bar, in which the T number sequence is 22, 11, 10; and in last bar, with a T value of −1. Elfman later moves cleverly between the diatonic Lydian character of this main theme and whole tone scale using a shared S0; this is accomplished smoothly in part because the first four tones of each of the two collections form the same intervals (all whole tones). However, to emphasize the symmetry of whole tone, the pitch A is analytically shifted from S51 to S10 as the transition begins in bar 14, continuing through the cadence at the end of the excerpt. The aggregate effect on the dynamic shape of the melody from this transformation can be seen by comparing the full T number sequences of bars 8–10 and 16–18 respectively, at 22, 11, 10, 7, 16, 14, 16, 16, −1, and 22, 11, 42, 7, 7, 19, 14, 14, 11; except for the large leap near the beginning and lack of strong final cadence, the differences are not as dramatic as might be expected, again perhaps owing to the similarity between Lydian and whole tone. Going one step further, the SPV between these two versions of the melody could be designated at 84 percent: 30/30 for rhythm, 3/10 for collection relationship, 5/10 for transposition, 8/10 for contour, and 30/30 for texture.

A very strong harmonic effect is achieved through close voice-leading in bars 11–12 even as S0 is shifting from C to B. The Lydian chord that is most explicit in bars 8–9, 11, and 13 does not carry as high a dissonance level in this analysis as it would in traditional Western functionality, as it here actually forms the basis for consonance throughout; only on the very last chord of the piece (not shown

[18] *Theme from The Simpsons*, from the Twentieth Century Fox Television Series THE SIMPSONS™. Music by Danny Elfman. Copyright © 1990, 1991 Fox Film Music Corporation. This arrangement Copyright © 2011 Fox Film Music Corporation. All Rights Reserved. Used by Permission. The Simpsons™ & © 1990 Twentieth Century Fox Film Corporation. Reprinted by Permission of Hal Leonard Corporation. *Note: the above permission covers the World excluding Italy. All reasonable effort was made to find the copyright holder of this work for Italy, but without success.*

[19] Note that bar numbers in this analysis refer to the actual excerpted bars, as indicated on the example itself.

here) does Elfman resolve to a more consonant harmonic entity, an unornamented "major triad" (CDV=5).

The texture of Tx(6,6,10) suggested here warrants further comment as well, since the accompaniment to the main thematic material is more rhythmically independent in much of the composition, and the full timbral resources of the Western orchestra are used. On the whole this combination distinguishes it, for example, from the Ellington and Radiohead examples above, perhaps locating it texturally somewhere between those two and the Bach *Invention* discussed earlier in this chapter.

Perhaps a fitting final comment on these last six examples is that they are all well within the mainstream of contemporary practice, yet each displays a combination of characteristics, some more subtle than others, that would not as likely exist in a world without constant, deep, cross-cultural musical influence.

Conclusion

In closing, it is important to reiterate that the excerpts in this chapter (and indeed throughout this study) are meant to demonstrate possibilities, not necessarily comprehensive certainties. A considerable amount of empirical research remains to be done in order to discover caveats and refinements to the concepts and methods suggested herein. Some attempt has been made to compare very different musics using common terms, the result of which is that the differences are all the clearer, while potential commonalities at the very least suggest themselves.

And many of these findings are intriguing. Conventional wisdom has, for example, long noted the "energy" of music from the Western European Baroque period, yet to discover a world of complex rhythmic vitality in a short work by J.S. Bach that is commensurate with Central African multi-ostinato or modern Indian/Asian fusion is heartening in its confirmation of something musically human that crosses time, space, and culture. Likewise, to see the projections of 3:2 pitch relations operating in everything from Bartók to jazz to Peruvian music reaffirms the physicality of basic human hearing, however much more extended the multiple tonalities and alternate tunings of any one of these are when compared to any other. Moreover, to understand that levels of simultaneous pitch, rhythmic, and timbral independence help shape the effect and affect of this wide range of musics is a reminder of the abilities of the human brain to multitask at incredible rates and levels of subtlety within the world of sound.

These analytical conclusions, then, are not value judgments, but value affirmations. Human music-making offers infinite variety precisely because such variety may successfully be pursued within the parameters of identifiable human musical principles. Otherwise, the threshold between music and noise would too often seem on the verge of being crossed. As noted in Chapter 1, every culture has its own definition of musical meaning, and these can never be fully subsumed into a universal. Yet, by the evidence suggested in this study, there may very well be concepts that illuminate the sounding features of a vast array of human musics, and for which reasonable arguments can be made as to their origins in human physiology, human understanding of the physical world, the psychology of human perception, and/or the actual practice of known human musical systems. Moreover, it is important to recall the global musicianship imperative that drives the search for these qualified musical universals. A re-examination of such questions and their practical implications therefore forms the content of the next and final chapter.

This page has been left blank intentionally

Chapter 7
Further Implications and Conclusion

Introduction

The purpose of analysis is to illuminate. Music theory at its best often describes things that music-makers have already done, but also suggests things that might yet be done. This study has suggested that the processes of creation and re-creation in music have understandable human parameters; otherwise, musicians could not be trained to preserve and extend established traditions, nor be inspired to create new ones. Thus, having proposed the outlines of a global music theory, questions loom large as to how such understanding might enhance the efforts of musicians in their creative and re-creative activities. For the purposes of clarity, the questions may be considered as they apply to a particular continuum that ranges from re-creation to new creation: performance of pre-composed pieces, improvisation as "on-the-spot" composition, and composition as a creative process outside of "real time." All three of these basic activities may operate within parameters that are more or less free, depending on the musical traditions in question. Examination of the implications of global music theory is best made without resorting to the idea that any theory drives musical decisions. But if the principles proposed in this book do in fact represent the foundational significance claimed, they will offer perspectives that might assist performers, improvisers, and composers in their work, and, by extension, offer music educators a method of addressing a wide variety of musics.

Performance

Musical re-creation of pre-composed pieces normally brings with it significant questions of interpretation, since no method of passing music along (whether written or aural) can carry all of the nuances possible or even necessary for effective musical manifestation. And, regardless of the particular sensibilities of composers, each performance therefore normally adds a new layer of input to the musical enterprise. The acceptable level of such "original" contributions varies from situation to situation; the level of individualism inherent in the prevailing culture is likely to affect how much each performer makes each piece his or her own. Closely related to this issue is the question of how much improvisation is included in the particular performance tradition. But interpretive contributions, however subtle, are almost always present.

What this means is that an analytical method is likely to be most useful to performers to the extent to which it illuminates musical characteristics that aid in making such interpretive decisions in ways that flow from the structure of the music as well as from its context (and indeed from the interaction between the two). Clarke (1999:492–3) offers general support not only for the notion that understanding of deeper musical structure is closely tied to expressive performance decisions, but also that the greatest differences between performances occur with regard to the *surface* detail of the music. Thus a theory that illuminates both these categories and their relationships would seem to be of particular value to performers. For example, the unpredictability of grouping patterns and frequent shifts of focus between hierarchical levels lends a "mysterious" effect to a piece like *Koku reibo* (see Chapter 2), but the performer is clearly in control of how much durations, pitches, and timbres diverge from the notated Kinko-*ryū* score (within the limits of Kinko tradition); as a result, more or less stable patterns and relationships may be emphasized as desired, and analysis using the proposed theories may aid the artist in coming to terms creatively with such tensions. That is, the performer may gain insight that allows him or her to heighten or minimize the levels of tension and release in the rhythm, pitch, timbre, and similarity processes that constitute the expressive and intellectual substance of the music.

Another way to say this is that the interpretive decisions envisioned here tend to fall into the category of things that can shape musical lines. An understanding of groupings may be very valuable in this regard since it gives performers suggested guidance for how such groupings might be aurally delineated using dynamics, timbral shifts, articulations, and other methods. For example, the performer who approaches the understanding of rhythm in Bach along the lines of what was demonstrated in Chapter 6 will likely play the linear shapes of the piece with more sophistication than a conception amounting to continuously even groupings would suggest. Likewise, musicians attempting to bring a *kriti* to life might find defensible reasons to emphasize rhythmic dissonances against the prevailing *tāḷa* through examining the twos and threes outside the bounds of traditional Indian *tāḷa* theory, while carefully considering the tonal effect of micro-adjustments in pitch in relation to traditionally established characteristics of the particular *rāga* structure. Similar sorts of explorations attend the realms of timbre and texture, all contributing to the musical flow.

Other useful examples of the nexus between analytical and performance knowledge can be found in the areas of timbre, tuning, and texture. Performers know, whether intuitively, experientially, or analytically, that the tuning of a given pitch in a given context is inextricably tied to its timbre, and routinely adjust that relationship to the extent possible for the desired expressive effect. Likewise, the awareness of textural complexity, and of each individual musician's part in it from moment to moment, is essential to transforming undifferentiated chaos into musical clarity.

A related benefit of the methods proposed herein that might accrue to performers is simply the entrée they give to foundational aspects of unfamiliar musics. This is not meant to suggest that any theory based on "qualified universals" be used as an excuse to short-circuit exploration into indigenous musics using indigenous methods. At the same time, any number of complexities in any number of traditions might be apprehended in ways unimagined (or un-embraced) within the contexts in which those musics have previously originated, and thus may be articulated in a more informed fashion through pre-performance or even coincident performance analysis of the type suggested.

As Arnold Whittall has observed, "All interpretation can be regarded as inherently analytical" (1993:318). This sort of thinking is essential to any attempt to link analysis with performance,[1] an idea that students of music seem often reluctant to embrace, perhaps for fear of somehow demystifying perceived beauties. This in turn raises the larger question of whether musical analysis is sometimes seen as a type of deconstruction that might be (mis)understood as devaluing the reality of the music itself. While such questions are outside the scope of this study, Rink (2002:37–9) sums up the issue well and suggests a middle way by noting that "performers are perhaps wise to resist any systematic attempt to correlate the findings of rigorous analytical methodologies and actual performance … Nevertheless, more rigorous analytical study can assist performers in solving conceptual or technical problems … as well as in memorising and in combating performance anxiety." That is, analysis can be useful beyond strictly expressive concerns. At the same time, if the dynamism of tension and release is at the heart of musical expression, better understanding of the way that musical elements contribute to that process cannot help but inform performance decisions. If both performance and analysis are interpretive activities (as envisioned in this study), the benefits of their synergy would seem to outweigh the dangers of prescriptive one-way thinking.

Improvisation and Composition

In combining aspects of composition with aspects of performance, improvisation often presents musicians with significant challenges. Indeed, the symbiotic relationship between analysis, composition, and improvisation is a complex and often surprising one, as, for example, Steve Larson has colorfully demonstrated in comparing twentieth-century art music with jazz (2005:273). The level of improvisational contribution to any particular musical project varies greatly, but insight into the elemental relationships in the music provides a solid basis on which to elaborate appropriately and effectively as various under- and over-lying patterns, tendencies, and processes are recognized. Similarly, extending these sensibilities into the realm of formal composition allows the composer to more deliberately develop those aspects of musical ebb and flow that he or she

---

[1] For an interesting survey of this topic, see Cook 1999, where the additional important point is made that performance questions can effectively inform analysis as well.

intuits during the compositional process. For instance, upon discovering that a main rhythmic motive at the surface level constitutes, say, a 2+3+2, the composer or improviser might proceed intentionally to fashion groupings at higher levels to match, or perhaps to contrast, thus providing rich webs of structural rhythmic consonances and dissonances that can do much to provide dynamic shape in the music.

Even more intriguing is the possibility of effectively managing integration of disparate stylistic characteristics in the process of creating something new. Musical products like *Blue Lotus* and *Gipsy Trail* (see Chapter 6) are effective not because they include a mix of elements from different musics, but rather because those elements work together to create something coherent, more a blending of colors than a patchwork quilt. In such situations, dynamism in one elemental area can reinforce or contrast with that in another. The resulting web is then all the more rich.

The concerns of this discussion can also be understood as constituting a special subcategory of "eclecticism." Speaking in the context of Western music, but in a way that could be equally applicable to some global musical questions, Leonard Meyer (1967) notes how often art is now seen by artists as objective construct, a problem to be solved, rather than as an intensely personal means of communication. This Meyer labels *formalism* (1967:235–44). In an interesting twist, Meyer suggests that it is formalists who are attracted to eclecticism, a challenging problem to be solved: how does one make a coherent piece of art from widely disparate elements? How does one project a coherent body of work in a polystylistic fashion? Hearkening back to a pre-global era, Meyer frames this mindset as one giving assent to the notion that:

> if each style reflects the ethos of the culture out of which it arises and if each ethos is, so it was believed, homogenous and consistent, then the resulting style should be so as well … [T]he [Western] model of organic unity often employed to account for the internal structure of the work of art and, at times, the history of cultures—and hence of styles—called for a single unified, self-consistent process. But … [i]f a work of art is an impersonal construct, and creation a kind of problem-solving, then experiments with mixtures of means and materials, either within or between works, need not constitute an imperfection. On the contrary, the skillful and elegant combinations of disparate styles … within a single work may become a challenging and attractive problem. (1967:190–91)

Yet one is left to wonder whether eclecticism is instead really a newer way to project consonance and dissonance (and hence concomitant expression) onto a larger (and, increasingly, a more global) musical screen. As such, standards for evaluating both the musical coherence and the expressiveness of a globally eclectic composition can be formulated and applied. The writing of such music and the creation and application of such standards are tall orders, but the work of many recent composers shows that it is possible and perhaps even desirable as well. Embracing the energies available through this kind of global eclecticism can produce an extraordinary artistic synergy, a breath of fresh air perhaps badly needed in a too-often stale world of musical practice. Thus it is that awareness of how cross-cultural musical elements can work together coherently in a musical process offers composers and improvisers a much-expanded field for creative exploration.

Ethnomusicology

As noted previously, this study make no claim that analysis of the kind suggested herein illuminates the "meaning" of music, and certainly not its "cultural meaning." Still, the value of understanding musical elements and processes is of inestimable value to ethnomusicology, because "cultural meaning" is inevitably tied to interpretations of those elements and processes. That is, the way the music sounds and the ways it unfolds are never completely separate from what it means to the people from which it originates. Analysis apart from cultural meaning is, therefore, a necessary though not sufficient component of ethnomusicology.

As suggested in Chapter 1, there is great value in understanding and applying the theories of individual musics in their individual cultural contexts. However, this approach alone is also insufficient, for two reasons. First, it is increasingly clear that musics affect each other across geographical, historical, and even philosophical lines. This is what is meant, in one sense, by the term "global" in this study. Moreover, the speed of this mutual musical affectation is increasing as well. In effect, then, the cultural-musical context of our time is as much intercultural as it is monocultural. Thus, understanding musical meaning increasingly requires an understanding of cross-cultural synthesis.

Second, even if one grants the idea of "neatly hived off" cultures and their musics (Appiah 2006:xx), sole dependence on culturally-bound theories makes useful comparisons very difficult. As suggested earlier, the continued defense of these barriers may be intentional, an attempt to protect musical cultures from unfair (or irrelevant) comparative value judgments. But today's global musical world makes such fears quaint at best and, in fact, essentially untenable. Those who would use analysis as a tool to make cultural value judgments cannot be stopped, regardless of the analytical systems they employ. It is folly to attempt to protect musics from such abuse by ignoring connections between them.

At the same time, culture-specific music theories can provide useful, and even essential, dialogue with a global theory. It is much more likely that each approach will contribute more soundly to musical understanding when they provide mutual checks and balances. A more open understanding of ethnomusicology, then, would be one that values exploration of how essentially human musical principles are expressed in myriad ways across various cultures, and how the resulting stylistic characteristics are creatively and endlessly combined in yet other musics. In short, accepting the outlines of a practical global music theory aimed at illumination rather than at cultural value judgments would enhance, rather than detract from, ethnomusicological pursuits.

An effective global theory, then, must be broad enough to be applicable to a wide range of musics on the basis of qualified musical universals, but not so broad as to eradicate the illumination of difference. This study, however imperfectly, has attempted to offer the contours of such an approach, and to open an ongoing dialogue with the findings of ethnomusicology.

Music Education and Pedagogy

The fundamental question of whether the proposed method offers practical value for music educators looms large. On the one hand, the concepts are rather simple—human musical elements can be seen as manifestations of twos and threes in various ways, with timbre, tuning, and texture important elements to be added to rhythm, melody, and harmony in the analysis of musical process—while on the other hand its application to particular musical situations can be quite complex. However, such application could be made at a variety of complexity levels, so that, for example, young children could learn the kinesthetic differences between durational twos and threes (perhaps through dance or other physical activities), while undergraduates might be introduced to the basics of grouping and pitch dynamics in simpler pieces, and postgraduates might undertake complex comparative studies with a wider variety of larger pieces. Students in applied performance lessons might benefit from some combination of aural and written analysis with regard to interpretive decisions. And, of course, composers could use the method to become more aware of how musical elements work dynamically in compositions they are attracted to as well as in their own original works. The theory also holds promise for small and large ensemble leaders, for whom knowledge of how various parts fit with others could aid in passing on improved interpretive subtlety.

Moreover, a global theory increases the value of formal music theory study for music educators, since it becomes applicable at a variety of levels to the variety of musical situations they are likely to encounter in their teaching. This point is an important one, because it is an answer to the very real question of how much investment ought to be made in analytical understanding for musicians, and the specific costs of reimagining music theory pedagogy for all.

Musical diversity is often identified as a key value in modern music education, and so the question of how well infinite human musical diversity can be appropriately captured and conveyed ought to be raised. Certainly, parochialism ought to be avoided, but it is a tempting trap for music educators when time and resources are limited. This is precisely why a practical global theory might be so valuable in its promise to allow the study of musical diversity to be manageable. Indeed, music educators, of all musical practitioners, are most in need of an approach that can be absorbed and transmitted within the limitations of various skill and resource contexts, including the very limitations these educators experience in their own formal training as music teachers.

It cannot be denied, however, that the entire concept of what "music education" means in a global context is both intrinsically and contextually challenging. That is, moving towards a global music theory as the foundational basis for music education would probably require concomitant moves in the realms of performance and history studies, which in turn would precipitate a crisis around the issue of core repertoire. Such daunting questions are beyond the scope of this study, but are essential in our twenty-first century global milieu.

A Final Word

We live today in a global musical world, but also one in which the local and the particular remain musically relevant, and likely always will. As journalist Thomas Friedman has so colorfully noted (2007), ours is an increasingly "flat" world—a world of connections and also of fluid, though still discernible, boundaries. Precisely because of this fluidity, one begins to see that it is on the whole a world more oriented to musical synthesis than to musical distinction. Musical analysis in such a world ought to be based in no small part on connections and commonalities between disparate musics, and on contemplating the endless ways in which these may be combined and expressed. The well-educated musician of our time will be one who understands what makes music human and what makes humans musical, within and across cultures. The full implications of those matters lie far beyond the scope of this book, but they would benefit immensely from a set of simple theoretical concepts that are applicable to a wide range of human music-making.

Yet the "global musicianship dilemma" also compels us to find a more manageable way to operate effectively in such a world. That is, a global music theory cannot simply be an endless expansion of known particularities. Rather, it must capture in a few simple concepts the essence of musical synthesis while also being pertinent to many specific musics. The most elegant theories pertaining to any comprehensible element of human existence tend toward such simplicity while having infinitely profound implications. This is something we, as we move towards a global music theory that can serve as the basis for training twenty-first-century musicians, would do well to remember.

This study has suggested an approach that is conceptually simpler, more consistent, and easier to apprehend, yet flexible enough to permit expanded exploration of implications at a variety of deeper levels and in a variety of cultural contexts: *for practical analytical purposes across human cultures, musical elements, structures, and processes can be fundamentally understood and expressed as complex webs of relationships operating around the interaction of "twos" and "threes": as durational groupings of twos and threes at various hierarchical levels; and as pitch relations organized around acoustical ratios of 3:2 and 2:1.*

The elements arising from this fundamental view—rhythm, melody, and harmony—interact to form textures and other processes that constitute "music."

It has also been noted herein that for practical purposes any "universal" theories need only be so in a carefully qualified sense. Like Western tonal theory in its application to the music of a variety of Euro-American cultures over a span of some 400 years, the elements of a global music theory need to be widely applicable throughout the world while also capable of illuminating obvious aural differences. Beethoven's music is different from *Drum Gahu*, but both may operate under principles that stem from human physicality and perceptual psychology, as well as from elemental number theory, in the broadest possible sense. To have a global music theory that allows the exploration of both similarity and difference would seem to be a step in the direction of discovering how we might successfully "start making sense of our complex cross-cultural musical selves and perceptions" (Tenzer 2006a:34). I have echoed Tenzer in saying that such an enterprise is not without risks. Nevertheless, my hope is that, in the culmination of many such steps, our musical lives might become all the richer.

Bibliography

‘Abdel-Qāder, Muhmammed (musical performer). n.d. “Mu‘annā” (Palestinian traditional) Jerusalem: Jewish National and University Library, music archives, tape 4, no. 7.

Adams, Charles. 1976. “Melodic Contour Typology.” *Ethnomusicology* 20.2:179–215.

Agawu, Kofi. 1990. “Variation Procedures in Northern Ewe Song.” *Ethnomusicology* 34.2:221–43.

—. 2003. *Representing African Music: Postcolonial Notes, Queries, Positions*. New York: Routledge.

Antokoletz, Elliot. 1984. *The Music of Bela Bartok: A Study of Tonality and Progression in Twentieth-Century Music*. Berkeley: University of California Press.

—. 1986. *Twentieth-Century Music*. New York: Prentice Hall.

Apel, Willi. 1990. *Gregorian Chant*. Bloomington, Indiana: Indiana University Press.

Appiah, Kwame Anthony. 2006. *Cosmopolitanism: Ethics in a World of Strangers*. New York: W.W. Norton.

Arom, Simha. 2000. “Prolegomena to a Biomusicology.” In Nils Wallin, Bjorn Merker, and Stephen Brown, eds, *The Origins of Music*, 27–8. Cambridge, Massachusetts: MIT Press.

Azadehfar, Mohammed. 2006. *Rhythmic Structure in Iranian Music*. Tehran: University of Art.

Baker, James. 1986. *The Music of Alexander Scriabin*. New Haven: Yale University Press.

Barbour, J. Murray. 1951. *Tuning and Temperament: A Historical Survey*. East Lansing, Michigan: Michigan State College Press.

Barry, Phillips. 1919. “Greek Music.” *The Musical Quarterly* 5.4:578–613.

Bass, Richard. 1994. “Models of Octatonic and Whole-Tone Interaction: George Crumb and His Predecessors.” *Journal of Music Theory* 38.2:155–86.

Benjamin, Thomas; Horvit, Michael; and Nelson, Robert. 1998. *Techniques and Materials of Tonal Music* (5th edn). New York: Wadsworth.

Benson, Dave. 2006. *Music: A Mathematical Offering*. Cambridge: Cambridge University Press.

Berger, Arthur. 1963. “Problems of Pitch Organization in Stravinsky.” *Perspectives of New Music* 2.1:11–42.

Bergeson, Tonya R. and Trehuab, Sandra E. 2006. “Infants’ Perception of Rhythmic Patterns.” *Music Perception* 23.4:345–60.

Berliner, Paul. 1993. *The Soul of Mbira*. Chicago: University of Chicago Press.

Berry, Jason. 1988. "African Cultural Memory in New Orleans Music." *Black Music Research Journal* 8.1:3–12.

Blacking, John. 1973. *How Musical in Man?* Seattle: University of Washington Press.

Bochner, Salomon. 1973. "Symmetry and Asymmetry." In *The Dictionary of the History of Ideas*, vol. 4, 346–53. New York: Charles Scribner's Sons.

Boomsliter, Paul and Creel, Warren. 1961. "The Long Pattern Hypothesis in Harmony and Hearing." *Journal of Music Theory* 5.1:2–31.

Bosanquet, R.H.M. 1876. *An Elementary Treatise on Musical Intervals and Temperament*. London: MacMillan and Co.

Boyer, Carl (rev. Merzbach, Uta C.). 1991. *A History of Mathematics* (2nd edn). New York: John Wiley & Sons.

Bribitzer-Stull, Matthew. 2006. "The A♭-C-E Complex: The Origin and Function of Chromatic Major Third Collections in Nineteenth-Century Music." *Music Theory Spectrum* 28.2:167–90.

Brown, Mark. 2009. "Composer Reinvents the Piano." *The Guardian* 23 November, 2009:10.

Burns, Edward. 1999. "Intervals, Scales, and Tuning." In Diana Deutsch, ed., *The Psychology of Music* (2nd edn), 215–64. New York: Academic Press.

Cage, John. 1961. *Silence: Lectures and Writings*. Middletown, Connecticut: Wesleyan University Press.

Carterette, Edward and Kendall, Roger. 1999. "Comparative Music Perception and Cognition." In Diana Deutsch, ed., *The Psychology of Music* (2nd edn), 725–91. New York: Academic Press.

Chew, Geoffrey. 1983. "The Spice of Music: Towards a Theory of the Leading Note." *Music Analysis* 2.1:35–53.

Clarke, Eric. 1999. "Rhythm and Timing in Music." In Diana Deutsch, ed., *The Psychology of Music* (2nd edn), 473–500. New York: Academic Press.

Clayton, Martin. 2000. *Time in Indian Music*. London: Oxford University Press.

Cohen, Dalia and Katz, Ruth. 2006. *Palestinian Arab Music: A Maqām Tradition in Practice*. Chicago: University of Chicago Press.

Cook, Nicholas. 1999. "Analysing Performance and Performing Analysis." In Nicholas Cook and Mark Everist, eds, *Rethinking Music*, 239–61. Oxford: Oxford University Press.

Cooper, Grosvenor and Meyer, Leonard. 1960. *The Rhythmic Structure of Music*. Chicago: University of Chicago Press.

Cowan, Tyler. 2002. *Creative Destruction: How Globalization is Changing the World's Cultures*. Princeton, New Jersey: Princeton University Press.

Creston, Paul. 1961. *Principles of Rhythm*. New York: Franco Columbo, Inc.

Danielou, Alain. 1980. *The Ragas of Northern Indian Music*. New Delhi, India: Munshiram Manoharlal.

Davis, Ruth F. 2004. *Ma'luf: Reflections on the Arab Andalusian Music of Tunisia*. Lanham, Maryland: Scarecrow Press.

Deutsch, Diana. 1999a. “Grouping Mechanisms in Music.” In Diana Deutsch, ed., *The Psychology of Music* (2nd edn), 299–348. New York: Academic Press.

—. 1999b. “The Processing of Pitch Combinations.” In Diana Deutsch, ed., *The Psychology of Music* (2nd edn), 349–411. New York: Academic Press.

Deva, B.C. 1973. *An Introduction to Indian Music*. Publications Division, Ministry of Information and Broadcasting, Govt. of India.

du Sautoy, Marcus. 2003. *The Music of the Primes: Searching to Solve the Greatest Mystery in Mathematics*. New York: HarperCollins.

Duriyanga, Phra Chen. 1972. *Thai Music in Western Notation* (3rd edn). Bangkok: The Fine Arts Department.

Ekwueme, Lazarus E.N. 1974. “African-Music Retentions in the New World.” *The Black Perspective in Music* 2.2: 128–44.

Epstein, David. 1985. “Tempo Relations: A Cross-Cultural Study.” *Music Theory Spectrum* 7:34–71.

Fitch, W.T. 2006. “The Biology and Evolution of Music: A Comparative Perspective.” *Cognition* 100:173–215.

Fletcher, Peter. 2001. *World Musics in Context: A Comprehensive Survey of the World’s Major Musical Cultures*. New York: Oxford University Press.

Forte, Allen. 1973. *The Structure of Atonal Music*. New Haven and London: Yale University Press.

Framjee, Firoze. 1986. *Textbook of Indian Music: Theory and Practice* (2nd edn). Hathras, India: Sakhi Prakashan.

Friedman, Thomas. 2007. *The World is Flat: A Brief History of the Twenty-First Century*. New York: Picador.

Fukuda, Teruhisa (musical performer). 2003. “Koku reibo” (Japanese traditional). *Shakuhachi—Kinko School*. Ocora-Radio France CD C-560184, track 3.

Fuller, Ramon. 1991. “A Study of Microtonal Equal Temperaments.” *Journal of Music Theory* 35.1/2:211–37.

Fürniss, Susanne. 2006. “Aka Polyphony.” In Michael Tenzer, ed., *Analytical Studies in World Music*, 163–204. New York: Oxford University Press.

Gauldin, Robert. 1983. “The Cycle-7 Complex: Relations of Diatonic Set Theory to the Evolution of Ancient Tonal Systems.” *Music Theory Spectrum* 5:39–55.

Gill, Andy. 2011. “The Return of Radiohead.” *Independent Online* March 28, 2011. Retrieved 16 April, 2011 from www.iol.co.za/tonight/music/the-return-of-radiohead-1.1048243.

Gilmore, Bob. 1995. “Changing the Metaphor: Ratio Models of Musical Pitch in the Work of Harry Partch, Ben Johnston, and James Tenney.” *Perspectives of New Music* 33.1/2:458–503.

Goldman, Richard Franko. 1961. “Varèse: Ionisation; Density 21.5; Intégrales; Octandre; Hyperprism; Poème Electronique. Instrumentalists, cond. Robert Craft. Columbia MS 6146 (stereo).” (In Reviews of Records). *Musical Quarterly* 47.1:133–4.

Gowers, Timothy. 2002. *Mathematics: A Very Short Introduction*. London: Oxford University Press.

Gridley, Mark and Rave, Wallace. 1984. "Towards Identification of African Traits in Early Jazz." *The Black Perspective in Music* 12.1: 44–56.

Hanford, Lisa. 1987. "A New Model for Pitch Motion in Tonal Music." *Music Analysis* 6.1/2:133–67.

Hannon, Erin E. and Trehub, Sandra E. 2005. "Metrical Categories in Infancy and Adulthood." *Psychological Science* 16.1:48–55.

Hindemith, Paul (trans. Mendel, Arthur). 1942. *The Craft of Musical Composition* (vol. 1). London: Schott.

Huron, David. 1991. "Tonal Consonance versus Tonal Fusion in Polyphonic Sonorities." *Music Perception* 9.2:135–54.

Jairazbhoy, N.A. 1975. "An Interpretation of the 22 Śrutis." *Asian Music* 6.1/2:38–59.

Johnston, Ben. 1964. "Scalar Order as a Compositional Resource." *Perspectives of New Music* 2.2:56–76.

—. 1966. "Proportionality and Expanded Musical Pitch Relations." *Perspectives of New Music* 5.1:112–20.

Kaemmer, John. 2000. "Southern African: An Introduction." In Ruth M. Stone, ed., *The Garland Handbook of African Music*, 310–31. New York: Garland Publishing.

Kak, Subhash. 2006. "Golden Mean and the Physics of Aesthetics." *FoArm Magazine* 5:73–81.

Kaufmann, Walter. 1968. *The Ragas of North India*. Bloomington, Indiana: University of Indiana Press.

—. 1976. *The Ragas of South India*. Bloomington, Indiana: University of Indiana Press.

Kolinski, Mieczyslaw. 1973. "A Cross-Cultural Approach to Metro-Rhythmic Patterns." *Ethnomusicology* 17.3:494–506.

Kramer, Jonathan D. 1988. *The Time of Music: New Meanings, New Temporalities, New Listening Strategies*. New York: Schirmer Books.

Kubik, Gerhard. 1985. "African Tone-Systems: A Reassessment." *Yearbook for Traditional Music* 17:31–63.

—. 2000. "Central Africa: An Introduction." In Ruth M. Stone, ed., *The Garland Handbook of African Music*, 260–90. New York: Garland Publishing.

—. 2005. "The African Matrix in Jazz Harmonic Practices." *Black Music Research Journal* 25.1/2:167–222.

Kunst, Jaap. 1973. *Music in Java: Its History, Its Theory, and Its Technique* (3rd edn, enlarged and ed. by E. L. Heins). The Hague: Martinus Nijhoff.

Larson, Steve. 2005. "Composition versus Improvisation?" *Journal of Music Theory* 49.2: 241–75.

LaRue, Jan. 1970. *Guidelines for Style Analysis*. New York: W.W. Norton.

Lee, Riley. 1992. "Yearning for the Bell: A Study of Transmission in the Shakuhachi Honkyoku Tradition." Doctoral thesis, University of Sydney.

Lendvai, Erno. 1971. *Béla Bartók: An analysis of His Music*. London: Kahn & Averill.

Lerdahl, Fred and Jackendoff, Ray. 1983. *A Generative Theory of Tonal Music*. Cambridge, Massachusetts: MIT Press.

Lester, Joel. 1986. *The Rhythms of Tonal Music*. Carbondale, Illinois: Southern Illinois University Press.

Livio, Mario. 2002. *The Golden Ratio: The Story of Phi*. New York: Broadway.

Locke, David. 1998. *Drum Gahu: An Introduction to African Rhythm*. Tempe, Arizona: White Cliffs Media.

—. 2005. "Africa/Ewe, Mande, Dagbamba, Shona, BaAka." In Jeff Todd Titon, ed., *Worlds of Music* (2nd brief edn), 73–119. Belmont, California: Thompson Schirmer.

London, Justin. 2001. "Rhythm." In Stanley Sadie, ed., *The New Grove Dictionary of Music and Musicians*, vol. 21: 227–302. New York: Macmillan.

Longuet-Higgins, H.C. and Lee, C.S. 1982. "The Perception of Musical Rhythms." *Perception* 11:115–28.

Mâche, François-Bernard. 2000. "The Necessity of and Problem with a Universal Musicology." In Nils Wallin, Bjorn Merker, and Stephen Brown, eds, *The Origins of Music*, 473–9. Cambridge, Massachusetts: MIT Press.

Manuel, Peter. 1989. "Modal Harmony in Andalusian, Eastern European, and Turkish Syncretic Musics." *Yearbook for Traditional Music* 21:70–94.

Marcus, Scott L. 2007. *Music in Egypt: Experiencing Music, Expressing Culture*. New York: Oxford University Press.

Margulis, Elizabeth Hellmuth. 2007. "Silences in Music Are Musical Not Silent: An Exploratory Study of Context Effects on the Experience of Musical Pauses." *Music Perception* 24.5:485–506.

McClain, Ernest. 1979. "Chinese Cyclic Tunings in Late Antiquity." *Ethnomusicology* 23.2:205–24.

Meyer, Leonard. 1956. *Emotion and Meaning in Music*. Chicago: University of Chicago Press.

—. 1967. *Music, the Arts, and Ideas*. Chicago: University of Chicago Press.

Miller, George. 1956. "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information." *Psychological Review* 63:81–97.

Moore, Allan. 1992. "Patterns of Harmony." *Popular Music* 11.1:73–106.Morris, Robert. 1998. "Voice-Leading Spaces." *Music Theory Spectrum* 20.2:175–208.

—. 2001. "Variation and Process in South Indian Music: Some 'Kritis' and Their 'Sangatis.'" *Music Theory Spectrum* 23.1:74–89.

Morris, Robert and Ravikiran, Chitravina. 2006. "Ravikiran's Concept of Melharmony: An Inquiry into Harmony in South Indian Ragas." *Music Theory Spectrum* 28.2:255–76.

Morton, David. 1976. *The Traditional Music of Thailand*. Berkeley: University of California Press.

Nattiez, Jean-Jacques (trans. Abbate, Carolyn). 1990. *Music and Discourse: Toward a Semiology of Music*. Princeton, New Jersey: Princeton University Press.

Nelson, Stephen. 2008. “Court and Religious Music (2): Music of *Gagaku* and *Shōmyō*.” In Alison Tokita and David Hughes, eds, *The Ashgate Research Companion to Japanese Music*, 49–76. Aldershot: Ashgate.

Nettl, Bruno. 1986. “World Music in the Twentieth Century: A Survey of Research on Western Influence.” *Acta Musicologica* 58, Fasc. 2:360–73.

—. 2000a. “An Ethnomusicologist Contemplates Universals in Musical Sound and Musical Culture.” In Nils Wallin, Bjorn Merker, and Stephen Brown, eds, *The Origins of Music*, 463–72. Cambridge, Massachusetts: MIT Press.

—. 2000b. “There’s Room for Us All.” *College Music Symposium* 40:24–30.

—. 2005. *The Study of Ethnomusicology: Thirty-One Issues and Concepts*. Chicago: University of Illinois Press.

Neuhaus, Christiane and Knösche, Thomas. 2006. “Processing of Rhythmic and Melodic Gestalts—An Erp Study.” *Music Perception* 24.2:209–22.

Nketia, J.H. Kwabena. 1974. *The Music of Africa*. New York: W.W. Norton.

Nzewi, Meki. 1997. *African Music: Theoretical Content and Creative Continuum*. Olderhausen, Germany: Lugert Verlag (Institut für Didaktik populärer Musik).

Ockelford, Adam. 2002. “The Magical Number Two, Plus or Minus One: Some Limits on Our Capacity for Processing Musical Information.” *Musicæ Scientiæ* 6.2:177–215.

—. 2004. “On Similarity, Derivation and the Cognition of Musical Structure.” *Psychology of Music* 32.1:23–74.

—. 2005. *Repetition in Music: Theoretical and Metatheoretical Perspectives*. Aldershot: Ashgate.

Ostransky, Leroy. 1978. “Early Jazz.” *Music Educators Journal* 64.6:34–9.

Palmer, John. 2001. “Yes, ‘Awaken’, and the Progressive Rock Style.” *Popular Music* 20.2:243–61.

Parncutt, Richard. 1988. “Revision of Terhardt’s Psychoacoustical Model of the Root(s) of a Musical Chord.” *Music Perception* 6.1:65–94.

—. 2006. “Commentary on Cook & Fujisawa’s ‘The Psychophysics of Harmony Perception: Harmony is a Three-Tone Phenomenon’.” *Empirical Musicology Review* 1.4:204–9.

Partch, Harry. 1974. *Genesis of a Music* (2nd edn). New York: Da Capo Press.

Patel, Aniruddh. 2006. “Musical Rhythm, Linguistic Rhythm, and Human Evolution.” *Music Perception* 24.1:99–104.

—. 2007. *Music, Language, and the Brain*. New York: Oxford University Press.

Perlman, Marc. 2004. *Unplayed Melodies: Javanese Gamelan and the Genesis of Music Theory*. Berkeley, California: University of California Press.

Perry, Jeffrey. 2005. “Cage’s Sonatas and Interludes for Prepared Piano: Performance, Hearing and Analysis.” *Music Theory Spectrum* 27.1: 35–66.

Pierce, John. 1999. “The Nature of Musical Sound.” In Diana Deutsch, ed., *The Psychology of Music* (2nd edn), 1–23. New York: Academic Press.

Pieterse, Jan Nederveen. 2004. *Globalization and Culture: Global Melange*. New York: Rowman and Littlefield.

Pomeroy, Boyd. 2004. "Tales of Two Tonics: Directional Tonality in Debussy's Orchestral Music." *Music Theory Spectrum* 26.1:87–118.

Povel, D.J., and Essens, P.J. 1985. "Perception of temporal patterns." *Music Perception* 2:411–40.

Powers, Harold. 1981. "Tonal Types and Modal Categories in Renaissance Polyphony." *Journal of the American Musicological Society* 34.3:428–70.

Rahn, Jay. 1978. "Javanese Pélog Tunings Reconsidered." *Yearbook of the International Folk Music Council* 10:69–82.

—. 1983. *A Theory for All Music: Problems and Solutions in the Analysis of Non-Western Forms*. Toronto: University of Toronto Press.

Revill, David. 1993. *The Roaring Silence: John Cage: A Life*. New York: Arcade Publishing.

Rink, John. 2002. "Analysis and (or?) Performance." In John Rink, ed., *Musical Performance: A Guide to Understanding*, 35–58. Cambridge: Cambridge University Press.

Rowell, Lewis. 1979. "The Subconscious Language of Musical Time." *Music Theory Spectrum* 1:96–106.

Ruckert, George E. 2004. *Music in North India: Experiencing Music, Expressing Culture*. New York: Oxford University Press.

Sachs, Curt. 1952. Rhythm and Tempo: An Introduction. *The Musical Quarterly* 38.3:384–98.

Sakai, K.; Kitaguchi, K.; and Hikosaka, O. 2003. "Chunking during human visuomotor sequence learning." *Experimental Brain Research* 152:229–42.

Sambamurthy, P. 1999. *South Indian Music, Book V* (7th edn). Chennai, India: The Indian Music Publishing House.

Schechter, John. 2005. "Latin America/Chile, Bolivia, Ecuador, Peru." In Jeff Todd Titon, ed., *Worlds of Music* (2nd brief edn), 265–309. Belmont, California: Thompson Schirmer.

Schippers, Huib. 2010. *Facing the Music: Shaping Music Education from a Global Perspective*. New York: Oxford University Press.

Schneider, Albrecht. 2001. "Sound, Pitch, and Scale: From 'Tone Measurements' to Sonological Analysis." *Ethnomusicology* 45.3:489–519.

Sethares, William A. 2005. *Tuning, Timbre, Spectrum, Scale* (2nd edn). London: Springer-Verlag.

Sloboda, John. 1985. *The Musical Mind: The Cognitive Psychology of Music*. New York: Oxford University Press.

Stock, Jonathan. 1993. "The Application of Schenkerian Analysis to Ethnomusicology: Problems and Possibilities." *Music Analysis* 12.2:215–40.

—. 1996. *World Sound Matters: An Anthology of Music from Around the World* (Transcriptions). London: Schott.

Subbulakshmi, M.S. (musical performer). 1970. "Vidulaku Mrokkeda" (composed by Tyagaraja). Kolkata, India: Saregama Records, HTCS03B8066/67/68.

Subramaniam, Lakshminarayana. (musical performer). 1999. "Blue Lotus" and "Gipsy Trail." *Global Fusion*. Elektra/Wea, ASIN B00000JG3E, tracks 3 and 4.

Surjodiningrat,W.; Sudarjana, P.J.; and Susanto, A. 1972. *Tone Measurements of Outstanding Javanese Gamelans in Jogjakarta and Surakarta*. Jogjakarta: Gadjah Mada University Press.

Temperley, David. 2001. *The Cognition of Basic Musical Structures*. Cambridge, Massachusetts: MIT Press.

Tenney, James. 1988. *A History of 'Consonance' and 'Dissonance.'* New York: Excelsior.

Tenzer, Michael. 2000. *Gamelan Gong Kebyar: The Art of Twentieth-Century Balinese Music*. Chicago: University of Chicago Press.

—. 2006a. "Introduction: Analysis, Categorization, and Theory of Musics of the World." In Michael Tenzer, ed., *Analytical Studies in World Music*, 3–38. New York: Oxford University Press.

—. 2006b. "Oleg Tumulilingan: Layers of Time and Melody in Balinese Music." In Michael Tenzer, ed., *Analytical Studies in World Music*, 205–36. New York: Oxford University Press.

Thompson, William. 2006. "Pitch Frames as Melodic Archetypes." *Empirical Musicology Review* 1.2:85–102.

Tokita, Alison and Hughes, David. 2008. "Context and Change in Japanese Music." In Alison Tokita and David Hughes, eds, *The Ashgate Research Companion to Japanese Music*, 1–33. Aldershot: Ashgate.

Touma, Habib Hassan (trans. Schwartz, L.). 1996. *The Music of the Arabs*. Portland, Oregon: Amadeus Press.

Toussaint, Godfried. n.d. "The Euclidean Algorithm Generates Traditional Musical Rhythms." Retrieved 11 November, 2007 from http://cgm.cs.mcgill.ca/~godfried/publications/banff.pdf.

Trehub, Sandra. 2000. "Human Processing Predispositions and Musical Universals." In Nils Wallin, Bjorn Merker, and Stephen Brown, eds, *The Origins of Music*, 427–48. Cambridge, Massachusetts: MIT Press.

Trehub, Sandra; Thorpe, Leigh; and Morongiello, Barbara. 1987. "Organizational Processes in Infants' Perception of Auditory Patterns." *Child Development* 58.3:741–9.

Tymoczko, Dmitri. 2004. "Scale Networks and Debussy." *Journal of Music Theory* 48.2:219–94.

van den Toorn, Pieter. 1983. *The Music of Igor Stravinsky*. New Haven, Connecticut: Yale University Press.

Viswanathan, T., and Allen, Matthew Harp. 2004. *Music in South India: Experiencing Music, Expressing Culture*. New York: Oxford University Press.

Voloshinov, Alexander. 1996. "Symmetry as a Superprinciple of Science and Art." *Leonardo* 29.2:109–13.

Wade, Bonnie C. 1979. *Music in India: The Classical Traditions*. Englewood Cliffs, New Jersey: Prentice-Hall.

—. 2005. *Music in Japan: Experiencing Music, Expressing Culture*. New York: Oxford University Press.

Wallin, Nils; Merker, Bjorn; and Brown, Stephen, eds. 2000. *The Origins of Music*. Cambridge, Massachusetts: MIT Press.

Weintraub, Andrew. 1997. “Constructing the Popular: Superstars, Performance, and Cultural Authority in Sundanese Wayang Golek Purwa of West Java, Indonesia.” Doctoral thesis, University of California at Berkeley.

West, M.L. 1994. “The Babylonian Musical Notation and the Hurrian Melodic Texts.” *Music and Letters* 75.2:161–79.

Whittall, Arnold. 1975. “Tonality and the Whole-Tone Scale in the Music of Debussy.” *Music Review* 36.4:261–71.

—. 1993. “Experience, Thought and Musicology.” *The Musical Times* 134.1804:318–20.

Wichmann, Siegfried. 1981. *Japonisme: The Japanese Influence on Western Art since 1858*. New York: Thames and Hudson.

Wienpahl, Robert. 1971. “Modality, Monality and Tonality in the Sixteenth and Seventeenth Centuries.” *Music and Letters* 52.4:407–17.

Williams, Lindsey. 2005. “Effect of Music Training and Musical Complexity on Focus of Attention to Melody or Harmony.” *Journal of Research in Music Education* 53.3:210–21.

Yano, Christine and Shūhei, Hosokawa. 2008. “Popular Music in Modern Japan.” In Alison Tokita and David Hughes, eds, *The Ashgate Research Companion to Japanese Music*, 345–62. Aldershot: Ashgate.

Yarman, Ozan. 2007. “Seventy-Nine-Tone Tuning and Theory for Turkish Maqam Music.” Doctoral thesis, Istanbul Technical University.

This page has been left blank intentionally

Index