NON-ISOCHRONOUS METER: A STUDY OF CROSS-CULTURAL PRACTICES, ANALYTIC TECHNIQUE, AND IMPLICATIONS FOR JAZZ PEDAGOGY

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ABSTRACT

This dissertation examines the use of *non-isochronous* (*NI*) meters in jazz compositional and performative practices (meters as comprised of cycles of a prime number [e.g., 5, 7, 11] or uneven divisions of non-prime cycles [e.g., 9 divided as 2+2+2+3]). The explorative meter practices of jazz, while constituting a central role in the construction of its own identity, remains curiously absent from jazz scholarship. The conjunct research broadly examines NI meters and the various processes/strategies and systems utilized in historical and current jazz composition and performance practices.

While a considerable amount of NI meter composers have advertantly drawn from the metric practices of non-Western music traditions, the potential for utilizing insights gleaned from contemporary music-theoretical discussions of meter have yet to fully emerge as a complimentary and/or organizational schemata within jazz pedagogy and discourse. This paper seeks to address this divide, but not before an accurate picture of historical meter practice is assessed, largely as a means for contextualizing developments within historical and contemporary practice and discourse. The dissertation presents a chronology of explorative meter developments in jazz, firstly, by tracing compositional output, and secondly, by establishing the relevant sources within conjunct periods of development i.e., scholarly works, relative academic developments, and tractable world music sources. Bridging the gap between world music meter sources and theoretical musicology (primarily, the underlying perceptual and cognitive model which represents a topology of the structural premises of meter) the research acts to direct and inform a compositional process which directly accounts for an isomorphic link between structurally similar meters.

DEDICATION

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GLOSSARY OF TERMS

Beat Cycle

A metric cycle comprised of long and short beats (generally, in a 2:3 ratio).

Beat Projection

The projection of isochronous beats across a series of non-isochronous beat cycles.

Diatonic Rhythm

The organization of meters into beat cycle subdivisions that utilize syncopated ostinatos which parallel the structural continuity of the diatonic scale.

Entrainment

The attentional paths which facilitate a process of matching our temporal expectations with the onset of events in a perceived environment.

Equal Tempered System (ETS)

A system of tuning in which an interval (usually an octave) is divided into a series of equal frequency ratios between successive notes.

Fibonacci Numbers

A series or sequence of numbers in which each number is the sum of the two preceding numbers (i.e., 1, 1, 2, 3, 5, 8, etc.).

Isochronous

Beat cycles comprised of even durational values.

Inter-Onset-Interval (IOI)

A series of successive notes (of equal durational value) which act as a perceptual ground in which to track the various durational periodicities of metric and rhythmic cycles.

Isomorphic

The structural connection between two or more distinct N cycles.

Maximally Even

A set which is distributed as evenly as possible.

Meter

A cycle of beats which function as a perceptual ground for rhythmic gestures.

Metric Modulation

The proportional relationship between meters with distinct cardinalities.

N Cycles

The amount (N represents any given number) of inter-onset-intervals in meters comprised of beat cycles (e.g. the beat cycle of 3+3+3+2 is an eleven beat N cycle).

Non-Isochronous (NI) Meter

N Cycles with beat cycles comprised of long and short intervals.

Rotation

The cyclic permutation of all the members of a set into a sequence or order.

Segmentation

A rhythmic cycle which architecturally divides a meter into durational periodicities of greater or lesser value than the durational periodicities associated with beat cycles comprised of twos and threes (e.g. 12 = 5+4+3).

Synchronization

The internalization and externalization of durational periodicities which map to the onset of events as extracted from the periodic cycles inherent in meter.

Tactus

A referential periodicity (generally, between the fastest and slowest beat levels) which establishes a coherent premise for ensuing divisional strategies.

Tala (Talam or Tal)

A term used in Indian classical music to represent a number of rhythmic and metric schools of classification.

Time-Line

The motional patterns of rhythmic ostinatos.

Usul (Wazn)

The rhythmic and metric cycles associated with Turkish (Ottoman) classical music.

World Music

A musical category encompassing traditional and neo-traditional music styles from around the world.

INTRODUCTION

The domination of pitch-centric jazz analysis was shaped by the forces of historical musicology which presumably positioned the development of harmony and melody within the evolutionary stratum of European art practice; the residual effects of which continue to permeate a majority of contemporary scholarship. Through the efforts of historical musicology, the evolution of European art practice had been coherently defined within a well-bound body of research. Nonetheless, the common assumption during the late nineteenth and early twentieth century was that the meters and rhythms of European folk practices also existed in the wells of Western art music. Historical statements regarding world music practice were largely hypothetical, a result of the relative void in research which had yet to establish a coherent map of world music traditions and practices. More recently, a discernible body of ethnomusicological studies has enabled a more informed and thorough commentary which has been the creative impetus behind a number of endeavors (theoretical or otherwise) which seek to gain insight within a broader and more inclusionary perspective. An examination of more recent music publications, while showing a continuum of works which emphasize chord-scales, harmonic substitutions and chord progression theory, has nonetheless, also shown a marked increase in the theoretical proliferation of rhythmic based systems. This has in turn facilitated further interest in the possibilities of utilizing world music practices and traditions.

Michael Tenzer proposes that analytical models may be used to facilitate a compositional process. Tenzer suggests that our purpose "is to make the diverse systems of musical thought under consideration available for creative musicians looking for an informed basis on which to

know, assimilate, model, or borrow from world musics."[1] It is this 'purpose' that characterizes the framework of this present study, an examination of non-isochronous (NI) meter practices in jazz (meters as comprised of cycles of a prime number [e.g., 5, 7, 11] or uneven divisions of non-prime cycles [e.g., 9 divided as 2+2+2+3]. Accordingly, the study utilizes a vast compendium of diverse world music meter sources in conjunction with the insights of recent studies of meter. While such meters are typically attributable to non-Western traditions, examples in jazz, while confirming claims of its rarity, also show an increase of use, particularly in the last twenty years. Metric variability in jazz, while constituting an important role in the creation of its identity, remains curiously absent from jazz scholarship.

In an expressive climate of stylistic and regional inclusion I adopt a view of jazz as a continuum of interconnected styles, what Ludwig Wittgenstein metaphorically suggests when he stated that "the strength of the thread does not reside in the fact that some one fiber runs through its whole length, but in the overlapping of many fibers."[2] Similarly, what Mark Gridley calls the "family of resemblances approach" looks for ways in which certain styles resemble and/or differ from others. Rather than searching for a single fiber we may satisfy ourselves with finding links between adjacent styles. While subtle style categories like bebop, cool bop, hard bop, and so forth, create the convenience of broadly positioning movements within distinct historical identities, they also open us to the possibility of narrowly constricting definition when we might more elegantly view a number of strands that comprise an interconnected continuum of change and source. These multiple and over-lapping layers imbue a multiplicity of analytic and aesthetic perspectives, and thus call for an analytic method of jazz that admits a variety of "vantage points

[1] Michael Tenzer, *Analytical Studies in World Music* (Oxford University Press, 2006), 5.
[2] Mark Gridley, "Three Approaches to Defining Jazz," *The Music Quarterly* 73, no. 4 (1989): 524.

rather than legislating a singular, authoritative perception."[3]

In early jazz, the Cuban habanera (tango) and rumba rhythms, an exceedingly popular component of early New Orleans brass band repertoire, instilled the influential and characteristic rhythm, the tresillo (3+3+2), a pattern where according to Borneman (1946) and A.M. Jones (1954) African phrases are built up of the numbers 2 and 3 or of a combination of 2 and 3. Early in the history of African-American music analysis, Winthrop Sargeant (1938) identified the 3+3+2 pattern within jazz and other Africa-derived rhythms. In 1927, Aaron Copeland noted that the temporal organization of foxtrot patterns contrasted with Europe-derived practice, suggesting non-syncopated measures of 3/8, 3/8, and 2/8.[4] Following the work of Sargeant, Borneman, Gunther Schuller (1968), and Marshall Stearns (1956) all traced this pattern to African musical traditions. Scott Joplin (1867-1917) and other ragtime composers frequently used tresillo patterns, and Jelly Roll Morton (1890-1941), notable for popularizing the term "Spanish tinge," positioned the importance of the habanera cross-rhythms as a central means of employing a rhythmic aesthetic akin to what he viewed as jazz. Indeed, the tresillo is the most prevalent rhythmic cell in sub-Saharan music traditions and musics of the African diaspora. Its prevalence in countless world music traditions exists not necesarily the result of aesthetic proclivities, but rather as a consequence of a temporal organization which lie within spatial regions of perceptual and cognitive saliency. While the basic 3-3-2 pattern predominates the Sub-Saharan practices, it is interesting to note that the tapping studies of Repp *et al.* (2005) found that study participants synchronized with 3-3-2 more accurately than its rotational (i.e., the three possible phase relationships or permutations are: 2-3-3, 3-2-3, and 3-3-2) counterparts (i.e., 2-3-3 or 3-2-3). The

[3] Jay Rahn, "Turning the Analysis Around: Africa-Derived Rhythms and Europe-Derived Theory," *Black Music Research Journal* 16, no. 1 (1996): 72.

[4] Ibid., 73.

notion that this pattern is a surface rhythm which maps to an underlying binary based meter may be too narrow of a perspective, especially when considering the plethora of world music traditions which treat various groupings of twos and threes as meter itself. Cultures which express beat cycles as two periodicities (e.g. 2+3) of unequal lengths do not necesarily require further referential periodicities to establish a sense of meter, while cultures which use a tactus with one durational periodicity (i.e., a quarter note) require at least one other referential periodicity as a means of constructing meter.

When we speak of musical analysis, we refer to the identification and categorization of patterns, systems, and groups as a means of determining the musical propensities within individual works, genres, or styles. With Tenzer, the analytical identification of structural patterns ultimately serve a number of diverse purposes:

> to demonstrate or inspire compositional depth or ingenuity, to discover an archetypal sound-structure model on which a music or repertoire is based, to symbolize or reflect a philosophy, social value or belief (of the analyst, the composer(s), performer(s), or their society), to reveal a historical process of change, to unearth unsuspecting connections to music elsewhere, to embody a mathematical principal. Good analysis demystifies by cracking sound codes, better enabling the ear to collaborate with the mind in search of richer experience.[5]

Theodor Adorno, insightfully viewed analysis as an opportunity to reveal structure which would not normally make itself apparent. We are impelled by the intriguing notion that analysis provides a privileged experience which may be legitimized in structures which ordinarily remain unrecognized. Cultural expressions of music may also be contextualized within spatial, temporal, or structural commonalities and/or limits, all the while reconciling the vast diversity of expression which exists within those bounds.

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[5] Tenzer, *Analytical Studies in World Music*, 7.

Patterns, cycles, rhythms, time-lines, ostinatos, hemiolas, song forms, meters, etc., in short, periodicities are central to the organization of music. The twentieth century adoption of compositional procedures which sought to abolish periodic regularities (minimalism withstanding) is seen by Tenzer as abstractly removed from the conventional temporal relationships inherent in world music practices. Accordingly, the abolishment of periodic regularities must be viewed as a rare and unique exception which only has resounding significance to the culture that produced it and in no way reflects the expressive temporal traditions of world practices. When we speak of periodicities we are specifically referring to how durational values regulate and structure hierarchical patterns. Tenzer associates periodicities as a fundamental concern of composition as it inevitably generates musical or architectural form - time delineates space. “When one grasps how periodicities drive music one thinks and understands more compositionally than when one deals with a less malleable, more static element such as scale or mode. This means that, given a perspective as broad as ours, rhythms and formal structure are prior in importance to pitch and other parameters.”[6] Periodicities are an implicit concern in my own analysis which seeks to examine meter in jazz, particularly its intersections with world musics as a platform for non-isochronous meter development. Tenzer's advancement of world music as a form of 'activism' asserts a broad creative palette of cultural resources.

In the analysis of diverse repertoires, it is important to acknowledge the great degree of regional diversity and variety, even within well-bounded traditions which employ formalized written and/or oral models of dissemination. There are no cultural absolutes, as distortions are inevitable in non-static traditions which are bound only by the transformative experience of continual change. Western researchers in collaboration with the musicians (and their respective

[6] Ibid., 24.

traditions) they study may even engender new collective hybrids of music and analysis. “Now that knowledge and ideas about world music cultures have leapt into international awareness, local concepts fluctuate and exchange with cosmopolitan ones all the more. The music appears differently even to its own creators once outsiders value it.”[7] In an age of global interstices and transversements a number of artists have expressed a need to provide an important counterbalance to the potentially alienating or homogenizing forces of (neoliberal) globalization, what Frederick Moehn views as a dynamic exploration of the narratives of identity within a process of consciously mixing and reconciling social and sonic spaces. Moehn's examination of musical hybrids suggest that while creativity may freely transverse the boundaries of global music technologies and practice, artists tend to constrain the degrees in which foreign practices are incorporated; a model which Moehn formatively accounts for in what he views as the stronger associative fields or forces within regional and national identities.[8]

While a considerable amount of NI meter composers have advertantly drawn from the metric practices of non-Western music traditions, the potential for utilizing the insights gleaned from contemporary music-theoretical discussions of meter have yet to fully emerge as a complimentary and/or organizational schemata within jazz pedagogy and discourse. Accordingly, this dissertation addresses this divide by building upon past and current developments as a means of illuminating historical and contemporary performative and compositional processes. In this particular case, the NI meter practices associated with jazz accord us the advantage of an examination which involves a relatively small and tractable tradition. Thus, it remains possible to accurately examine the virtual entirety of its compositional output, at least from its early

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7 Ibid., 11.

8 Jordan Saull, review of *Contemporary Carioca: Technologies of Mixing in a Brazilian Music Scene*, by Frederick Moehn, *Journal of the International Association for the Study of Popular Music* 4, no.1 (2014): 137-138.

formative periods to about 1970, at which point the exponential increase in use, not just in jazz, but in a variety of music genres and settings, convolutes the potential for a similarly thorough analysis. Nonetheless, an examination of NI meter developments up to at least the beginning of the 1970s can only act to provide a greater vantage point in the assessment of more recent periods and developments. Thus, by limiting the ensuing historical contextualization up to the early 1970s we can assert a tractable performative and compositional tradition while simultaneously avoiding the pitfalls of an inordinately long, tangential, and discursive historical overview.

In the 20th century, the quest to map and understand non-Western music traditions, which are often transmitted orally without notation, facilitated the need to transmit this knowledge within Western institutions of learning. Traditions which had historically never required the need to address Western analytic practices, were now being asked to re-contextualize, classify, and describe their traditions through modes of Western understanding. Distortions are inevitable. Much can be gleaned by contextualizing non-conventional jazz meter practices within the discourse of these developments, especially when considering the various means and localities in which cultural informations were sourced. Sources which have inspired non-conventional jazz meter practice frequently emerge within the topics addressed in Chapters Two and Three. Chapter Three, presents a chronology of meter developments in jazz, firstly, by tracing compositional output, and secondly, by establishing the relevant sources within conjunct periods of exploratory meter development i.e., scholarly works, relative academic developments, and world music sources which were utilized and advocated by early exploratory pioneers. Jazz's contemporary relationship with meter exists in the historical expansion from 2/4 to 4/4, to 12/8, which in turn facilitated a broader expressive array of NI beat cycles. Chapter Two, surveys world music meter traditions by categorizing various expressive forms which utilize meters typically foreign to

European art practice. It seeks to describe, compare, and classify differing forms of metric expressitivity in world music practices, largely with the hopes of stimulating a pedagogical and compositional process. Chapter Four, makes use of various transcriptions and scores as a means of demonstrating various procedural processes in which conventional meters may be re-contextualized into alternative non-conventional metric realizations (i.e., non-isochronous meters). Chapter One, examines the underlying perceptual and cognitive models employed in Justin London's contemporary music-theoretic discussions of meter; largely a topology of the underlying structural premises of meter and the ways in which the perception of meter may act to direct and inform a compositional process. Importantly, London's lack of comparative meter analysis fails to address one of the most intriguing features inherent in world music traditions, namely, the perceived relationship between differing meters. Accordingly, the following cross-cultural examination of non-Western music traditions attempts to rectify the limited empirical basis in which a number of London's theories rest.

CHAPTER ONE

METRIC PARAMETERS AND CONSTRAINTS

1.1 Rhythm and Meter

Curt Sachs's examination of the inseparable link between rhythm and meter notes that the earliest known Western commentary on the topic is by the Roman grammarian Charisius (c. A.D. 400) who wrote: *Rhythmus est metrum fluens, metrum rhyhmus clausus*, or "rhythm is flowing meter, and meter is bonded rhythm."[9] Charistius' flowing meter may describe the ebb and flow of a conductor's baton with its incremental (and barely perceptible) "shades of driving or checking for which Hugo Riemann once revamped the Greek word *agogico*."[10] Conversely, mechanical or metronomic time is likely to handicap the execution of certain styles, études, and genres, and is potentially fraught with the danger that one falls, as Ralph Kirkpatrick puts it, "below the human level."[11] Nonetheless, the magnitude and scope of humanity's endeavors in temporal regularity and strictness transcend the precious heirloom of our primordial ancestry – non-metronomic rhythm.

This strictness of time is largely the consequent result of meter, a temporal invariant which directs a listener's ear to locations in time, thus optimizing our ability to perceive a dynamic shifting surface of patterns, cycles, and varying periodicities. By directing our attention

[9] Curt Sachs, "Rhythm and Tempo: An Introduction," *The Musical Quarterly* 38, no. 3 (1952): 385.
[10] Ibid., 389.
[11] Ibid.

to specific temporal locations, we allocate our attention towards an anticipatory schemata, one which makes listeners and performers particularly sensitive to the spatial organization of motional gestures, rhythms, and figures. Mari Riess Jones views temporal attention as a perceptual energy delineated toward the act of mentally patterning temporal reference points, thus enabling us to both internalize and externalize various periodicities. The attentional paths which facilitate synchronization, also known as *entrainment* or *attunement,* involves a process of matching our temporal expectations with the onset of events in a perceived environment. These nested psychological rhythms synchronize to *inter-onset intervals* (IOIs) or successive note onsets as extracted from the periodic cycles inherent in meter.

> Attentional paths may initially reflect simple, naive expectancies. Whether expectancies are naive or sophisticated ones that are acquired through experience, they are always dynamic. In music, for example, it is not uncommon to experience these expectancies as rhythmical anticipations of very simple prototypical patterns, patterns perhaps associated with a particular musical genre. Of course, such simple paths will usually be inappropriate as exact matches to a true pattern as it unfolds in time. But the idea here is that we can cast ourselves cognitively toward a good vantage point from which to pick up details of more complex real-world sequences.[12]

1.2 Temporal Entrainment and Synchronization

In Justin London's theory, meter is a condition of our ability to 'entrain' to periodicities that correspond to the cognitive and perceivable range of temporal stimuli. London correspondingly maps the proposed temporal range (in milliseconds) of meters and their corespondent surface rhythms within *metric trees*. These metric trees delineate the perceivable range of periodicities above (meter) and below (subdivisions) a tactus. London is particularly

[12] Mari Riess Jones, "Only Time Can Tell: On the Topology of Mental Space and Time," *Critical Inquiry* 7, no. 2 (Spring 1981): 571.

interested in establishing a framework in which to codify the temporal conditions in which meters may be heard. By relating tempo to the upper and lower limits of perceivable durational periodicities, London formulates a theory with far reaching implications for the practice and study of music. His use of a vast body of cognitive and perceptual research is the basis in which he formulates and maps differing temporal or motional expectancies within various tempo regions and/or ranges. Briefly examined in the following sections, this body of research may be integrated into Tenzer's model of the 'activist,' firstly, by establishing hierarchical preferential rates which may be integrated into a compositional model, and secondly, by using such rates to conjecture modulatory processes. My intention here is not to simply reiterate the various studies which London himself so thoroughly addresses, but rather to examine a snippet of some of the more pertinent examples as a means of contextualizing London's assertion of preferential rates, periodicities, and meters. London establishes nine significant areas of research, all of which examine the cognitive and perceptual restraints inherent in the various components which define aspects of London's working model of rhythm and meter:[13]

1. The range of *subjective rhythmization*: the longest and shortest inter onset periods for continuous, isochronous (and otherwise undifferentiated) stimuli that we tend to group into twos and threes;
2. the range of *spontaneous tempo*: the longest and shortest periods in which we are able produce a steady beat;
3. the values for *preferred tempos*: the rate at which we are most comfortable at producing a steady beat;

[13] Justin London, "Cognitive Constraints on Metric Systems: Some Observations and Hypotheses," *Music Perception: An Interdisciplinary Journal* 19, no. 4 (2002): 530.

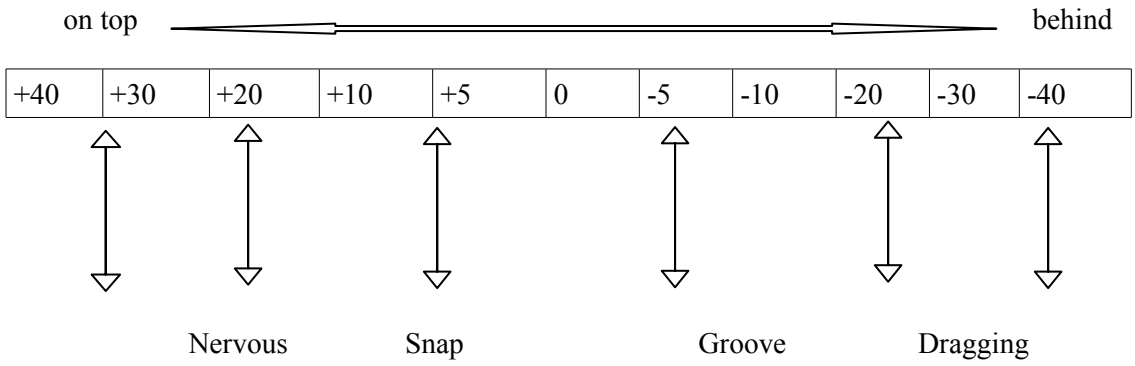
4. the range in which we are most likely to hear a pulse or tactus;
5. the *indifference interval*: a period that we tend to judge as neither too long or too short;
6. our sensitivity to *changes in tempo* at different initial rates and in different contexts;
7. our sensitivity to differences of duration relative to the magnitude of the durations involved;
8. and the shortest and longest durations musicians tend to produce in rhythmically palpable patterns (i.e., apart from trills, violin tremolos, vibratos, etc.);
9. and the extent and limits of the psychological present.

Recent efforts in jazz related research has been similarly concerned with the perception of preferential durational values. J.A. Progler's research regarding swing suggests that rhythm may be measured on a sub-syntactical level (i.e., the discrepancy between notated music [syntactical] and actual performance practice). Progler's research examines the placement of notes along a horizontal axis, noting what MIDI (musical instrument digital interface) specialists and producers have long known, namely, that drum beats seem light and snappy when pushed forward by milliseconds, and are perceived as big and powerful when pushed back by milliseconds. Indeed, a well known fact among jazz musicians is the subtle control which can be asserted by playing either 'down the center,' 'up,' or 'back on the time,' what Peter Reinholdsson observed as the manipulative placement of walking bass lines to aesthetically control and alter the motional quality generated by the musical gestures of other ensemble players.[14]

[14] Peter Reinholdsson, "Approaching Jazz Performance Empirically: Some Reflections on Methods and Problems," *Action and Perception in Rhythm and Music: Papers Given at a Symposium in the Third*

MIDI ‘track shifting’ and ‘quantization’ processes have long been at the center of inquiries regarding the potential to accurately codify the durational values associated with genre and style. The producer and MIDI programmer Michael Stewart, has attempted to devise a means in which one can add a human feel, what he calls a *feel spectrum*. Figure 1.1 demonstrates Stewart's prescription for generating an assortment of differing time feels at 130 bpm.

Figure 1.1 Stewart's 'Feel Spectrum' in Milliseconds at 130 bpm[15]



As a producer of modern rock, Stewart tends to narrow his field of inquiry, thus failing to address a broader spectrum of tempos. Presently, I am less concerned with the accuracy of Stewart's prescription for 'time feels' than I am in merely demonstrating that a number of disparate and seemingly unrelated studies have centered around attempts to numerically define a number of motional qualities in music, particularly in relationship to tempo. Of course in actual fact, establishing fixed numeric quantities for the dissynchrony between successive eighth notes

International Conference on Event Perception and Action, Stockholm: Royal Swedish Academy of Music, no. 55, ed. by A. Gabrielsson (1987): 121-22, qtd. in J.A. Progler, “Searching for Swing: Participatory Discrepancies in the Jazz Rhythm Section,” *Ethnomusicology* 39, no. 1 (Winter 1995): 27-28.

[15] Michael Stewart, “The Feel Factor: Music with Soul,” *Electronic Musician*, October, 1987, 57, qtd. in Progler, “Searching for Swing,” 23-24.

(i.e., the lilt or swing) in swing lines is impossible given the incremental shifts which occur throughout the course of any given performance. Additionally, the fastest tempos dissolve the potential for dissynchrony, demanding a more even and isochronous relationship between beats.

Rachel and Hao Huang's research show that standard jazz song performances typically implement incremental shifts in the range of 3-4 bpm. Progler perceives such shifts (3-4 bpm) as a normative form of rhythmic expressitivity, noting that Huang's examination of certain Billie Holiday recordings show that the suggested meter of the soloist is often at odds with the meter of the accompaniment, ultimately creating a tension in the dissynchrony of simultaneously expressed temporalities. In Thomas Owens' (1974) dissertation on Charlie Parker, his use of the melogram reveals that the length of individual measures fluctuate over the course of Parker's improvisations. Progler's own research on jazz drummer ride-tap patterns shows that drummers on countless jazz and blues recordings exhibit a large syntactical spike (durational) on the fourth beat of the fourth measure in a typical 12-bar blues song form, thus suggesting a strong link between our rhythmic behavior and the context of harmonic and melodic gestures (e.g. "Kansas City Blues," Verve, 1951). Such studies reflect an interest in defining the syntactical and sub-syntactical levels which shape and define the varying aesthetic components of jazz.

London's cognitive and perceptual framework presumably pertains to all cultures. While London acknowledges that unique environmental factors may foster expressive forms of meter which potentially fall outside of the proposed parameters, he nonetheless maintains that such research still asserts a strong fundamental model in which to formulate a theory of meter as generally experienced by all cultures and people. Nonetheless, adjustments must be made to his proposed upper-tempo limit as it falls well short of the associative upper tempo limits in numerous musical examples (e.g., bebop era). Additionally, London's proposed *metric tree*, a

tempo map of possible meters and their respective subdivisions, needs further extension into NI meters and NI subdivisions of a tactus. Peter Selinsky, whose theoretical efforts in NI jazz meter analysis, while using London's proposed parameters as the foundational premise for his own analytical efforts, has similarly recognized London's need to further explore non-isochronous meter practice. "Despite effectively describing non-isochronous formations as isolated meters, London does not propose any method by which to compare them."[16] Nonetheless, Selinsky, whose thesis similarly revolves around NI meter expressions in jazz, has also recognized the potential to harness London's observations by further abstracting their values into an extended framework which accounts for NI meter formations.

1.3 Perceptual and Cognitive Research

Many of the simplest studies of entrainment involve the ability to synchronize or coordinate our behavioral responses with a metronome. Such tapping studies involve some of the earliest research into attention and synchrony, with studies dating from the late 19th to the early 20th century (e.g., Dunlap 1910; Stevens 1886).[17] The data which has emerged from this body of research show strikingly similar results. Studies which involved simultaneous tapping with a metronome (1:1) reveal that subjects tend to systematically tap in the range of 20-60 ms before the metronome. These studies have shown that our ability to synchronize increases:

1. at moderate tempos when subjects tap both on the click and on the off-beat of the click (Semjen, Schulze, et al., 1992);

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[16] Peter Selinsky, "An Analytical Approach to Non-isochronous Meter: Variable Beat Length in Groove-oriented Jazz" (M.A. thesis, University of Buffalo, State University of New York, 2012): 4.

[17] London, *Hearing in Time*, 12.

2. when subjects divided each metronome click by tapping equal division of the beat in ratios of 1:2, 1:3, or 1:4, and so forth;
3. when subjects were asked to synchronize with extended tones rather than empty metronome clicks (Wohlschlager and Koch, 2000);
4. when presented with a series of intervals rather than a single interval (Schulze, 1978; Drake and Botte, 1993; Hirsh, Monohan, *et al.* 1990);
5. our ability to perceive pattern displacement when sequences of patterns induce metrically organized accents (Jones, Boltz and Kidd, 1982);
6. our ability to hear pitch alterations when presented at metrically prominent accent points (Jones and Ralston, 1991, Dowling, Lung, and Herrbold);
7. our ability to perceive temporal displacement within IOIs when presented within salient tempo ranges (Halpen and Darwin, 1982).

The process of projecting metric order, commonly known as *subjective rhythmization* (Bolton 1894; Meuman 1894), was first observed in studies in which a series of identically successive clicks were abstracted by accenting certain notes, thus research participants tended to project a sense of temporal organization. London, alternatively suggests the term *subjective metricization*, as it more aptly describes a subjective process in which the listener differentiates non-ordered stimuli into twos, threes, or fours, as a means of asserting a sense of order. In 1787, Heinrich Koch described how composers might organize accents, noting that a series of six successive beats can be grouped in either twos or threes. Musical passages which lend themselves equally to either binary or ternary realizations (i.e., which can be interpreted as bars of either 3/4 or as bars of 6/8) strongly effect the harmonic implications as each meter highlights distinct

melodic regions within their own structural and accentual framework. These particular metric contexts, what London calls *metrically malleable*, or *metrically neutral* passages, have long been exploited by composers who understand our proclivity towards maintaining an insistent meter even in the wake of an uncooperative and conflicting surface (i.e., metrically ambiguous rhythms). While syncopation may openly conflict with an established metric framework, we are assured that listeners will hold hard and fast by hearing the syncopation merely as an uncooperative surface event which is made all the more tractable through its relegation to meter. As early as 1636, Charles Butler similarly acknowledged how specific melodic passages were capable of diverse interpretations, based on either groups of twos or threes, and that these differing interpretations are strongly bound by the time signature established at the piece's onset. A passages metrical interpretation depends entirely on the metric cues of precedent passages. Thus, the assertion of a given meter allows us to experience the tension and release of passages which either openly conflict or cooperate with the established metric context.

The fundamental distinction between meter (a listener's pattern of entrainment) and surface rhythms/ patterns, is that meter functions as a perceptual ground for rhythmic gestures. Accordingly, figure-ground relationships require a listener to maintain a metric templates even in the wake of contradictory surface behaviors. Nonetheless, meter itself must be tractable. Periodicities may simply be too fast or too slow.

To assert the upper and lower limits of periodicities, London averages the results of a number of studies which include: the 130 ms lower limit of Efron's sensory research (1973), the 120 ms lower limit of Lehiste's (1970) vocal articulation study, the 100 ms shelf of Roderer's (1995) study of cortical processing, the 100 ms shelf of Hirsh, Monohan, *et al.* study of interval changes between two successive tone onsets, the 100 ms shelf of Friberg and Sundström's (2002)

study of the short note in jazz ride patterns, the 1580 ms upper limit and 115 ms lower limit shelves of Bolton's (1894) synchronization studies, the 1800 ms shelf of Fraisse's (1982) synchronization study, the 2000 ms shelf in Monohan's (1993) synchronization studies, the 2000 ms shelf of Woodrow's (1932) sensory memory studies, the 2000 ms shelf of Brower's (1993) sensory memory studies, and the 2400 ms shelf of Mates, Mueller's, *et al.* (1993) synchronization study.

Many of these perceptual and cognitive studies utilize non-musical or quasi-musical stimuli, particularly troublesome in light of research which has shown that thresholds are intrinsically dependent on the interactive relationship between rhythm and pitch. London proposes that the shortest interval that we can hear or perform exists around 100 milliseconds (ms), while the upper limits of meter exist around 5 to 6 seconds. IOIs that exist beyond these thresholds cannot be processed into stable patterns.

Repp, London, *et al.* (2004), found that participants who were subjected to increasingly complex rhythms required the fastest subdivision to be considerably slower, around 170 ms. Similarly, Pressing (1998) found that participants which were asked to tap between the beats (known as “antiphase tapping”) required as much as 375 ms. Thus, asserting an upper limit for meter depends partly on the metric context in that different patterns establish either more or less complexity which in turn affects levels of entrainment. Woodrow (1932) found that 1.5-2 seconds represented the upper limit of our capacity to reproduce empty intervals and that our ability to synchronize to rhythm (which Woodrow equated with the poetic foot) became virtually impossible with durational values around 3.4 seconds. The studies of Pöppel (1972), Michon (1978), and Fraisse (1984), all assert attentional capacities with upper limits of 5-7 seconds. London asserts that if two seconds exists as the upper limit for hearing successive events, than 4

to 6 seconds represents a reasonable framework for the absolute value of meter as such values represent two or three times the value of successive beats (duple or ternary meters).

London further examines the notion that within the range of perceivable patterns exists a series of distinct and important sub-ranges. The studies of Jones (1992), and Collyer and Church (1998), found that within distinct tempos their exists differing correspondent strategies of attending such that one may effectively further divide the temporal span into a series of important sub-regions (i.e., maximally salient regions). Similarly, Repp (1995) observes that participants found it difficult to recognize identical rhythmic patterns when tempos were radically altered. Meyer and Palmer's recent study (2001), which asked performers to direct their attention to various metrical levels (i.e., eights, then quarters, and finally half notes), found systematically slower performances when performers were asked to focus on the half note pulse (rather than the quarter note). A focus on the eighth note level created discernibly faster performances. London views such studies as indicative of our tendency to establish counting rates closest to the middle of perceived durational values. Accordingly, London puts forth that counting strategies tend to shift to incorporate rates which closely align to maximally salient regions. Indeed, while studies suggest a perceivable range from 100 ms to 5 to 6 seconds, we are incapable of perceiving the entirety of this range equally as our performance of rhythmic figures and gestures reconfigure to align to these perceptual and kinematic differences.

London draws our attention to another important temporal shelf, namely, durational values in and around 250 ms. Utilizing the studies of Michon (1964), Massaro (1970), Crowder (1993), Large (2000), and Fraisse (1982), London establishes the importance of differing types of durations as qualitatively distinct within differing attentional frameworks. Thus, the beat (or tactus) in a range of 200-250 ms corresponds with studies which show that the fastest IOIs occur

in the range of 100 ms, roughly half the periodicity of our tactus. London establishes that this special relationship between the fastest initial-onset-interval and the tactus means that the fastest tactus in simple subdivision is at least 200 ms or greater, while a tactus in compound subdivision requires 300 ms or greater. This may simply be the result of the 100 ms threshold which as a fundamental psycho-physical limit is of inherently greater importance than any other proposed thresholds or limits. Besides the differences in motional character between two-beat subdivisions and three-beat subdivisions, it is important to establish that compound subdivisions infer uneven subdivisions in which the long unit comprises two thirds of the durational value while the shorter unit comprises one third.

The vast array of world music traditions which create an idiomatic swing or lilt requires that one note be shorter than the other. Thus, with a tactus of 200 ms, the shorter note durations fall below the fundamental threshold of 100 ms which London suggests as a possible explanation for why the fastest tactus beats tend to be longer than 200 ms, and why notes faster than 100 ms are heard as sub-metrical and are often contextualized in performances and hearing as grace-notes. For London, the 250 ms threshold establishes the qualitative aspects of a beat which may experience the complex potential for enriching the metric context by further expressing subtle proportional changes (i.e., a lilt). In table 2.1, London demonstrates the absolute timing constraints on beats and subdivisions in the range of 200 to 750 ms, namely as a means of differentiating the constraints specific to binary and ternary forms. Thus, by considering 250 ms as an absolute threshold, London shows how timing constraints effect differing meters.

Table 1.1 Absolute Timing Constraints on Beats:

Beat or tactus rate	Simple SD	Compound SD
< 200 ms	none	none
200-300 ms	100-150 ms	none
300-500 ms	< 250 ms	< 250 ms
500-750 ms	> 250 ms	< 250 ms
750 + ms	> 250 ms	> 250 ms

In the range of 300–500 ms neither simple or compound subdivisions (given the 100 ms limit) are capable of further subdivision while compound meters remain inaccessible in ranges of 500-750 ms. "This means that in the range of maximal pulse salience of 500–750 ms there is a potential difference in hierarchic depth between units of simple versus compound subdivision, as triplets are made of units less than 250 ms, while duplets are made of units longer than 250 ms, and hence could be further subdivided."[18] This may also partly explain the subjective differences between simple and compound subdivisions and the effect they have on our perception of tempo or motional qualities among passages with the same IOIs.

1.4 The Primacy of the Tactus

In any music-theoretic discussion of meter it is imperative to discuss the primacy of the tactus, as meter is fundamentally grounded in the perception and production of a pulse or beat. The tactus represents the structural level of meter which most often provokes listeners to tap their foot in time. Accordingly, listening can be experienced as an embodiment of motional trajectories. In certain musical textures which involve a number of beat lengths, it may be possible for

[18] Ibid., 38.

listeners to construe differing periodicities as a tactus, especially given the wide range of tempos in which any given tactus may be perceived (200-2000 ms). Logically, a tactus works in tandem with at least one other organizational level of periodicities, what London views as the seamless integration of multiple periodicities into a coherent attentional framework.

Music-theoretical discussions of the tactus go back at least to the late-fifteenth century, when the notion of a fundamental periodicity (i.e., tactus) was thought to correspond either to the rate of a resting pulse (Ramos de Pareia 1482), rate of normal breathing patterns (Gaffurius 1496), or the rate of a walking stride (Buchner 1520). Koch (1787) recognized the importance of establishing a periodicity in the middle (i.e., a referential periodicity between the fastest and slowest beat levels) of a metric hierarchy, what he viewed as a coherent premise for ensuing divisional strategies. London acknowledges that meter must contain at least two fundamental periodicities, adding that three or more periodicities provide a stronger referential framework in which to track fast, moderate, and slow event onsets. This referential framework corresponds to various possible subdivisions of the tactus, the tactus level itself, and the higher-level ordering of beats into measures. Within the course of a musical piece or passage, sub-tactus periodicities may experience great diversity. Sub-tactus periodicities may be intermittent or entirely absent with the potential to shift between simple and compound realizations. Large and Jones (1999), proposed an attentional dynamic in which active temporal anticipations of the periodicities associated with external rhythms increase and evolve proportionate to the listener's evolving sense of the beat. As the listener internalizes the 'time' their temporal focus increases, thus resulting in a corresponding depth of expectancy. London views sub-tactus diversity in terms of the presence or absence of additional levels of entrainment. His metrical hierarchy, as enriched by multiple subdivisional levels, is an abolishment of *hyper-meter*, a term first used by Cone (1968) to refer to metric

structures that existed beyond the notated measure i.e., Cone's hyper-meters represents the same aforementioned subdivisional layers or levels, and one which London critically views as a natural delineation of meter, not something extraordinary.[19]

London proposes that the perceivable range of a tactus is from about 200 ms to 2000 ms (30 bpm to 300 bpm). Similarly, Warren (1983) shows that subjects accurately recognize the successive note onsets of melodic patterns in a range from 200 to 2000 ms. Studies which examine when listeners shift from either tapping on every beat to every other beat (fast tempos) , or when listeners interpolated taps at slower tempos, reveal a salient range of maximal pulse perception in and around 600 ms (100 bpm). Wundt (1911) found that subjects tend to overestimate the duration of intervals less than 600 ms, whereas intervals over 600 ms tended to elicit an underestimation of its value. Semjen, Vorberg, and Schulze's research (1998) asked subjects to spontaneously tap to a comfortable or natural pace, showed preferential rates in the range of 428.8 ms to 725 ms, with a mean average around 565.3 ms. Interestingly, Drake, Jones, and Baruch (2000) found a faster average (400 ms) spontaneous tempo (i.e., study participants were asked to choose a tempo in the absence of musical stimuli) for children four to six years old, perhaps suggesting that metabolism or physiology effects the perception of time. While the tactus is strongly connected to our sense of tempo, it nonetheless exists inherently as an interconnected manifestation within multi-nested metric hierarchies.

One of the issues which should be addressed in any discussion of meter is the nature and origin of accent. Lerdahl and Jackendoff (1983) define three types of accent: *phenomenal accents*, which give emphasis to a moment through the use of devises such as sforzandi, sudden changes of dynamics or timbre, as well as dramatic intervallic leaps; *structural accents*, that emphasize

[19] Ibid., 19.

melodic and/or harmonic points of gravity within phrases, passages, or sections; and *metrical accents*, which arise when a particular beat within a metrical context is given greater emphasis. Phenomenal accents and structural accents are also capable of existing in non-metered musics. Lerdahl and Jackendoff further define metrical accent as a structure that "expresses the intuition that the events of a piece are related to a regular alternation of strong and weak beats at a number of hierarchical levels."[20]

Importantly, London's model of metrical accents account for a subjective placement of accents, which though inferred from the musical surface, are not always in sync with the accents postulated analytically, theoretically, or otherwise. Thus, when American music styles of the African diaspora employ the characteristic back-beat accents of two and four, they are idiomatically clarifying meter and are not working in direct opposition to the accents on beats one and three. Accordingly, in certain instances, syncopation may act to enable metric clarity. London's behavioral model flexibly accounts for metrical accent(s) as marked *by* consciousness, rather than the inflexible view put forth by Cooper and Myer (1960), that accents are events that are marked *for* consciousness.

Nonetheless, in a metrical context, London asserts the importance of accent as a means of clarifying a meter's downbeat. In the absence of a clearly delineated downbeat accent we are incapable of perceiving the metrically distinct rotations (see appendix - possible beat cycles in N cycles 4–16) of a given beat cycle (analogous to the rotations of a pitch class i.e., C-D-E-D → D-E-D-C → E-D-C-D → D-C-D-E, or four distinct permutations of S-S-S-L). In addition, the presence of perfectly symmetrical half-measure likely has significant bearing on our ability to perceive a discernable downbeat. We are thus more likely to construe a 12 cycle as 2-2-2-3-3 or

[20] Fred Lerdahl and R.A. Jackendoff, *A Generative Theory of Tonal Music (*Language Arts and Discipline, MIT Press, 1983), 6.

3-3-2-2-2 rather than the more ambiguous 2-2-3-3-2 rotation. This consistency is perhaps most evident in N cycles of 12, a meter associated with the structural depth of the 12-tone ETS. "About all that can be said regarding the preference for certain rotations is that the lack of any clear cases of the 2-3-2-3-2 pattern suggests that in any rotation, the Ls need to be distributed consistently at the beginning (3-2|3-2-2 or 3-2-2|3-2) or the end (2-3|2-2-3 or 2-2-3|2-3) of each half-measure. In the case of the 2-3-2-3-2 pattern, the placement of the Ls is inherently inconsistent (either 2-3|2-3-2 or 2-3-2|3-2), which may make it less preferable as an entrainment pattern."[21]

1.5 The Structure of NI meters

In London's definition of the beat cycles in NI meters he restricts the IOIs to a range of 400-1200 ms. The organization of groups of twos and threes which impart a sense of metric regularity, beyond experiencing the constraints of 100 ms floor and 400 ms ceiling, must constitute a substantial contrast between the long and short beats, thus providing a perceptual sense of regularity. Their durational difference must be significant enough to afford their distinctiveness, but not so great as to give rise to a confusion of levels (i.e., between short and very short periodicities below the beat cycle). Generally, the durational values of long and short (L-S) invoke triplet subdivisions, though Schulze's (1989a) recent research on the recognition of rhythmic patterns showed that subjects tended to focus on motional and gestural qualities over that of beat-based counting strategies.

It is important to distinguish between the non-isochronous beat patterns, the series of

[21] London, *Hearing in Time*, 129-130.

[S]horts and [L]ongs, often delineated as twos or threes, and that of other surface rhythm cycles. Thus, though a cycle of 9-beats may be partitioned into a three-beat sub-cycle comprised of 2, 3, and 4, this can only represent a pattern of surface durations. To best demonstrate the distinctions between surface rhythms and beat cycles London considers the 2-3-4 pattern as analogous to the 8-beat cycle 2-2-4 (two quarter notes followed by a half) in which the interpolation of an ongoing beat level easily rectifies the "missing beat" thus maintaining the premise of an isochronous beat level.

Interestingly, London asserts the possibility of two beat N cycles, accordingly demonstrating the possibilities of utilizing various non-isochronous groupings in various N cycles (e.g., 4+3, 3+5, 5+4, 7+5). All of these two beat cycles require exceedingly fast tempos such that no intervening level of interpolation can be abstracted. Importantly, in contrast to the 3+5, pattern, the 5+7 relationship best approximates the 1:1 beat ratio though at most tempos 5s and 7s will decompose into shorter units. Conversely, London proposes that N cycles comprised of six or seven beats are incapable of existing under the constraints of tempo. Similarly, tempo is also a critical component in certain three beat cycles, as in the case of 4-6-6 and the 5-5-6 (London has yet to locate a single example of a song constructed in this later pattern), both of which require IOIs of the N cycle to be shorter than 150 ms.

Ideally, NI meters employ the principle of maximal evenness. Lerdahl, who has extrapolated well-formed meters from the constraints of maximal even tonal sets (scales) asserts a number of *WFCs* (*Well-formed-constraints*) which London has formulated into the five requirements inherent in non-isochronous meter forms. They are: WFC 1: If the IOIs of an N cycle are non-isochronous, then the IOIs of the beat cycle must be nominally isochronous (i.e., categorically equivalent, though subject to expressive variation); WFC 2: if the IOIs of an N cycle

are non-isochronous, their absolute lengths must be such as to avoid ambiguity and contradiction - (S) must be ½ (L); WFC 3: sequencing of NI elements on the N cycle will remain constant from beat to beat within the cycle, maintaining maximal evenness; WFC 4: if the IOIs of an N cycle are isochronous, then the beat cycle need not be; WFC 5: if the beat cycle is NI, then either (1) it is maximally even or (2) the cycle above the beat cycle, in most cases the half-measure cycle, must be maximally even.

Furthermore, given the motivation of maximal evenness, the 2-3-4 pattern fails the constraints of WFC 5 as the pattern does not fit into even half measures. Thus, maximal evenness creates the most even distributions in 9-cycle meters which contain four-beat cycles (2-2-2-3). Analogous to the category of "interval class" (i.e., minor second, major second, minor third, etc.) in tonal theory, "beat class" similarly constructs a quantitative approach by distinguishing beat by the number of units each subdivision spans. This parallel between beat class and interval class has established a considerable body of theoretical lore which directly draws from the parallel constraints inherent in scale structure.

Rahn's (1991) refinement of Bolzano's theory (1980) of scale coherence (i.e., seconds are smaller than thirds, thirds are smaller than its fourths, and so forth) develops the concept of *difference*, *ambiguity*, and *contradiction* as a means of explaining the features of well-formed scales. In the context of the C major scale Rahn explains his notion of 'difference' as the distinction between the generic size of two class degrees (i.e., both C-E and D-F are thirds) versus the different specific sizes asserted by semitones (i.e., major versus minor thirds). 'Ambiguity' is related to difference. Thus, the distinction between F-B and B-F is that though both share the same specific size (six semitones), they also share contrasting functions as the tritone may be construed as either an augmented fourth or as a diminished fifth. 'Contradiction' is defined as the

severe discrepancy between specific and generic intervals when a interval is larger in terms of its scale degree than in terms of its semitones. If beat intervals are analogous to steps of a diatonic scales we may then assume that meters should not contain ambiguities and contradictions. Accordingly, metric cycle with the specific beat intervals of “2” and “4” give rise to an ambiguity by creating two units which are equal to the shortest beat.

Maximal evenness may also explain how metric cycles may be partitioned into two maximally even half-measures (i.e., N = 13 creates maximally even half-measures comprised of six and seven beat measures). Maximal evenness ensures that differences, ambiguities, and contradictions are avoided. Additionally, maximal evenness establishes perceptual and sensorimotor advantages. Thus, the optimization of periodic motor behavior works in tandem with the periodic rhythmic movements which establish the relatively even and smooth transitions of direction associated with bodily motion.

1.6 NI Beats and the relevance of the 2:3 Ratio

While the three-versus-four relationship may occasionally occur, most musical styles that use NI meters invariably construct their subdivisions with short and long beats composed of twos and threes. Given the practical range of subdivisions between the 100 ms floor and IOIs at about 300-400ms, as the number of subdivisions per beat increase, the beats themselves simply become too long, at which point the listener begins to interpolate intervening levels of beats. Thus, if one wanted to hypothetically compose a meter comprised of long beats of seven to nine subdivisions, even in the absence of musical surface cues (intervening beat levels) the listener's sense of subjective rhythmization will likely elicit an interpolated beat level, especially given the

perceptual range of beat levels. At all but the slowest tempos, pairs of beats beyond a 4:5 ratio are apt to sound like a rubato or expressive variant of isochronous beat pairs.

> And if the tempo is slow enough to make the 4:5 ratio salient, for example where IOIs on the N cycle are ≥ 150 ms, the listener is apt to interpolate an intervening level of metric articulations, creating a 2-2-2-3 or 2-2-3-2 pattern – in other words, decomposing the fours and fives into twos and threes. Conversely, as the tempo increases, the IOIs of the N cycle may go beyond the lower perceptual limit for intervals on the N cycle, rendering the 4:5 ratio meaningless. For example, one could not really speak of a 4:5 relationship in which the absolute values of the beats were 260 ms and 325 ms, because this would require an N cycle with 65 ms IOIs, which is well beneath the 100 ms metric floor.[22]

Similarly, a 4:7 ratio, will likely decompose the group of 7 into 4 + 3, yielding an overall pattern of 4-4-3 or 4-3-4. If the Long and Short beat ratio is comprised of 2:5, the 5 will similarly decompose into 2 + 3. Clearly, the combinatorial and perceptual properties of NI beats tend toward 2:3 or 3:4 ratios. In the case of patterns which contain three specific beat classes, as in the case of 3:4:5 or 4:5:6 relationships, a number of other problems emerge. In all but the fastest tempos the duration of the L of the S-M-L exceeds the absolute limit on beat lengths. London's example shows that if a N cycles' (N = number of beats in a metric cycle) IOI is 200 ms than the 4:5:6 produces three beat values of 800, 1000, and 1200 ms, the longest of which is twice the value for the range of maximal pulse salience creating a tendency towards dividing it into two 600 ms beats (3+3) which redefines the beat classes as 3:4:5. Clearly, establishing meters with three specific beat classes is exceedingly difficult as various constraints inevitably result in a reduction to twos and threes.

[22] Ibid., 108.

> It also seems clear that if one had three specific beat classes, they would tend to fall into 3:4:5 or 4:5:6 relationships in order to avoid ambiguities and contradictions. Moreover, the L of each of these S-M-L sets would need a high degree of rhythmic integrity, marked by the coherence of the rhythmic surface, to prevent it from decomposing to shorter units. And all of this is possible only at relatively rapid tempos, for as the N cycle IOI increases there is a natural tendency for the beat IOI to subdivide, with a concomitant shift of the sense of beat to a lower level. When this happens, each putative long beat class will decompose into two shorter beat classes.[23]

Indeed, NI meters are particularly sensitive to the effects of tempo in the formation of their beat cycles. Accordingly, table 1.2 shows tempo-metrical types for the 2:3 ratio at various tempos. London shows that table 1.2 establishes three primary tempo ranges: in N cycles with IOIs which are less than 150 ms as both L and S beats fall below the 500–700 ms range; in N cycles with IOIs which are between 150 and 250 ms as the Ls fall within the 500–700 ms range; and in N cycle IOIs which are greater than 250 ms as the Ss fall within the 500–800 ms range. These tempo regions exist regardless of the cardinalities (i.e., the number of elements in a set or other grouping, as a property of that grouping) present in N cycles.

[23] Ibid., 110-111.

Table 1.2 NI Meters and Tempo - NI Beat timings at various tempos

N-cycle IOI	Long Beat Interval	Short Beat Interval
100 ms	300 ms	200 ms
125 ms	375 ms	250 ms
150 ms	450 ms	300 ms
175 ms	525 ms	350 ms
200 ms	600 ms	400 ms
225 ms	675 ms	450 ms
250 ms	750 ms	500 ms
275 ms	825 ms	550 ms
300 ms	900 ms	600 ms
350 ms	1050 ms	700 ms
400 ms	1200 ms	800 ms

At the very shortest IOIs (N cycle IOI = 100 ms), Ls and Ss fall on different sides of the 250 ms threshold. As the IOI on the N cycle moves above 125 ms, the L and S beats both move above 250 ms. Thus there is a very narrow range in which the 250 ms threshold might be exploited. However, Repp *et al.* (2005) found that sensorimotor synchronization was difficult if not impossible for NI meters with N cycles faster than 160–180 ms, suggesting that NI meters are subject to more stringent timing constraints than are I meters. Moreover, at such rapid tempos it is likely that a higher level of meter might be heard as the tactus, especially if that level is isochronous, as S + L = 500 ms, and a 300 ms–200 ms L-S might then be heard as a binary subdivision of an expressively varied beat. Conversely, when IOIs on the N cycle are greater than 400 ms, the durations of both L and S beats move beyond the range of range of maximal pulse salience (1200 and 〉 800 ms, respectively). Therefore, NI meters may be more strongly constrained by tempo than I meters.

1.7 Selinsky's Modulatory Networks

One of the primary strategies employed in non-isochronous meter settings revolves around manipulating the proportional components contained in the beat cycles associated with clave oriented archetypes. Peter Selinsky's thesis, *An Analytical Approach to Non-isochronous Meter: Variable Beat Length in Groove Oriented Jazz,* proposes various metric networks which are generated from what he calls *directed meters*, patterns such as the tresillo (3+3+2) which are viewed as a non-isochronous meter form comprised of a metric cycle which contains exactly two beat lengths and at least three beats. All but one of these beats, what Selinsky calls the *normal beat*, are of equal duration. Selinsky proposes that the last beat of the metric cycle is the most naturally effective position for the single non-normative beat (the *special beat*), though, problematically, he does not address this placement in terms of distributional or maximal evenness. The ratio between the beat lengths of 'normal' and 'special' beats restricts relationships in which shorter beats divide evenly into longer beats. While allowable beat length ratios must be between 1:2 or 2:1 they must not contain disparate fractional lengths.

Selinsky's interest is in comparing the different types of directed meters by differentiating the motional qualities as associated with their differing levels of *metric dissonance*; generally defined as the beats of a meter which do not conform to the expectations of listeners who project isochronous beat relationships as a means of mapping non-isochronous beat cycles. The differing levels of metric dissonance are defined by the amount of beats in a directed meter which do not align with isochronous beat projections. Additionally, the proportional distance between non-aligned beats and the projected inter-onset beats further define relative levels of dissonance. When special beats contain the shorter durational beat value the following normal beat precedes

its projected point of arrival, what Selinsky aptly refers to as an *appoggiatura beat* given that appoggiaturas are used to anticipate harmonic arrival. Similarly, special beats that are longer than the durational length of 'normal beats' are called *suspension beats* as they mirror the harmonic relationships asserted in the use of suspensions as a means of delaying arrival points.

Selinsky suggests that the surprise elicited from the fractional distances from projected beat onsets (i.e., a projected isochronous beat) are approximately "the same for an onset 5/8 of the way between projected onsets as for an onset which occurs 7/8 of the way between projected onsets. Conversely, an onset 6/8 of the way between projected onsets elicits significantly less response as one commonly hears such relationships as typical sixteenth-note anticipations of a quarter note; a common anticipatory device.

> Degree of deviation *is* an integer value representing the number of cycles, of a given directed meter, that will occur before the actual beat onsets realign with the onsets of an infinite isochronous projection of the normal beat. Degree of deviation is calculated by taking the duration of the normal beat (in time-span units) and dividing it by the greatest common denominator of the durations of the normal and special beats. If the durations, in time-span units, of the normal and special beats are relatively prime, (i.e. if they share no common factors except 1), the degree of deviation is simply the length of the normal beat in time-span units.[24]

Thus, in the case of the tresillo pattern, a projected isochronous three beat pattern establishes a realignment after three complete cycles (degree of deviation = 3), which constitutes a realignment period of twenty-four beats. By comparison, a directed meter which contains a beat cycle of 2+2+2+3 (thus, a projected isochronous beat pattern in twos) establishes a period of eighteen beats and the completion of two cycles before its third cycle realigns (degree of deviation = 2) with projected IOIs.

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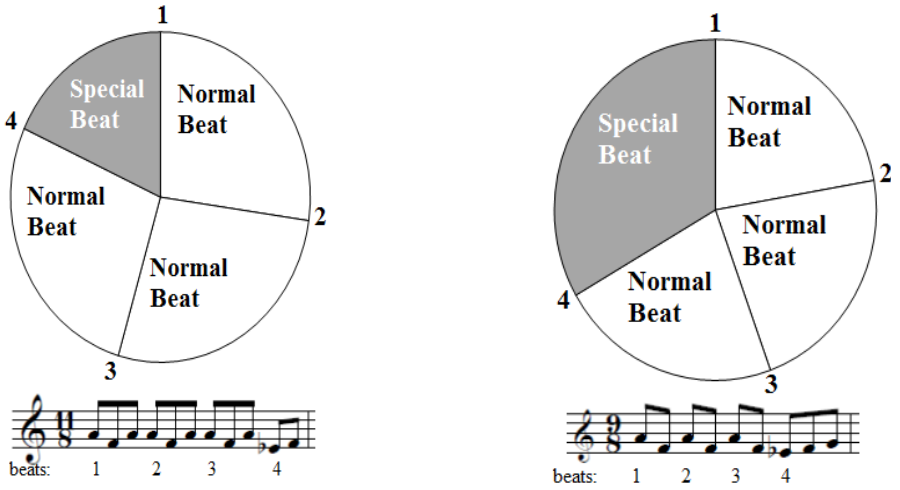
[24] Selinsky, *An Analytical Approach To Non-Isochronous Meter,* 26.

A directed meter in eleven expressed as a three-beat cycle of 4+4+3 shows how certain forms of directed meters contain differing paths of progressional dissonance as each of its four cycles (degree of deviation = 4) has distinctly different proportional distances. In the first cycle, each beat aligns with the projected beat onsets; in the second cycle, each beat arrives one-fourth earlier than the projected beat onsets; in the third cycle, each beat arrives one-half before projected beat onsets; and in the fourth cycle, each beat arrives three-quarters before the projected beat onsets. Selinsky observes that the third cycle of this example is less metrically dissonant than the second cycle. By excluding an analysis of the fourth cycle Selinsky fails to address whether or not the fourth cycle is equal or greater than the dissonant levels of the second cycle.

Selinsky proposes a modulatory process between directed meters which share the same amount of sub-division beats. In Selinsky's example, Brubeck's composition “Blue Rondo a la Turk,” he demonstrates how one might re-contextualize its directed meter (2+2+2+3) into the nearest 4-beat construction that fulfills the defining characteristics of directed meters. Selinsky proposes an eleven beat cycle with a four beat subdivision expressed as 3+3+3+2. This configuration of eleven is the nearest available meter which shares the closest amount of IOI beats within a directed meter of four-beats. The next closest directed meters with four-beat subdivisions are meters in thirteen (3+3+3+4), followed by meters in fourteen (3+3+3+5), meters in fifteen (4+4+4+3), and so forth. Problematically, Selinsky, while suggesting that his research is intrinsically connected to London's proposed temporal shelves, nonetheless, begins to address directed meters with inordinate lengths, thus greatly contradicting his proposed alliance with London's metric model. Selinsky's study of meter examines the potential for organizing chains of directed meters which may be analytically examined in terms of a proposed progressional map of metric tension and release.

Figure 1.2 Selinsky's modulation between meters with four-beat subdivisions



The inherent value of Selinsky's research is a proposed system for numerating the metric dissonance of various directed meters which may be utilized analytically, compositionally, or otherwise as a means of understanding the relevant motional qualities inherent in non-isochronous meters which are organized against an underlying projection of isochronous beats. Selinsky fails to present his findings in a way that fully addresses the most relevant and salient meters. His most important and relatively simple observation is that directed meters which share the same amount of subdivisions are inherent paths in jazz arrangements which seek to utilize differing forms of meter (see figure 1.2). Selinsky's modulatory paths are presented in the following chart which limits the available 'directed' N cycle meters to numbers no greater than nineteen (see table 1.3).

Table 1.3 The closest directed meter with the same amount of subdivisions.

Metric Dissonance Value	Normal Beat Alignment	Degree of Deviation	Beat Subdivision
	7	2	2+2+3
2.33	8	3	3+3+2
	10		3+3+4
	11		4+4+3
4.2	13	5	5+5+3
	17		6+6+5
5.16	19	6	6+6+7
1.5	9	2	2+2+2+3
2.33	11	3	3+3+3+2
	13		3+3+3+4
	15		4+4+4+3
2.75	19	4	4+4+4+4+3

While all the 'metric dissonance values' have not been calculated, it is sufficient to observe that an increase in the size of beat subdivision levels instigates proportionately greater levels of metric dissonance. Selinsky fails to address relative degrees of deviation and metric dissonance values in relationship to projected isochronous beats generated from both subdivision levels (i.e., the normative and special beat level). In so doing, Selinsky fails to acknowledge that subjective rhythmization may elicit differing isochronous beat projections (foot taps). In the case of a 9 cycle set (2+2+2+3), Selinsky's projected two beat pattern, may in certain instances (i.e., the 3+2+2+2) be interpreted as a projected field of isochronous three beat figures, especially in light of the encultured patterns so prevalent in divisive interpretations of nine (3+3+3). What I am suggesting is that the affects of encultured patterns of meter may effect a proclivity toward certain isochronous beat projections over that of others. For example, as in the case of the 7-cycle

(2+2+3), while Selinsky remains transfixed on his notion of isochronous two beat projections, three beat projections tend to illicit different motional quality, yet contain no additional 'degrees of deviation.'

A relatively recent and interesting development in the organization of meters into various beat cycle subdivisions involves the observation that a number of African rhythmic traditions utilize syncopated percussive ostinatos which parallel the structural continuity of the diatonic scale. Thus, CDEFGAB, or TTSTTTS, or 2212221 corresponds to a rhythm of two quarter-notes, one eighth-note, three quarter-notes, and one eighth-note. Similarly, the remaining modes of the major scale contain their correspondent time-line (e.g., 2122212 for Dorian).

> Understood in terms of pitch and time, number-theory proofs have shown how far certain features of this diatonic structure extend into cognate rhythms and micro-tonal, non-12-semitone scales. The most important of these theorems have appeared in the already epochal study of maximally even sets by John Clough and Jack Douthett (1991) and in Clough's recent treatment of diatonic interval cycles (1994). Increasingly, this body of theoretical lore has shown close structural connections within, between, and among the 7-tone/12-pulse rhythms just discussed, as well as diatonically structured rhythms comprising 5 tones among 12 pulses, 5 or 3 among 8, and 9 or 7 among 16.[25]

Concepts of maximal evenness and proportionality correspond to the inherent sense of flow and smoothness that allows such diatonic rhythms to be heard as coherent and unified wholes. Selinsky's approach to beat cycles is restricted to his notion of 'directed meters' which theoretically fails to account for the inherent smoothness of maximally even sets. His unnecessarily complicated solution of linking a series of various directed meter together only acts to further convolute the analysis. His proposed directed meter in thirteen, which he denotes as 2+2+2+2+2+3, lacks the structural potential of what London might conversely propose in the

[25] Rahn, “Turning the Analysis Around,” 77.

maximally even configuration of 2+3+3+2+3. London's point is that by avoiding meters which clump their respective twos and threes together we are less likely to perceive a modulating tactus at the beat cycle level.

Meters in eleven are particularly interesting in that our WFCs limit the number of possible beat cycles to those which involve any rotation of the four-beat set of 3-3-3-2, or the five-beat set of 2-2-2-2-3, both of which also exist in Selinsky's model of directed meters. London suggest a possible link to a 22-cycle meter with a beat cycle of 4-4-4-4-3-3. Meters in eleven, which may have beat cycles which are dominated by twos or threes, suggest an interpretative depth which is structurally unique. In a linear representation of NI meters (from smallest N cycle to larger N cycles) which contain this structural component, no meter with fewer N cycles contains this feature and the next available meters with this structural feature emerges in meters of 17 (any rotation of 3-3-3-3-3-2, or 2-2-2-2-2-2-2-3) and 23 (3-3-3-3-3-3-3-2, or 2 x 10 [+] 3), neither of which are maximally even.

Meters in thirteen, which may be configured as either 2+2+2+2+2+3, or as 3+3+3+2+2, may also be distributed as a maximally even set (2+3+3+2+3). Meters in nineteen also provide maximally even distributions (3+3+3+2+3+3+2) and mimic the structural smoothness of the diatonic rhythms in the 7 tone – 16 pulse set. Indeed, very few non-isochronous meters share the structural components of diatonic sets which are limited in their required use of beat cycles of either three, five, seven, or nine.

The means in which Clough and Douthett assert their diatonic time-line sets is largely premised on a taxonomy of relationships among scales, set, and interval cycles. This taxonomy, is defined by eight structural features (*generated* [G], well-formed [WF], *Myhill's property* [MP], *distributionally even* [DE], maximally even [ME], *deep scales* [DP], diatonic [DT], and *Balzano*

[BZ]) as previously defined by a number of theoretical treatises which examine the structural properties of scales. One of the implicative relationships proposed in the taxonomy is the notion that isomorphic entities (which ensure the existence of inverse mapping between structurally similar groups) exist between the structures inherent in the well-formed scales of our 12-tone ETS (equal tempered system) and those which similarly exist in ETSs of differing cardinalities (micro-tonal systems). While the 17-tone Arabic, 53-tone Chinese, the Javanese and Balinese *pelog* (as embedded in a 9-ETS) and *slendro* scales (as embedded in a 5-ETS), and the equiheptatonic scale as embedded in a 7-ETS have historically been at the center of discourses surrounding ETSs, other micro-tonal systems have also been proposed.

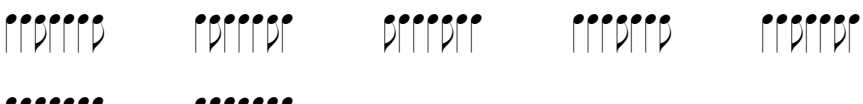
Figure 1.3 The Diatonic Rhythms of Clough and Douthett

3 tones – 8 pulses

5 tones – 8 pulses

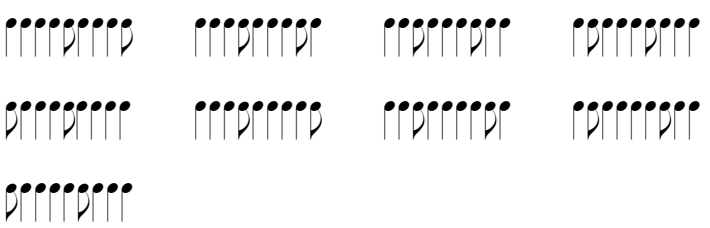
5 tones – 12 pulses

7 tones – 12 pulses



7 tones – 16 pulses

9 tones – 16 pulses



Interest in micro-tonal systems which use either ETSs or 'proportional' systems (in which ratios are preserved) extends back to at least the Renaissance. The 'deep scale' component of the taxonomy centers around Carlton Gamer's research (1967) which determines the most 'desirable temperaments' to be: 12-, 19-, 22-, 31-, 34-, 41-, 53-, and 72-tone ETSs. The majority of theoretical literature has emphasized 12-, 19-, 31- and 53-tone systems but, significantly, Gamer's examination of isomorphic characteristics yields additional ETSs worthy of further examination. He notes that DP's in various ETSs employ similar interval structures that yield unique multiplicities as represented by their relative interval vectors. The usual diatonic scales vector [254361] expresses the unique structure of each successive interval class, thus facilitating a hierarchization of the collection in terms of pitch class intersection. These aforementioned scales are all representative of the DP sets that express this ability for maximum hierarchization within a system of transposition. Ultimately, Gamer seeks to expose deep scales in various ETSs, noting that certain deep scales deserve further exploration, in particular the ten-tone set in a 19-tone ETS, and the twelve-tone set in a 22-tone ETS.[26] All such sets are analogous to the usual diatonic set and chromatic heptachord. Each set allows for a hierarchy of pitch intersection in transposition. It is acknowledged that these sets maintain the tonal relationships of the usual diatonic scale when employing the intervallic generator of the 5th.

1.8 Metric Trees - Envelopes and Nodes

London's visual representation of the interaction between tempo and various beat-level IOIs, what he refers to as a *metric tree*, extrapolates broader related periodicities, both at lower

[26] Carlton Gamer, "Some Combinatorial Resources of Equal-tempered Systems," *Journal of Music Theory* 11, no. 1 (Spring 1967): 45.

and higher divisional levels, from a central referential node, the tactus level itself. Problematically, London restricts all relative branches to common practice meters, an issue I rectify by including a linear presentation of all non-isochronous periodicities possible with 100ms floors and 6 second ceilings. Importantly, at certain tempos more than one node may be perceived as a tactus. Nodes below the beat level (the subordinate level) represent all possible duple and tuplet divisions of a tactus (represented as a quarter note - a value that exists in the middle of the range of durational orthography, which may in part explain its predominance in contemporary compositional practice) while nodes above the beat level represent measures.

The most obvious condition of tempo is that slower speeds provide a greater variety of subdivisional levels while offering a limited amount of metric layers above the beat level. Conversely, faster tempos provide multiple meters, above the beat level, but considerably fewer subordinate subdivisions. London restricts the amount nodes by preserving the 6 second and 100 ms shelves. While the table (see appendix 1) preserves the six second upper limit some flexibility has been maintained by providing the next subdivisional level below 100 ms, primarily in response to the overwhelming evidence of such tempos, particularly as found in the repertory of tempos utilized in jazz from the mid 1940s and on.

Another distinct advantage to including non-isochronous beat lengths through a linear presentation of increasingly faster tempos is that it clearly delineates the sort of periodicities which exist in preferential rates of 500-750 ms. Thus, the most salient groupings are likely to provide the most efficient modulatory paths (both perceptually and performatively) and may have far reaching implications in the service of theories which revolve around notions of metric modulation (e.g., Benadon's tempo networks). The implication, as London suggests, is that we struggle to resonate to tempos which are wholly absent of metric periodicities in the range of 500-

750 ms. In table 2.4 London shows that periodicities in the 500-700 ms range are entirely absent in both duple and triple based meters when the tactus falls approximately within the 333-500 ms or the 700-1000 ms range. More importantly, when periodicities in the preferred range of 500-750 ms are present they tend to occur either on the level of the tactus itself, or on the level of measure.

Countless sources have suggested various explanations for a general bias toward duple based meters over that of triple based meters (and triplet subdivisions, though to a lesser extent). Such explanations include possibilities such as our general preference for symmetry, or the influence of bipedalism and the binary period of walking. In contrast, London argues that systemic relationships among metric levels suggest that such a bias is simply due to the fact that fewer ternary options lie within the range of maximal pulse saliency. One should acknowledge that periodicities which exist at the outer limits of proposed thresholds (i.e., 100 ms to 6 seconds), while possible, may nonetheless require an attentional effort which in certain instances may be hard to sustain.

These important periodicities or periodic ranges establish the perceptual and cognitive framework for hearing a rapid series of twelve or sixteen pulses not as independent articulations, but rather as groups or meta-groups. London's point is that in hearing twelve as a pair of sextuplets or sixteen as four quadruplets, we are creating a hierarchically integrated cycle which involves not simply the organization of a stream of pulses into twos and threes, but rather as cycles which involve multiple levels of structure.

Table 1.4 Periodicities from 500 to 700 ms across the usable range of tempos:

Duration of Triple Measure	Duration of Duple Measure	Beat Rate	Duration of Binary SD	Duration of Ternary SD
6000	4000	2000	1000	**667**
5400	3600	1800	900	**600**
4500	3000	1500	750	**500**
3600	2400	1200	**600**	400
3000	2000	1000	**500**	333
2500	1600	832	416	277
2250	1500	750	375	250
2100	1400	**700**	350	233
2000	1300	**650**	325	216
1800	1200	**600**	300	200
1650	1100	**555**	278	185
1500	1000	**500**	250	167
1250	860	430	215	143
1130	750	375	188	125
1000 – 60 bpm	**660**	333	167	111
900 – 67 bpm	**600**	300 – 200 bpm	150	100
750 – 80 bpm	**500**	250	125	—
600 – 100 bpm	400	200	100	—

Table 1.5 Possible hierarchic configurations as tempo changes

Duration of the central node in BPM and (ms)	# of nodes within the metric envelope	Measure nodes × Subdivision nodes,–1	Periodicities in the 600–700 ms range?
40 (1500 ms)	12	3 × 10−1 = 29	N
50 (1200 ms)	13	4 × 10−1 = 39	Y
60 (1000 ms)	11	4 × 8−1 = 31	N
72 (833 ms)	11	6 × 6−1 = 35	N
80 (750 ms)	11	6 × 6−1 = 35	N
86 (700 ms)	11	6 × 6−1 = 35	Y
92 (650 ms)	10	5 × 6−1 = 29	Y
100 (600 ms)	12	7 × 6−1 = 41	Y
108 (555 ms)	11	8 × 4−1 = 31	N
120 (500 ms)	11	8 × 4−1 = 31	N
140 (428 ms)	13	10 × 4−1 = 39	N
160 (375 ms)	13	10 × 4−1 = 39	N
180 (333 ms)	12	10 × 3−1 = 29	Y
200 (300 ms)	12	10 × 3−1 = 29	Y

Table 1.5 presents the results of London's 'metric tree' at tempos from 40-200 bpm. His suggestion that there is no linear continuity in the representative of the amount of nodes in relationship to tempo is largely due to the fact that various beat cycles may be viewed as two distinct nodes (i.e., either as12/8 or 6/4) such that the tempos which potentially contain such meters represent distinct rotations rather than N cycles alone. Conversely, the table (appendix 1) of the representative meters at given bpm tempos presents N cycles alone, thus presenting a linear transition between the amount of nodes (i.e., a central or connecting point between intersecting rhythms) at any given tempo.

1.9 Benadon's Tempo Networks

Fernando Benadon utilizes London's metric parameters to great avail in his development of a *conceptual tempo* network which "provides an abstract durational grid over which different emergent tempos may be manifestated."[27] Importantly, Benadon extends London's 100ms threshold in his consideration of quintuplet subdivisions. In traditional definitions of metric modulation, the new subdivisional speed, which is equivalent to a subdivisional speed of the 'old' tempo, cannot be perceptually processed without representative accents that actualize the new intended tempo. Thus, to discern either an acceleration or de-acceleration of a new tempo rate, the musical surface must utilize a subdivisional change delineated through accent or through rhythmic groupings unique to the new tempo. Though new tempos do not facilitate changes in the potential complexity of rhythmic polyphony, they do potentially facilitate new durational periodicities which influences our perception of the tactus, meter, and motional qualities associated with specific rhythmic gestures. Importantly, if one considers the limits of tempo and subdivisional periodicities, such modulations accord us access to different subdivision rates. Benadon's notion is that performers might utilize tempo (metric modulation) in the service of simplifying the interpretation of complex polyrhythms.

Benadon proposes a modulatory system, what he calls a *tempo network,* which is comprised of a primary *tonic tempo* and a network of fractionally related tempos. While shared durational periodicities are used as a link between tempos, Benadon acknowledges that only a small number of durational links are perceptually viable (for example, to equate a dotted eighth

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[27] Fernando Benadon, "*Towards a Theory of Tempo Modulation*" (Proceedings of the 8th International Conference on Music Perception and Cognition, August, 2004): 564, http://www.ludions.com/aru/electr/resources/Benadon2004.pdf.

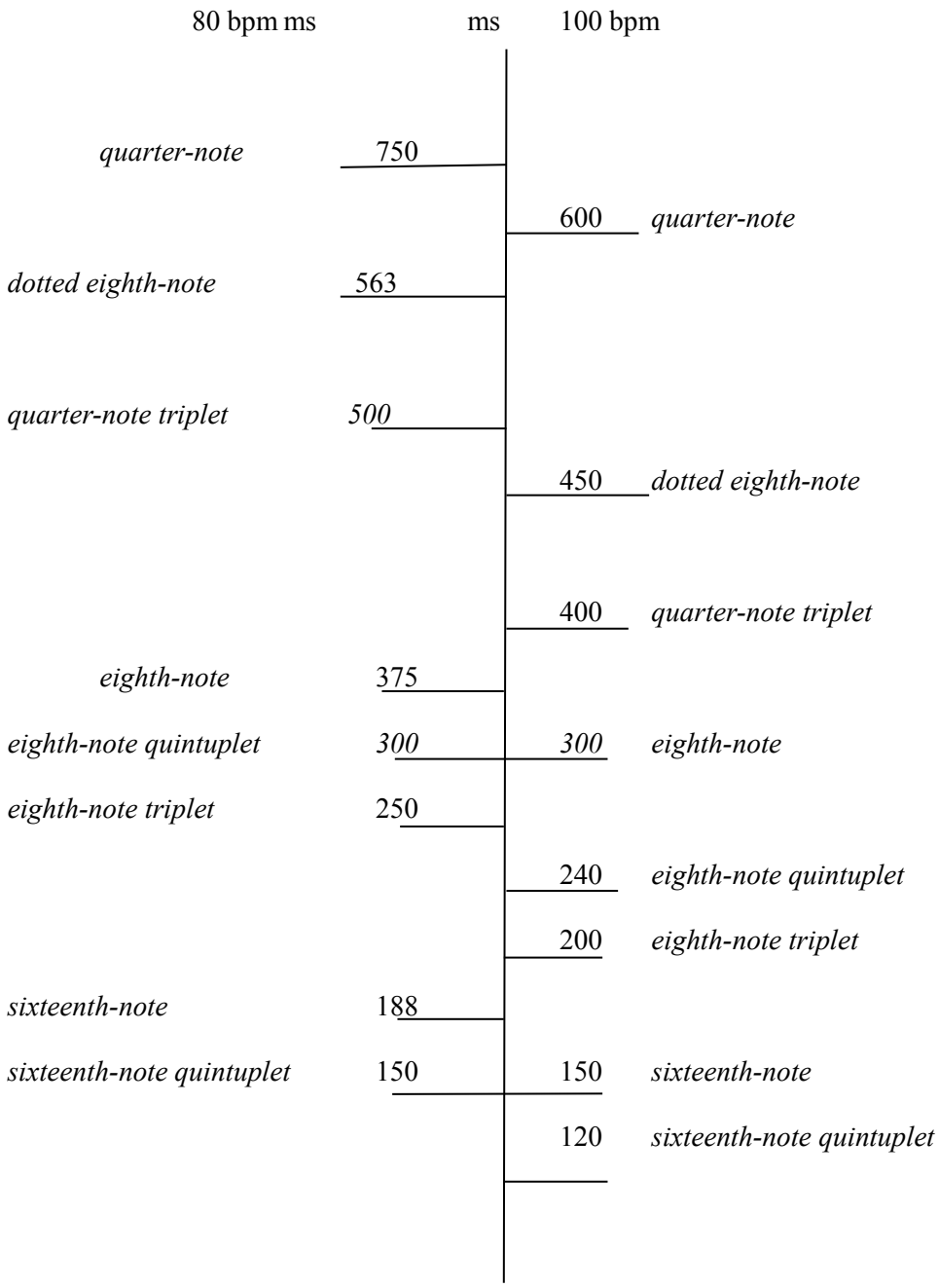
note quintuplet with a sixty-fourth note - while conceivable - is far too complicated). Brandon's solution is to construct a network which limits the number of ratios. Thus, by multiplying a tonic tempo of 80 bpm by a ratio containing either 3, 4, or 5 in the numerator or denominator we produce a network of six additionally related tempos (3/5=48, 3/4=60, 4/5=64, [80], 5/4=100, 4/3=106.67, 5/3=133.33).

Importantly, Benadon caps the modulatory field of durational periodicities to fractions which contain numbers no greater than five. One might easily extend Benadon's durational tempo links to include the next non-isochronous fractions (i.e., septuple), thus increasing the amount of available tempos in a network. From a performative standpoint the newly implied tactus requires one to generate a 'new' tactus through various grouping strategies. These include: three of five eighth-note quintuplets (48 bpm), three sixteenths notes (60 bpm), four of five eighth-note quintuplets (64 bpm), five sixteenth notes (100 bpm), four eighth-note triplets (106.67 bpm), and five eighth-note triplets (133.33 bpm). Benadon fails to address the overall saliency of the IOI groupings employed in his various modulatory paths. In figure 1.4, Benadon demonstrates the 300 ms durational link between a 'tonic tempo' of 80 bpm and a related tempo of 100 bpm, asserting that his choice of modulating through the 300 ms door (versus the available option of a 150 ms window) is based in performative and perceptual viability. Nonetheless, he fails to address the importance of durational tempo links with periodicities in and around 500-750 ms. Table 1.6 expands Benadon's model by adding metric modulations which include septuple based groupings. Additionally, it serves to reveal a number of important observations regarding modulatory practice. Firstly, the division of the tactus (given our 100ms floor) establishes a relatively small window of tempos in which quintuple and septuple divisions become available. Additionally, given the increased divisional complexity and/or level of performative experience in

non-isochronous divisions of a tactus we might full well expect to increase the milli-second floor to accommodate the accordant level of performative complexity. Nonetheless, with a 100 ms floor quintuple divisions first emerge around 120 bpm (500 ms) while septuple divisions first emerge at tempos around 80 bpm and slower. Secondly, it reveals that tempos that exploit the 500-750 ms range first emerge around 80 bpm and that this important tempo shelf relates to all non-isochronous fractions.

Grouping strategies which employ IOIs above the tactus level are examined in table 1.7. Accordingly, while the fractions in divisions of a tactus position the larger numbers in the denominator, divisions above a tactus invert this placement (thus, 3/7 becomes 7/3). Presumably, the execution of non-isochronous groupings above the tactus level are exceedingly more difficult as they require an additional fractional level of entrainment. Thus, performers are expected to firstly establish five or seven against two before engaging in the exceedingly more complicated task of subdividing into groupings of twos, threes, or fours. Table 1.7 examines durational periodicities greater than beat rates. While, 4/5 constitutes a 'new' tactus as generated by grouping four of five eight-note quintuplets, 5/4 generates a new slower tactus by grouping five sixteenth-notes. Accordingly, the remaining representative fractions are: 7/4 which groups seven sixteenth-notes, 4/3 which groups four eighth-note triplets, 5/3 which groups five eighth-note triplets, 7/3 which groups seven eighth-note triplets, and 7/5 which groups seven eighth-note quintuplets.

Figure 1.4 A 5:4 modulation (80 bpm to 100 bpm) – New emergent periodicities



Importantly, the absolute timing constraints in simple and compound sub-divisions (see table 1.1) severely restrict the available tempos in which metric modulations may take place. The triplet based fractions (4/3, 5/3, and 7/3) hypothetically exist from 200 bpm to 40 bpm, though the performative complexity increases as we move further from the exceedingly more challenging triplet divisions near our 100 ms floor.

Similarly, sixteenth-note based fractions require a tactus comprised of at least 400 ms and accordant modulations emerge from approximately 140 to 40 bpm, while quintuplet based modulations emerge (rates of 500 ms or slower) from 120 to 40 bpm. Modulations which utilize the maximal range of pulse saliency (500-700 ms) further decrease the viable range of pertinent tempos. Thus, eighth-note triplet based modulations are more performatively viable from approximately 80 to 120 bpm, a unique tempo region in that a number of triplet based modulations in the 500-750 ms range establish new beats which also exist in this range.

In sixteenth-note based modulations the 100 ms floor necessitates an original tactus of at least 400 ms (approx. 140-40 bpm). Again, maximal pulse rates from 500 to 700 ms suggest a more performatively viable tempo range of approximately 60 to 120 bpm. Quintuplet modulations require a tactus of at least 500 ms, though the increased level of complexity may again require a lower tempo limit, significantly greater than the proposed 100 ms floor. With a 100 ms floor quintuplets first emerge at 120 bpm (500 ms), though more salient regions exist from approximately 90 to 50 bpm.

Table 1.6 Divisions of a tactus with non-isochronous fractions with 3, 4, 5, and 7:

Beat rate	3/7	4/7	3/5	5/7	3/4	4/5
300 bpm 200 ms	698 bpm 86 ms	526 bpm 114 ms	500 bpm 120 ms	420 bpm 143 ms	400 bpm 150 ms	375 bpm 160 ms
280 bpm 214 ms	652 bpm 92 ms	491 bpm 122 ms	469 bpm 128 ms	392 bpm 153 ms	373 bpm 161 ms	351 bpm 171 ms
260 bpm 231 ms	606 bpm 99 ms	455 bpm 132 ms	432 bpm 139 ms	364 bpm 165 ms	347 bpm 173 ms	324 bpm 185 ms
240 bpm 250 ms	561 bpm 107 ms	420 bpm 143 ms	400 bpm 150 ms	335 bpm 179 ms	319 bpm 188 ms	300 bpm 200 ms
220 bpm 273 ms	513 bpm 117 ms	385 bpm 156 ms	366 bpm 164 ms	308 bpm 195 ms	293 bpm 205 ms	275 bpm 218 ms
200 bpm 300 ms	465 bpm 129 ms	351 bpm 171 ms	333 bpm 180 ms	280 bpm 214 ms	267 bpm 225 ms	250 bpm 240 ms
180 bpm 333 ms	420 bpm 143 ms	316 bpm 190 ms	300 bpm 200 ms	252 bpm 238 ms	240 bpm 250 ms	226 bpm 266 ms
160 bpm 375 ms	373 bpm 161 ms	280 bpm 214 ms	267 bpm 225 ms	224 bpm 268 ms	214 bpm 281 ms	200 bpm 300 ms
140 bpm 429 ms	326 bpm 184 ms	245 bpm 245 ms	234 bpm 257 ms	196 bpm 306 ms	186 bpm 322 ms	175 bpm 343 ms
120 bpm 500 ms	280 bpm 214 ms	210 bpm 286 ms	200 bpm 300 ms	168 bpm 357 ms	160 bpm 375 ms	150 bpm 400 ms
100 bpm 600 ms	233 bpm 257 ms	175 bpm 343 ms	167 bpm 360 ms	140 bpm 429 ms	133 bpm 450 ms	125 bpm 480 ms
80 bpm 750 ms	187 bpm 321 ms	140 bpm 429 ms	133 bpm 450 ms	112 bpm 536 ms	107 bpm 563 ms	100 bpm 600 ms
60 bpm 1000 ms	140 bpm 429 ms	105 bpm 571 ms	100 bpm 600 ms	84 bpm 714 ms	80 bpm 750 ms	75 bpm 800 ms
40 bpm 1500 ms	93 bpm 643 ms	70 bpm 857 ms	67 bpm 900 ms	56 bpm 1071 ms	53 bpm 1125 ms	50 bpm 1200 ms

Table 1.7 Non-isochronous divisions above a tactus

Beat rate	7/3	7/4	5/3	7/5	4/3	5/4
300 bpm 200 ms	128 bpm 467 ms	171 bpm 350 ms	180 bpm 333 ms	214 bpm 280 ms	225 bpm 267 ms	240 bpm 250 ms
280 bpm 214 ms	120 bpm 499 ms	160 bpm 376 ms	168 bpm 357 ms	200 bpm 300 ms	211 bpm 285 ms	224 bpm 268 ms
260 bpm 231 ms	111 bpm 539 ms	149 bpm 404 ms	156 bpm 385 ms	186 bpm 323 ms	195 bpm 308 ms	208 bpm 289 ms
240 bpm 250 ms	103 bpm 583 ms	137 bpm 438 ms	144 bpm 417 ms	171 bpm 350 ms	180 bpm 333 ms	192 bpm 313 ms
220 bpm 273 ms	94 bpm 637 ms	126 bpm 478 ms	132 bpm 455 ms	157 bpm 382 ms	165 bpm 364 ms	176 bpm 341 ms
200 bpm 300 ms	86 bpm 700 ms	114 bpm 525 ms	120 bpm 500 ms	143 bpm 420 ms	150 bpm 400 ms	160 bpm 375 ms
180 bpm 333 ms	77 bpm 777 ms	103 bpm 583 ms	108 bpm 555 ms	129 bpm 466 ms	135 bpm 444 ms	144 bpm 416 ms
160 bpm 375 ms	69 bpm 875 ms	91 bpm 656 ms	96 bpm 625 ms	114 bpm 525 ms	120 bpm 500 ms	128 bpm 469 ms
140 bpm 429 ms	60 bpm 1001 ms	80 bpm 751 ms	84 bpm 715 ms	100 bpm 601 ms	105 bpm 572 ms	112 bpm 536 ms
120 bpm 500 ms	51 bpm 1167 ms	69 bpm 875 ms	72 bpm 833 ms	86 bpm 700 ms	90 bpm 667 ms	96 bpm 625 ms
100 bpm 600 ms	43 bpm 1400 ms	57 bpm 1050 ms	60 bpm 1000 ms	71 bpm 840 ms	75 bpm 800 ms	80 bpm 750 ms
80 bpm 750 ms	34 bpm 1750 ms	46 bpm 1313 ms	48 bpm 1250 ms	57 bpm 1050 ms	60 bpm 1000 ms	64 bpm 938 ms
60 bpm 1000 ms	26 bpm 2333 ms	34 bpm 1750 ms	36 bpm 1667 ms	43 bpm 1400 ms	45 bpm 1333 ms	48 bpm 1250 ms
40 bpm 1500 ms	17 bpm 3500 ms	23 bpm 2625 ms	24 bpm 2500 ms	29 bpm 2100 ms	30 bpm 2000 ms	32 bpm 1875 ms

1.10 Hoenig's Tempo Networks

The historical use of metric modulation in jazz is relatively recent. Perhaps the most influential example, Miles Davis' quintet (with the drummer Tony Williams) recording of the Wayne Shorter composition “Footprints,” (1967, *Miles* Smiles, Columbia CS-9401) boldly demonstrates its powerful aesthetic implications. Nonetheless, Louis Armstrong's occasional development of incessant and continuous dotted quarter-note rhythms likely constitutes some of the earliest examples of such practices. In the 1950s and early 60s, Charles Mingus (with drummer Dannie Richmond) explored shifting from an eighth-note based quarter note pulse to quarter-notes with triplet divisions or shifts from quarter note pulses to dotted quarter-note pulses. The drummer and jazz educator John Riley states, that while the drummers Jack DeJohnette and Billy Cobham are credited for continuing to explore the aesthetics of modulatory practices, the actual codification of its language was initiated by Jeff Watts, who is credited for first attempting to accurately account for the specific mathematical components at play. The culminating efforts of Watt's modulatory work, in particular his drumming on the Wynton Marsalis albums *Standard Time Volume One*, and *The Black Codes From the Underground*, demonstrate a clear and articulate use of modulatory principles. Other notable examples from the 1960s include Ed Blackwell's experiments with shifting the background from 4/4, to 6/8, or 12/8. A number of other contemporary drummers, in particular Bill Stewart, have similarly demonstrated an effort to expressively articulate and integrate components of such practices. More recent examples have centered around the explorative work of drummer Ari Hoenig.

Hoenig and the bassist Johannes Weidenmueller view their collaborative work with temporal cycles not as an actual change in tempo, but rather as an *implied* change. Implied metric

modulation incorporates the superimposition of rhythms that impart the illusion of a change in tempo. Importantly, implied metric modulation distinguishes itself from the historical paradigm of modulation as pre-determined arrangements (for example, “Footprints”), thus establishing the ground-rules for the improvisatory use of modulations in standard jazz song forms. Nonetheless, Hoenig's pre-determined arrangement of the thirty-two bar jazz standard “Stella by Starlight” best reveals his temporal process, thus according us the best vantage point in which to articulate his procedural means. Hoenig's arrangement, as heard on the Jean-Michel Pilc Rio album entitled *Welcome Home* (2003) creates the distinct impression of a continuous increase in tempo. The recording starts with a piano intro which is followed by a bass solo on a halftime feel. At this point the listener is led to believe that this halftime feel is the actual tempo itself, primarily the result of Hoenig implying the conventional 4/4 ride tap pattern.

This halftime feel continues for the first eight bars of the melodic statement at which point a series of eighth-note pulses are grouped in sevens starting on beat one of bar nine. The bass and piano player delineate the first beat of each seven note grouping while continuing to preserve the harmonies originally intended metric placement. The transitions between the various groupings employed are coordinated to seamlessly connect within eight bar phrases, and while non-truncated versions are incapable of symmetrically mapping to eight bar phrases, they may nonetheless be grouped to best approximate (maximal evenness) eight bar lengths. Groups of seven eighth-notes, which start on beat one of the measures in 4/4, require seven repetitions before mapping with a downbeat. Thus, eight repetitions of groupings of seven eighth-notes maximizes the amount of repetitions contained within eight bar groups. In turn, groupings of six eighth-notes begin on the 'and' of beat four in bar eight, which is followed by groups of five eighth-notes which begin on the 'and' of beat one of bar seventeen, which is repeated until the

actual tempo of the piece is finally revealed with its emergence beginning on the 'and' of beat four in bar thirty-two.

Figure 1.5 Conventional 4/4 Tap-Ride Pattern

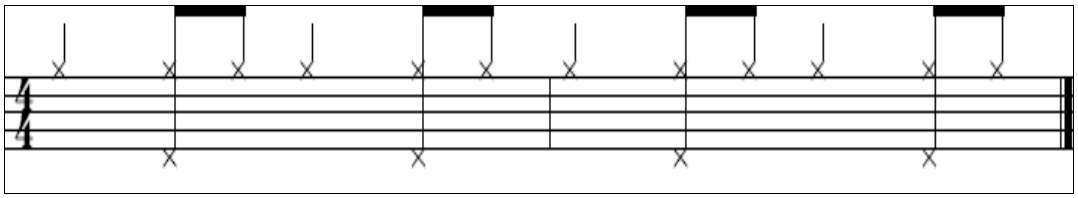
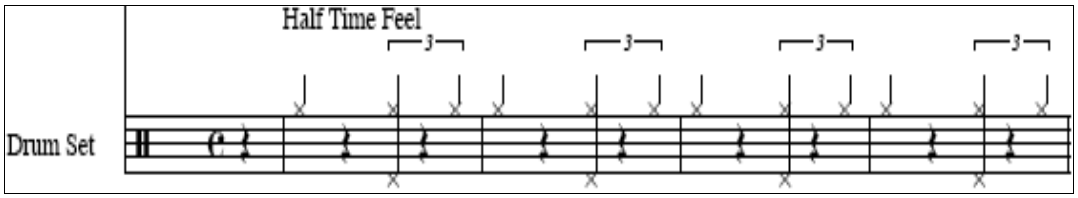


Figure 1.6 Duplicating a conventional 4/4 tap-ride pattern in halftime



The introduction of the actual meter sets up the tempo for conjunct solos. The completion of solos instigates the reintroduction of the melody (head-out) which is subjected to a similar arrangement, albeit in reverse order, thus implying a tempo which is incrementally and continuously slowing down. The 'head out' continues with the tempo established in the precedent solos (a fast 4/4 swing feel), at which point groups of five are initiated on the first beat of bar nine (the second 'A' section). In turn, we are introduced to six note groupings beginning on the 'and' of beat one in the first measure of the bridge (measure seventeen) which is in turn followed by seven note groupings starting on the 'and' of beat two in measure twenty-five (the first bar of the last A section). Importantly, aspects of Hoenig's modulatory process merely requires performers to group at the eighth-note level, a structural level which the majority of jazz improvisers are

intrinsically connected to as eighth-note based rhythms exist at the core of jazz vocabulary.

Figure 1.7 Eight-notes grouped in sevens

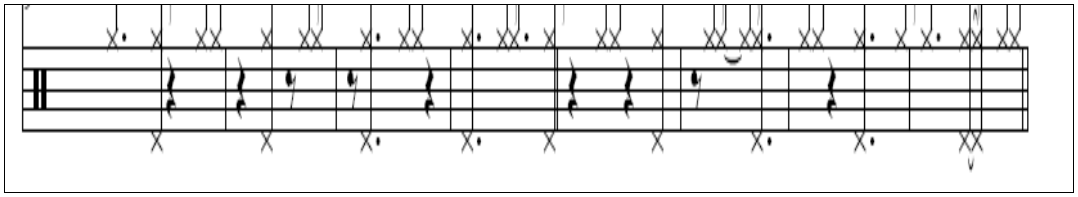
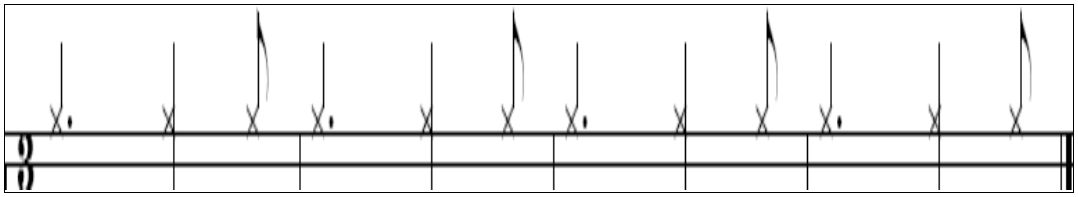


Figure 1.8 Eighth-notes grouped in sixes



Conversely, Elliott Carter's modulatory language mirrors the complexity of Benadon's tempo networks by assimilating a broad palette of tuplet groupings (threes, fives, sevens, etc). Hoenig also utilizes complex rhythmic relationships (for example, five against seven), but in the context of his arrangement of “Stella by Starlight” we are introduced to the notion that tempo changes do not necessitate complex fractional relationships. More importantly, Hoenig's efforts are ultimately contextualized within standard jazz song forms. Subdivisions of eighth-notes, triplets and sixteenth-notes form the premise of constructing varying forms of metric tension and release which correspond directly to the inherent structural tendencies among standard jazz song forms. Hoenig and Weidenmueller describe form in the following way:

> There are a few reasons why we think it is more beneficial to apply these exercises over a form rather than just over a particular pulse. First of all, one of the purposes of superimposing one groove or time feel over another is to create tension. Rhythmic superimposition creates two sets of pulses competing for your attention and therefore two sets of competing musical expectations. A form – any

> cyclical set of bars, with or without harmonic movement – provides an opportunity to raise the intensity of your expectations for resolution. Without a form over which to apply the new groove, you won't achieve the same amount of tension nor the effect of any subsequent release. Second of all, in order for musicians to communicate with one another, we must have some kind of framework or road map as a basis of communication. A form can be that framework.[28]

Riley's view is that the focus up through the 1960s was primarily based in harmony and that the harmonic developments associated with Coltrane's "Giant Steps" and various Wayne Shorter compositions left many musicians to believe that the harmonic aspects of jazz had been fully exploited. In response, compositional efforts turned towards rhythm, and while drummers such as Hoenig are leading the way, a number of other composers have become fully engaged and have articulated and fueled what has become a full-blown movement. In Jerad Lipi's interview, Riley states, "I see this trend of non-drummers having a curiosity about the different emotions and feelings you portray by exploring different rhythms and this has stimulated a lot of drummers.....to develop a comfort level within that realm."[29]

1.11 Summary

Most recently, London's research into West-African drumming has challenged important assumptions regarding his initially proposed threshold values. "Evidently, therefore, the weak point of metric theory today, given its recent upgrade with theories of aural perception and cognition, is the limited empirical base on which it rests. Consequently then, the major, and the

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[28] Ari Hoenig and Johannes Weidenmueller, *Metric Modulations: Contracting and Expanding Time Within Form, Vol. 2* (Mel Bay Publications, 2012), 5.

[29] Jared Lippi, "Time Travels – Modern Rhythm Section Techniques As Employed By Ari Hoenig" (M.M. thesis, Suny Purchase College, 2008): 110, http://arihoenig.com/wpcontent/uploads/jerad_lippi_thesis.pdf.

scientifically most promising task, is to pick up the most integrative approaches, such as London's, and to apply, modify, and further elaborate them from both culture/style-specific as well as cross-culturally comparative perspectives."[30]

Hans Neuhoff suggests increasing the explanatory power of London's 'anthropological' theory by engaging a broader range of repertoires i.e., contemporary Western art music (e.g., Stravinsky), computer generated musics, and a broad range of non-Western musics. Here we might recall Tenzer's rejection of contemporary Western art examples, particularly, the twentieth century adoption of compositional procedures which abolished periodic regularities, what Tenzer views as abstractly removed from the temporal relationships inherent in world music practices and accordingly must be viewed as an exception which only has resounding significance to the culture that produced it. Both Selinsky and Neuhoff acknowledge the need for metric theory to further investigate non-isochronous forms as a means of stimulating (provoking) and modifying London's proposed terrain.

Most recently, Neuhoff, the director of the *Institute for World Musics and Transcultural Music Studies*, established an international music conference (*Musical Meter in Comparative Perspective*, April, 2013) with a goal of bringing a diverse group of researchers together (London also presented at this conference) to collaboratively modify London's model. This collaborative undertaking largely reflects a new mythologized paradigm in theoretical lore. The fact that an increasing number of important ethnomusicologists and musicologists have embraced this body of literature, reflects the collectively perceived relevance bestowed to London's model. More importantly, this collaborative spirit, while recognizing the importance of broadening the scope of

[30] Hans Neuhoff, "Musical Meter in Comparative Perspective" (International Musicological Conference, Institute for World Music and Transcultural Music Studies, April, 2013): 4, http://www.hfmt-koeln.de/fileadmin/redaktion/downloads/2013_musical_metre_reader.pdf.

representative repertoires, also recognizes that beyond the apparent weaknesses of London's model, remains a theoretically promising foundational basis in which to meaningfully address the scope of meter.

The following examination of various non-Western music traditions engages issues of meter in the collaborative spirit of Neuhoff's recent conference, as it specifically attempts to rectify the limited empirical basis in which a number of London's theories rest. Ethnomusicological studies which specify components of a culture's distribution of non-isochronous beat cycles should act to facilitate a comparatively broader perspective. Countless non-Western music traditions establish distinct relationships between isochronous and non-isochronous meters. Such examples, while largely contextualized within various practices of metric modulation, acknowledges Selinsky and Neuhoff's claims that London's model requires further investigative efforts in the study of both non-isochronous meter forms as well as the relationship among differing meters. A broad overview of the types of non-isochronous meters employed in various non-Western traditions should further contextualize London's proposed meter lengths, not as a value theoretically abstracted from quasi-musical research settings, but more importantly, as an expression of human traditions and communities.

CHAPTER TWO

A COMPARATIVE ANALYSIS OF WORLD MUSIC METER PRACTICES

2.1 NI Meter Strategies in World Music Practices

While a number of studies have engaged in a comparative analysis of world music pitch practices, studies which examine and compare meter practices are virtually non-existent. As pointed out in chapter one, NI jazz meter practices which have specifically utilized world musics as a referential source have historically narrowed the cultural range of their inquiry to one or two cultures at most (primarily Balkan and North Indian musics). Conversely, the following comparison of NI meter traditions embraces a broader inclusionary panorama of world music practices. Importantly, the durational limits proposed by London significantly alter our reading of the variously proposed meters in Indian music scholarship i.e., the durational length of meters (4-6 sec) completely eliminates the extended metric frameworks theoretically proposed in numerous South Asian *anga tala* systems. Conversely, the relatively large collection of NI meters employed in Balkan musics are not theoretically or abstractly conjectured, but instead are the result of a thorough analysis of transcriptions from a considerable collection of historical and contemporary field recordings.

In the third year of my doctoral research I undertook a comprehensive examination which specifically addressed the representative examples of NI meter forms in world music practices.

During this period of research, I attempted to address very simple, yet, fundamental questions regarding NI meter practice, though with complete disregard to London's proposed perceptual thresholds, rather I accounted for all proposed lengths, theoretical or otherwise. In addition to addressing the question of the types of meters (various time signatures) utilized, I address questions regarding the proposed proclivity toward a hierarchical rotational schemata which utilizes dactylic and anapestic expressions within metric groups comprised of twos and threes. Rotational expressions in Balkan meter practice conclusively establishes the prominence of both anapestic and dactylic rotational forms (3+2+2 or 2+2+3, but not 2+3+2).[31]

The four pervasive NI meter traditions of the South Asian tala systems, the Turkish usul, the Arabic wazn, and the *aksak* of the Balkan peninsula all represent traditions that employ a multiplicity of NI meter forms. Conversely, the less prolific and often lesser known traditions rarely utilize more than one form of NI meter, thus lacking the variability associated with the aforementioned traditions. Indeed, the majority of the lesser known traditions, in addition to employing a number of common binary and ternary meters generally utilize a singular NI meter form, primarily, quintuple based meters. Both Spanish and Balkan metric variability may potentially have likely origins in Byzantine or Eastern musical meter traditions, the Balkan regions by way of Turkey, and Spain through the Islamic traditions of North Africa and the Middle East (though flamenco has been formally traced to a number of other migratory influences as well).

Various approaches were used in an attempt to compile a comprehensive survey of NI world music meter practices. Firstly, I attempted to search for representative examples country-by-country as this seemed to be the most systematic approach. Additionally, this approach

[31] Nice Fracile, "The "Aksak" Rhythm, a Distinctive Feature of the Balkan Folklore," *Studia Musicologica Academiae Scientiarum Hungaricae*, T. 44, Fasc. 1/2 (2003): 208.

examined relevant material from both musicological text as well as literature on regional dance forms. Purely instrumental music traditions in NI meter forms are generally rare (though by and large, surveys have tended to focus on dance genres at the expense of instrumental forms) with the vast majority appearing as a musical form which is directly attributable to the accompaniment of specific dance genres.

The most obvious entry point in world music NI meter studies, the South Asian tala systems, the Arabic w*azn*, and Turkish u*sul* traditions, are all considered to be 'classical' traditions, though they tend to co-exist in the murky waters which constitute hard and fast definitions of the term 'folkloric.' Traditional interpretations of genuine folk practice characteristically deem 'oral transmittance' as a critical and central component of any working definition, a 'component' which exists in the aforementioned 'classical' traditions. For example, the *desi* tala system's proto-classical systematization of various regional folkloric rhythms, as well as the adoption and systematization of the meters of folkloric genres in both wazn and usul traditions further underscores the follies of hard and fast definitions.

The notion of a 'regional propensity' as a shared cultural identity within similar geographical areas must subsume the possibility of 'uncharacteristic' anomalies within expressive cultural identity. Nonetheless, 'regional propensity' tends to be the rule rather than the exception. Regardless, one must be careful to avoid the pitfalls of over generalizations. While Africa has a notable absence of complex meter traditions (i.e., other than the prolific practices of North Africa's Al-Andalusian traditions meters in 5, 7, 11, etc. are non-existent), Uganda, given its regional isolation from Al-Andalusian culture, might have easily been overlooked.

Another problem regards origin or provenance, especially in light of the historical transience of geo-political borders. By attempting to associate specific meter traditions within

specific cultures one removes the potential for blanket statements regarding a “country's” meter tradition. The sheer magnitude of Russia's geographical size in conjunction with the existence of some three hundred distinct ethnicities/cultures underscores the danger of associating specific meter traditions with 'country, flag, and nation.' The propaganda of 19th and 20th century nationalist movements may have helped to foster or propagate specific cultural expressions, even in the realm of metric forms. The general consensus before the initial 'discoveries' of the so called 'Bulgarian rhythms' was that the meters of European folk-music traditions were indistinguishable from 'common practice' meters. The discovery of distinct cultural realizations of meter became an ally for nationalist agendas. Identifying culturally distinct traditions and/or characteristics makes a more formidable case for nationalist assertions of regional distinction; the inevitable platform for sovereignty. Examples abound, as in the case of the quintuple meter tradition of the *kalevala* which was propagated by Balto-Finnish nationalist concerns regarding cultural and regional distinction.

2.2 Aksak Meter Practices

The typical blanket term for Balkan meter practice has traditionally been 'Bulgarian Rhythm,' historically associated with Bartok's terminological use in his recognition of a metric tradition which lies most frequently within Bulgaria. A number of scholars have more recently adopted the term *aksak,* (a Turkish word, literally, 'lame') a term which aptly suggests the often proposed Turkish lineage of the rhythms and meters of the Balkan peninsula. The occurrence of these metric forms outside of Bulgaria is considerably less (Bartok had proposed that 5% of the Romanian repertoire consisted of such meters). To what point we can qualify Bartok's proposed

percentage of aksak in Romania is difficult to assess, though Nice Fracile's recent study surveys a more extensive collection of field recordings (encompassing the collections of Vasil Stoin to the present), thus broadening the scope and accuracy of statistical claims.

Bartok first encountered Bulgarian folk music in 1912 with his recording of seven Bulgarian songs. His subsequent transcriptions inaccurately accounted for the additive nature of there meters. Sometime around the late-1920s or early-1930s, Bartok read Vasil Stoin's publication (1927) which examined the Bulgarian musicologist Dobri Hristov's systematic research (1913) into the additive structure of Bulgarian meter; a meter which he defined as equal pulses at three to four-hundred and bpm (the inaccuracy of Hristov's defined bpm range will be addressed at a later point - see section on 'tempos') which are subsequently grouped into twos and threes (though some evidence also points to groupings in four). Theoretically, this creates a vast array of possible meters. In actuality, a finite amount of NI meters are actualized, the most common of which are: 5/16 (2+3), 7/16 (2+2+3 or 3+2+2), 9/16 (2+2+2+3 or 2+3+2+2), and 11/16 (2+2+3+2+2).[32]

In 1886, Anastas Stoyanov established what is likely the first successful notation of aksak meters in 5/8 and 7/8. An ethnographic publication in 1890, further detailed the rotational forms of seven delineating only the anapestic and dactylic forms (respectively, 2+2+3 and 3+2+2).[33] Hristov's landmark study of 1913, *The Rhythmic Bases of Our Folk Music*, and his subsequent book *The Technical Structure of Bulgarian Folk Music* (1928), significantly altered the landscape of Bulgarian scholarship through the endorsement of a structured analytical approach to research. Bartok's observations led him to a number of conclusions regarding the various rotational forms

[32] Timothy Rice, "Béla Bartok and Bulgarian Rhythm," in *Bartok Perspectives: Man, Composer, and Ethnomusicologist*, ed. Elliott Antokoletz *et al.* (Oxford University Press July, 2000), 196.

[33] Barbara Krader, "Bulgarian Folk Music Research," *Society for Ethnomusicology* 13, no. 2 (May 1969): 249.

most commonly practiced. Both Stoin and Bartok had concluded that 7/8 is most commonly expressed as 4+3 while Nice Fracile's more recent study observed that 7/8 is commonly expressed as either 3+2+2 or as 2+2+3, but never as 2+3+2. Stoin observed that the most frequent Bulgarian meters are in 5/16 (3+2 or 2+3), 7/16 (2+2+3), 8/16 (3+2+3), 9/16 (2+2+2+3), and some sixteen other less common metric forms.[34]

Table 2.1 Krustev's list of Bulgarian meters and their non-isochronous beat cycles

5/16 (most common complex form)	2+3
7/16	2+2+3 or 3+2+2
8/16	3+2+3 or rarely as 2+2+3
9/16	2+2+2+3
10/16	3+2+2+3 or 2+2+3+3 or rarely as 3+3+2+2
11/16	3+2+2+2+2 or 2+2+3+2+2 or 2+2+2+2+3
12/16 (composed of 7/16 and 5/16)	2+2+3+2+3 or 3+2+2+2+3 or 2+3+2+2+3
13/16	2+2+2+2+2+3 or very rarely as 2+3+3+2+3
14/16	2+3+2+2+3+2 or 2+2+2+3+2+3
15/16 (composed of 7/16 and 8/16)	3+2+2+3+2+3 or 3+2+3+2+2+3 rarely as 2+2+2+2+3+2+2
17/16	2+2+2+2+2+2+2+3

Fracile's study observes that the most common distribution of twos and threes utilizes either the dactylic form in which the prolonged unit is at the beginning of the phrase (3+2), or the anapestic form (2+3) which has its prolonged unit at the end of the phrase. This is further confirmed in Venelin Krustev's examination of common distributive forms. Beside the NI meter forms, as one might expect, exist the common practice forms of 2/4, 3/4, 3/8, 6/8, and 4/4. Meters in 2/4, are by far the most commonly used meter and exist in hundreds of compositional

[34] Venelin Krustev, *Bulgarian Music* (Sofia Press, 1978), 50.

examples. Less frequent is 3/4 and 3/8 while 4/4 and 6/8 are comparatively rare.

Krustev attributes 17/16 to Stoin who described it as the most complex variant of all known Bulgarian meters. Importantly, Krustev's affirms Fracile's observations regarding the proclivity toward anapestic and dactylic forms, though Fracile's list of meters represents a greater expressive range of beat cycle configurations. Fracile's study acknowledges a relatively small repertoire of aksak meters which additively combine two to four distinct meters. Nonetheless, examples such as 7/8, plus 9/8, plus 9/8, plus 9/8 are not construed as a single measure of 34/8, but rather as a conglomerate of two primary units (seven and nine), what is more commonly viewed as *segmentation.* Though Fracile's survey focuses on Bulgarian practices it similarly confirms a propensity towards dactylic and anapestic forms among a number of other countries, namely: Romania, Hungary, Greece, Albania, Kosovo, Serbia, and Turkey.

Table 2.2 Fracile's list of Bulgarian meters and their non-isochronous beat cycles

5/16	2+3 or 3+2
7/16	2+2+3 or 3+2+2
10/16	4+3+3 or 3+2+3+2 or 2+3+2+3 or 3+2+2+3
11/16	2+2+3+2+2 or 2+2+2+2+3 or 2+3+3+3 or 4+3+4
12/16	3+2+2+2+3 or 3+2+2+3+2 or 2+3+2+2+3
13/16	2+2+2+2+2+3 or 2+3+3+2+3
14/16	2+3+2+2+2+3 or 2+2+2+3+2+3
15/16	2+2+2+2+3+2+2

While the regional forms within the Balkans create relatively distinct song characteristics, these distinct characteristics are intrinsically shaped by the linguistic nature and specific instrumentation distinct to each sub-region. Nonetheless, among the array of 'distinct' characteristics that exist within the multiplicity of regional genres and styles exists an underlying

propensity towards rotational 'archetypes' that act to shape the structural makeup of surface rhythms in the various melodic and ornamental passages. The surface details that inform the Greek dances of the *Kalamatianos* (7/8), the *Tsakonikos* (5/4), and the *Ai Georgi*s (7/8) seem to share little with the characteristics of other Balkan music styles. In actuality, the line that connects the seemingly disparate genres of the Balkans becomes evident in the melodic and ornamental phrasing that correspondingly maps to dactylic and anapestic beat cycles.

2.3 Usul Meter Practices

The distinctive names of the Turkish usuls such as aksak (lame), *mandira* (Sheep-fold), and *hafîf* (light), define a number of descriptive components, namely, the associative meter, the regional origin and/or connection to a historical event, and/or an indication of the source of a poetic text. The inordinate length of the rhythmic cycles known as the *major usuls* are traditionally connected to the Islamic poetic text forms of the *kar*, the *ilahi* (hymn), and the *beste*, though a small repertory of meters with smaller cardinalities have also been attributed to this body of traditional poetic forms, generally characterized as prosodic rhythms with an unrelenting and incessant use of regular repetitions of a rhythmic or prosodic cycle. A number of linguistic theories have proposed a proclivity towards additive groupings of twos and threes as formally connected to the linguistic structure of the Turkish language which intrinsically delineates an accentual alternation of long and short syllables.[35]

Theoretically, the collection of usuls in Arabic traditions are much like the usuls of the Turkish tradition. While the Turkish *minor usuls* constitute fifteen distinct meters with successive

[35] Tolga Bektas, "Relationships between Prosodic and Musical Meters in the Best Form of Classical Turkish Music," *Asian Music* 36, no. 1 (Winter-Spring 2005): 6.

numerators from two to fifteen, the collection of *minor usuls* meters in the Arabic tradition consist of successive numerators from three to sixteen beats. Similarly, the canonized collection of meters in the Turkish *major usuls* integrate cycles from sixteen to one hundred and twenty four, while the Arabic major usuls integrate numerators from seventeen to one hundred and twenty four. The collection of Turkish minor usuls contain the following NI meters: 5 beats - *Turk Aksagi*, 7 beats – *Devr-i Hindi* or *Devr-i Turan*, 10 beats – *Aksak Semai*, *Lenk Fahte*, *Ceng-i Harbi*, 11 beats – *Tek Vurus*, 13 beats – *Nim Evsat*, *Sarki Devr-i Revani*, *Bektasi Devr-i Revani*, 14 beats – *Ayin Devr-i Revani* (*Mevlevi Devr-i Revani)*, and the 15 beat cycle known as *Raksan*.

In addition to defining the non-isochronous beat cycle for each associative meter, the Turkish minor and major usuls also relegate one of two distinct pitches for each beat. The delineated pitch sets (*dum* is marked as 'd' and *tek* accents as 't') aid the listener/performer by establishing distinct segmentative landmarks across a potentially monotonous map of smaller numbers. The associative pitches of each beat are defined as being either 'heavy' (represented by dum), or as light or moderate beats represented by a number of mnemonic terms such as tek, *te ke*, *tek ka* (each of these three terms delineates a specific relative pitch level). A number of these usuls share the same amount of beats and accordingly are distinguished purely through their distinct beat cycle and associative pitch patterns.

The canonical division of the usuls into 'minor' and 'major,' first credited to H. Sadeddin Arel (1880-1955), established a categorization which directly related to historically associative musical genres and/or styles. Thus, the minor usuls are generally associated with the smaller durational lengths of the *yuruksemai*, *agirsemai*, and *sarki*, whereas the major usuls generally constitute the repertoire of the long poetical song forms of the *kar* and the *beste*. Nonetheless, within these categorizations exist exceptions, as in the case of the *Lenk Fahte* (ten beat) which

may also be utilized within the larger song forms of the beste. Importantly, the inordinate length of the vast majority of the major usuls must be viewed not as singular meters, but rather as a strategy in which longer architectural poetic songs forms are constructed by utilizing multiple measures in additive or non-additive distributions. The following list of minor and major usuls has been compiled from two internet sites. The list of meters sources has been provided by the site www.Turkishmusicportal.org and the conjunct rotational forms sourced the internet site www.oud.eclipse.co.uk.

Table 2.3 Complete list of the Turkish Minor Usuls[36]

2 beats: *Nim Sofyan*	1+1 [d t]
3 beats: *Semai*	1+1+1 [d t t]
4 beats: *Sofyan*	2+1+1 [d t t]
5 beats: *Türk Aksagi*	2+2+1 (2+3) [d t t][37]
6 beats: *Yürük Semai,* or *Mürekkep Nim Sofyan*	1+1+1+1+2 [d t t d t]
7 beats: *Devr-i Hindi,* or *Devr-i Turan*	DH=1+1+1+2+2 (3+2+2) [d t t d t] DT=2+2+3 [d t t]
8 beats: *Düyek*, or *Müsemmen*	D=1+2+1+2+2 [d t t d t] M=3+2+3 [d t t] or 2+1+2+3 [d t d t]
9 beats: *Aksak, Evfer, Oynak*, or *Raks Aksagi*	A=2+1+1+2+2+1 [d t t d t t] E=2+1+1+2+1+2 [d t t d t t] O=1+1+1+2+2+2 [d t t d t t] R=2+3+2+2 [d t d t]
10 beats: *Aksak Semai, Lenk Fahte*, *Ceng-i Harbi,* or *Curcuna*	L=2+2+2+1+1+1+1 [d t t t t t t] or L=2+3+1+2+1+1 CH=1+1+1+1+1+1+1+1+1+1 A=2+1+2+2+2+1 (3+2+2+3) C=2+1+2+2+2+1 [d t t d t t] or 5+2+3 [d t t d t t]
11 beats: *Tek vurus*	[4+4+2]+[2+1+1+2+2+1+1+2]
12 beats: *Frenkçin, Nim Çember,* or *Ikiz aksak*	F=1+2+1+2+1+1+1+1+1+1
13 beats: *Nim Evsat, Sarki Devr-i Revani,* or *Bektasi Devr-i Revani*	S=1+1+1+2+2+2+2+1+1 [d t t d t d t t t] N=1+1+1+2+4+4 [t t t t d d]
14 beats: *âyin Devr-i Revani* (*Mevlevi Devr-i Revani)*	3+2+2+3+2+2 [d d t d t t]
15 beats: *Raksan*	1+1+1+2+1+2+2+2+1+2 [d t t d t t d t t t]

[36] "Turkish Music Portal – Theory – Usuls," http://www.turkishmusicportal.org/page.php?id=49.

[37] "Rotations of the Usuls," http://www.oud.eclipse.co.uk/usuller.html.

Table 2.4 Compete list of the Turkish Major Usuls[38]

16 beats: *Çifte Düyek, Fer', Nim Berefsan, Nim Hafif*	F=2+1+1+2+2+1+1+1+1+2+1+1 [d t t d t d t d d t t t]
18 beats:*Türki Darb, Nim Devir*	N=2+2+2+4+4+1+1+1+1 [d d t d t t t t]
20 beats: *Fahte*	F=2+1+1+2+2+2+2+2+2+1+1+1+1 [d d d t t t d t t t t t t]
21 beats: *Durak Evferi*	
22 beats: *Hezeç*	
24 beats: *Çenber, Nim Sakil*	
26 beats: *Evsat, Beste Devr-i Revani*	
28 beats: *Frengi Fer, Devr-i Kebir, Remel*	
32 beats: *Muhammes, Hafif Berefsan*	
38 beats: *Darb-i Hüner*	
48 beats: *Sakil*	
60 beats: *Nim Zencir*	
64 beats: *Havi*	
88 beats: *Darb-i Fetih*	
120 beats: *Zencir*	
124 beats: *Çehar*	

2.4 Meters of the Arabic Wazn

The collection of meters associated with the Arabic music tradition of the *wazn* (also commonly called usul, *mizan*, or *darb*) is associated with an expansive geographical region which includes the North African countries of Egypt, Libya, Tunisia, Algeria, Morocco, the disputed areas south of Morocco, and Mauritania. It is also an integral part of the high art and folkloric traditions of Jordan, Lebanon, Palestine, Israel, Saudi Arabia, Qatar, United Arabic Emirates,

[38] "Turkish Music Portal," http://www.turkishmusicportal.org/page.php?id=49.

Kuwait, Oman, and Yemen. First described by the *Golden Islamic Age* theorists of the 9th century, the systematization of meter and rhythm expressed the view that time should be divided into long and short durational values, a derivative of the poetical feet of versification. By the 10th century, al-Farabi had ascertained that the unit with which time should be measured should be an indivisible value which is derived by determining the shortest durational value perceivable as halves of a regular pulse in which no other perceivable halves may exist. Many of the usul and wazn patterns in use today can specifically be traced to the lineage of patterns first articulated by al-Farabi's system of classification.[39]

The Arabic wazn (literally "measure") consists of regularly recurring sequences of two or more durational values which are either long or short, accented or less accented. The first beat of a wazn is usually accented. As in the case of the Turkish usuls, a number of distinct meters share the same amount of beats, thus being distinguished solely by their unique rotational and associative pitch accents which are divided into 'time segments' (for example 14/4 as 4+2+2+6 has four time segments), an architectural strategy for establishing longer accentual durational distributions of groupings comprised of twos and/or threes. The notational system denotes the representative drum strokes as: '0' for *dum* (heavy), 'I' for *tak'*, and a dot or period for rests which have the same durational values as either dum or tak. Two consecutive stocatto strokes must be either both dum or both tak, though if the second stroke following dum is played legato it is called *mah,* or when following tak it is called *kah*. Importantly, only one type of stroke is played for any given unit of time (each beat in a beat cycle) though occasionally a single unit may encompass two distinct strokes (notated with a tie between two symbols).[40]

In addressing the repertory of meters in the wazn collection, it should be noted that a

[39] Habib Hassan Touma, *The Music of the Arabs* (Amadeus Press, 1996), 47.
[40] Idem., 48-49.

limited number of sources have been utilized. What generally seems to exist is a wide array of articles (academic or otherwise) which tend toward peripheral comments which reference a small component of the collective set, rarely addressing the collection as a whole. The following is (table 3.5) Touma's examination (which I have distilled down to non-isochronous meter forms) of the segmentations and relative beat cycles for the commonly practiced non-isochronous meter forms of the wazn.

Table 2.5 Touma's list of non-isochronous meters of the wazn.

Name	Meter	Segmentation	Rotation
Dawr Hindi	7/8	3+4	3+2+2
Aqsaq Samai	10/8	5+5	2+3+2+3
Sama-i Thaqil	10/8	5 + 5	3+2+2+3
Al-Awis	11/4	3+3+5	3+3+2+3
Al-Murabbaa	13/4	3+6+4	3+2+2+2+2+2
Zarafat	13/8	3+3+2+5	3+3+2+2+3
Muhajjar	14/4	4+2+2+6	2+2+2+2+2+2+2

The difficulty of finding scholarly sources which address the collection as a whole has led to the addition of a rather tentative internet reference (www.maqamworld.com), one of which in particular seemingly corroborates Touma's observations, yet, importantly adds additional insight into a number of the associative beat cycles. The following list of meters and beat cycles (table 2.6), while not including Touma's analysis of a given meters associative segmentation, nonetheless provides the entirety of the collection - both the minor and major wazn.

Table 2.6 The rotational expressions of non-isochronous meters - minor usuls/wazn.[41]

Usul	Rotation
Aaraj 5/8 (also known as usul *Aghar Aqsaq*)	2 + (2+1) = 2 + 3
Aghar Aqsaq Turki 5/4	3 +2
Dawr Hindi 7/8	3 + 2 + 2
Nawakht 7/4	3 + 2 + 2
Samai Thaqil 10/8	3 + 2 + 2 + 3
Jurjina (*Jurjuna*) 10/8 (used widely in Iraq/Iran)	3 + 2 + 2 + 3
Awis 11/8	3 + 4 + 4 = 3 + 2 + 2 + 2 + 2 or 2 + 2 + 2 + 2 + 3
Nim Oyun Havasi 11/8	3 + 2 +2 +2 +2
Dharafat (*Zarafat*) 13/8	3 +3 + 2 + 2 + 3
Murabbaa 13/4 (Arabic word for based on four)	3 + 4 + 4 + 2 = 3 + 2 + 2 + 2 + 2 + 2 + 2
Muhajjar 14/4	2 + 4 + 4 + 4 = 2 + 2 + 2 + 2 + 2 + 2 + 2
Fikra 15/4	3 + 3 + 2 + 2 + 2 + 3

2.5 Metric Commonalities

Interestingly, both the minor usul and minor wazn traditions coincide with the metric practices of the Balkan peninsula, a tradition which has been formalized and categorized as a theoretically constructed canon posthumously abstracted by ethnographic observations of performative practice itself. While London's cognitive and perceptual limits for meters are contextualized in milliseconds, he fails to translate this into a generalized metric length, yet the striking similarities between these three cultures suggest a perceptual limit in and around metric

[41] "Maqam World – Arabic Rhythms," http://www.maqamworld.com/rhythms.html.

cycles comprised of fifteen beats. While Krustev tentatively adds a seventeen beat cycle, he acknowledges that his addition of this meter is largely founded on Stoin's previous claim. Indeed, Fracile's absence of meters in seventeen, the result of an extensive examination of a relatively large cross-section of field recordings, suggests that Balkan meter practice perfectly coincides with the minor usul and minor wazn meter collections.

Additionally, the dactylic and anapestic beat cycles of Balkan meter practice is also found in the additive configurations of the minor usul and wazn. Meters which appear as non-dactylic or non-anapestic rotations may nonetheless, in certain instances preserve a dactylic or anapestic segmentation. Nonetheless, a number of meters simply do not preserve the dactylic or anapestic form, though such meters constitute the exception rather than the norm. Regardless, it is important to recognize London's assertion that smaller more tractable numbers are more easily engaged than longer beat cycles and accordingly meters such as ten, eleven, and so forth, become arguably far more difficult to perceive and/or perform than meters in five or seven. Thus, we are not in the least surprised by the fact that meters in five and seven occur with much greater frequency than meters of greater cardinalities (i.e., the number of elements in a set or other grouping). Similarly, cultures which primarily utilize common practice meters and only make ardent use of a singular NI meter form, by and large, tend toward expressions in five or seven, and while a number of meters have been presented with beat lengths of greater cardinalities, it remains safe to assume the performative practice of meters with beat cycles longer than five and seven exponentially decrease in direct proportion to a meters increased length.

2.6 South Asian Tala - A Historical Overview

The Sanskrit word *tala*, and the common vernacular forms of *tal* (Hindi) and *talam* (Tamil), is the term used in Indian classical music to represent a number of rhythmic and metric schools of classification. The tala systems that pervade the distinct modern traditions of Hindustani and Carnatic practice have both inherited the rhythmic concepts and language associated with the prosodic terminology of the *chanda* tala. While the chanda tala establishes the foundational premises of later tala discourse, the earliest extant 'canonical' post-Vedic system of classification is the *marga* tala, though it has played a considerably lesser role than the later 'provincial' *desi* tala system which largely provides the basis for modern tala practice.[42]

The aesthetic which characterizes the discourse of Indian musicological practice is markedly distinct from the procedural discourse of Western practice. This begins with Panini, the father of science in India, whose pioneering work in linguistics and grammar established a scientific culture which opened up fields wholly independent from their originally intended religious context - the scientific study of Vedic scriptures. In Panini, abstraction and phonocentricity (the centrality of phonetics) are intrinsically connected as best exemplified in his analytical arrangement of the Sanskrit alphabet; an algebraic meta-linguistic system which utilizes ordered grids that codify a phonetic basis for the formation of words. Interestingly, the pedagogical basis for the dissemination of the system required no form of visual notation as the Sanskrit alphabet was alternatively structured on an acoustical basis; a system steeped in a world of hearing versus seeing. Panini's system eloquently describes his abstract linguistic formulation

[42] Harold Powers and Richard Widdess, "India: Theory and Practice of Classical Music: Rhythm and Tala – Historical Development of Tala Systems," *Oxford Music Online*, http://www.oxfordmusiconline.com.ezproxy.library.yorku.ca .

in 4000 short aphorisms (*sutras*). The 'sutra technique,' which is centrally built around the premise of saying a lot in the shortest and most succinct way, parallels the reductionist model of Western scientific discourse, though comparatively, sutra literature is is steeped in an abstract symbolic discourse which is an utterly incomprehensible abstraction unless contextualized by educated commentary. Though Greek mathematical science was largely based on geometric or spatial concretions, Indian mathematical philosophy transcended these concepts by implementing a rudimentary algebra which allowed for both a heightened level of abstraction and computational possibilities.

In the spirit of Panini, both Vararuci and Aryabhata similarly represent astronomical and mathematical theorems by means of sound structures as formulated through an encoded numerical alphabet. Technically, the profane (secular) discipline of astronomy is not expressed through Sruti revelation, though despite this independence, these theorems speaks like sacred texts, thus reproducing a 'cultural pattern' of expression through a poetic discourse which imparts a sense of mystery and sensuality. What is being sought is a scientific statement which imbues beauty and virtuosity, within an expertly masked cryptic discourse. This 'cultural pattern' characterizes increased levels of convolution and enigmatic expression as indicative of the 'importance' of any given theorem. Measurements must not be simply written, even at the cost of comprehensibility. While this would be frowned upon in Western scientific discourse, here it is a kind of legitimacy which historically fulfilled social expectations, conventions and norms.

2.7 Chanda Tala

The earliest known Sanskrit treatise on prosody is Pingala's *Chandas-shastra* (with various estimates ranging from 200 to 400 BC), at the transition from Vedic to classical (Epic) Sanskrit poetry. Later sources are the *Agni Purana* (various *est.* from 700 to 1100 AD) which is fundamentally based on the Chandas-shastra, chapter fifteen of the *Bharatiya Natyashastra* (various est. from 1000 to 1300 AD), and chapter one-hundred and four of the *Brihat-samhita* (*est.* 1000-1300 AD). These texts addressed prosody in the context of the oldest Hindustani scriptures, the Vedas. The Veda or 'Vedic texts' are organized into four canonical divisions which are comprised of 'metrically' organized *mantras* or hymns. The hymns of the four canonical divisions largely borrow from the collection within the *Rigveda* (one of the canonical divisions). Thus, the hymns of the Rigveda constitute the central source of Vedic quantitative 'metric' prosody. Vedic texts were understood through the study of the *Vedanga* which consisted of six traditional disciplinary components known as: *Shiksha* (phonetics, phonology, and morpho-phonology), *Kalpa* (ritual), *Vyakarana* (grammar), *Nirukta* (etymology), *Chandas* (meter), and *Jyotisha* (astronomy for establishing the date of ritualistic events).[43]

The Vedic texts provided the symbolic transitional boundaries between abstraction and formalized strictness creating a "double aesthetic training ground."[44] The hymns of the Rigveda are full of cryptic and enigmatic poetry which prefigured the link between poetics and mathematics. The text of the Rigveda is organized in ten books, known as *mandalas.* Each mandala consists of numerous hymns (or *sukta*, literally, "well recited, eulogy") intended for

[43] A. C. Clayton, *The Rig-veda and the Vedic Religion: With Readings from the Veda (*Christian Literature Society for India, London and Madras, 1913), 25, archive.org/details/rigvedaandvedicr031644mbp.

[44] Annette Wilke and Oliver Moebus, *Sound and Communication: An Aesthetic Cultural History of Sanskrit Hinduism* (Walter de Gruyter GmbH & Co., 2011), 236, http://books.google.ca/books?id=KZCMe67IGPkC&printsec=frontcover&dq=Wilke.

various sacrificial rituals. As a rule hymns remain in a single 'meter' throughout, though mixed 'meter' forms are occasionally utilized, most notably in the first mandala (the first book of the Rigveda) which contains a hymn with nine distinct meters. Verses which contain either eight or twelve syllable lines are iambic (short - long), while verses of eleven syllable lines are trochaic (long – short).[45] In order to bring a linear progression into a metric system which utilizes an array of verse forms constructed of three, four, and/or five verses of varying syllabic quantities (eight, eleven, or twelve), the Rgvedins employ a coup-de-force by treating all the meters as if they had only four verses. The result is a linear sequence of seven meters, though, in practice these meters are not treated as a linear set. Instead, each meter is treated as a distinct figure, each with their own distinct polymorphisms (for example, Gayatri is associated with charisma, wisdom and the art of speaking ,while Ushni connotes health/long life).

Historically, the transition from Vedic meters to later Sanskrit meters saw the abandonment of the five and six line stanzas (common in the *Gathas*), as well as the three line verse (historically, the most revered of forms) in favor of the two verse, four line stanza. By Sanskrit times, the growing syntactic importance of the two line couplet reduced the range of Vedic meters to a single type.

[45] Clayton, *Rig-veda and the Vedic Religion*, 259.

Table 2.7 Linear realization of quantitative meters

Name	Actual Construction	Basic No. of Syllables
Gayatri	3 verses of 8 syllables	24/4 = 6
Ushni	2 verses of 8 syllables 1 verse of 12 syllables	28/4 = 7
Anushtubh	4 verses of 8 syllables	32/4 = 8
Brhati	2 verses of 8 syllables 1 verse of 12 syllables 1 verse of 8 syllables	36/4 = 9
Pankti	5 verses of 8 syllables	40/4 = 10
Tristubh	4 verses of 11 syllables	44/4 = 11
Jagati	4 verse of 12 syllables	48/4 = 12

In earlier Vedic practice only three to four syllables near the end of the line are quantitatively defined while earlier syllables as well as the last syllable of a line remain undefined. While much may be conjectured regarding the natural linguistic accentual delineation of the language, the specific rotational forms cannot be ascertained. Later Sanskrit meter 'fixes' the quantitative value of all syllables. While Vedic meter established very specific rules regarding the length of syllables, the term 'length' has created some confusion (as well as the term 'meter') as the categories of long and short vowels are not specifically defined within a stable metrical relationship. While 'quantitative meters' have a salience which can be perceived and counted, they nonetheless contain no precise durational quantity.

While English and Spanish poetry is fundamentally determined by its pattern of stressed and unstressed syllables, Sanskrit (as many other languages) is determined by the pattern of long and short syllables. Meters are further classified in to two general categories: by the number of syllables in a line, or by the total length of the syllables in the line. In Pingala's system of

classification 'meter' is defined by an exact syllabic sequence, a system which establishes a precise means of addressing the characteristic surface rhythms of various distinct sequences of syllables. Crucially, in Pingala's system, the surface rhythms of a metric template are instead given the status of distinct meters and in this sense the chanda tala's systems of metrical classification differs markedly from modern definitions which define meter as the periodic templates that underlie surface behavior. Though Pingala's *Chandas-shastra* describes and documents hundreds of surface rhythms it does not document the underlying periodic template (meter). Convention in Sanskrit poetry requires a 'meter' (which in this instance is best viewed as a sequence of syllables which constitutes a specific surface rhythm) to be adhered to unyieldingly for at least the length of an entire verse (commonly four lines). As a descriptive system the classification of surface rhythms versus their underlying metric templates allows the system to directly account for a linguistic precision and correspondent mapping. While Pingala's surface rhythms are still capable of being mapped into an underlying metric template, the qualitative and undefined durational values defy contemporary definitions of meter.

Nonetheless, Pingala's remarkable work presents the first known description of a binary numeric system in connection with the systematic enumeration of meters with fixed patterns of short and long syllables. Pingala's interest in determining the amount of combinatorial patterns that exist in combinations of long and short syllables corresponds to binomial theorem and his presentation of meters in the form of *Pascal's triangle* is the earliest explicit description of a triangular array of binomial coefficients. It was also realized that the shallow diagonals of the triangle sum to the Fibonacci numbers. The development of the Fibonacci system is first attributed to Pingala only later being associated with Virahanka (c. 700 AD), also an Indian prosodist and mathematician whose work on prosody is foundationally premised on Pingala's

Chandas-sutras.

Defining Vedic meter as syllables with either long or short durations, Pingala's combinatorial examination of rhythm sought to determine the amount of patterns which can be formed from a given number of syllables. The number of syllables could be expressed as all longs, all shorts, or mixtures of longs and shorts. His system is capable of describing every rotational expression of any divisive or additive meter based on two distinct durational values. Pingala perhaps best exemplifies the cultural pattern of a prefigured link between art and mathematics, a 'link' which is the lineage of the theoretical discourse of later as well as modern tala systems of practice.

2.8 Marga Tala

The *marga* tala (also known as the *Gandharva* system) is the earliest extant post-Vedic system. The earliest description of this system is estimated to date from the first millennium AD. Gandharva is defined as ritual theater music comprised of through-composed songs. The system of classification governed the organizational strategies for constructing multiple layers of temporal structure. The ensemble of musicians were part of a select group formally initiated in the complexities of a secretive system. Three of the most distinctive characteristics of this music not only survives, but flourishes in Indian music today: *upohana*, *upavartana*, and *prastara*.[46]

The Marga system is best understood through its most representative musical style, the *gitaka*, a song genre which constitutes the most ancient form of music designated *Ghandarva*. Upohana, the direct ancestor of the modern improvisatory form known as *alapana* (or *alap*) is

[46] Lewis Rowell, *Music and Musical Thought in Early India* (University of Chicago Press, 1992), 248.

prescribed for five of the seven major *gitakas* and accordingly comprises one of the most salient features of the Gandharva tradition. In modern practice the alapana has become the common standard solution for beginning a musical composition; an introduction of later compositional material in an un-metered rubato like state.

Upavartana may be described simply as a compressed repetition at double the speed, a process prescribed for three of the seven gitakas. The acceleration of the underlying beat from a fourfold to a twofold state, and finally to a singular syllable, strictly progresses through the ratio of 4:2:1. This doubling of the speed functioned as either a concluding *Nachtanz,* or as a connective link between sections. This progression of strict temporal doubling survives in South Indian and Northern *dhrupad* practice today. In Northern styles, especially those which appear to have come under Persian influence, tempo is usually altered in a series of more gradual changes.[47]

The third structural characteristic, the prastara, is utilized in three of the seven gitakas. The prastara is described in the earliest treatises as a complex temporal permutation presented in an ordered matrix of possibilities which must be performed systematically in the same ordered manner until each permutation has been fulfilled. Prastara later became a staple tactic both in Sanskrit poetry and in Indian musical practice and is now classified as one of the ten 'vital breaths of tala,' which constitute the modern system of Carnatic practice. They are:

1. *kala* – the twelve divisions of absolute time
2. *marga* – the density of events within a pattern or rhythmic cycle
3. *kriya* – metric hand gestures
4. *anga* – the accentual components marked by kriyas which distinguish each particular tala cycle

[47] Idem., 250.

5. *graha* – the point in a tala cycle where the music begins
6. *jati* – expanded versions of the basic tala patterns, produced by counting with fingers
7. *kala* – a variable unit of time specifying the ratio between melodic activity and tala structure
8. *laya* – the three tempos (slow, moderate, fast)
9. *yati* – the design of a tala cycle given by the pattern and relative length of its components
10. *prastara* – the process of permutations

2.9 Desi Tala

The ten vital breaths of tala mark the emergence of conceptual tools which perpetuate the synchronization and control of a temporal cycle (*avarta).* The formal basis of the entire system acts to facilitate improvisation within cycled meters. The shift from the specifically prescribed ritualistic tradition of marga tala, to that of desi tala, became first codified during the second half of the first millennium. The desi tala defines the emergence of the formalization of popular regional rhythms, meters, and systems. The proportional compression of marga tala, what many viewed as overly complex, likely inspired the shift towards a more approachable system. The 'desi tala' system of classification, though initially formalized and classified alongside and within the marga tala system, eventually supplanted historical marga practice altogether. Unfortunately, the periods conjunct changes in rhythmic practice have been impossible to ascertain given that there is no surviving textual evidence from the intermediate developmental stages that constitute the formal change from marga to desi tala. Regardless, even later medieval scholars establish no consensus regarding the classification of rhythmic cycles.

An often cited and much disputed source of early desi tala literature is a passage from the *Bharata's Natyashastra* which mentions *misra* (mixed) and *sankirna* (blended) talas. Interestingly, this literature also mentions units of five, seven, nine, ten, and eleven – numbers which were excluded from marga metric theory altogether. While the commentary in Bharata's Natyashastra examines the aforementioned ratios in the context of the large scale musical structures of marga tala, later generations interpreted these numbers in the context of the more tractable repeatable cycles of specific tala patterns, known as the '*five rhythmic genera of jati*.' These are:

Table 2.8 The five rhythmic genera of jati

Meter	Name	Form
3	*tryasra*	triangular
4	*casturasra*	quadrangular
5	*khanda*	split
7	*misra*	mixed
9	*sankirna*	blended

The five jati have become a standard in modern Carnatic music. The jati are viewed as expanded versions of basic tala structures which inflate a particular limb (or *anga)* of a tala pattern which is conjunctionally represented by three, four, five, seven, or nine visibly gestured finger counts. This process transforms simple tala patterns into alternate realizations with heightened levels of temporal complexity. This transformation from simple to complex structures suggests a general developmental process within tala systems, namely, a marked propensity in the direction of metric asymmetry and irregularity. Indeed, both desi talas as well as modern tala practice are distinguished by their propensity toward additive (versus divisive) metric forms.

Table 2.9 Durational values in Desi tala

Name	Symbol	Relative Length	Notation	Duration
pluta	P	3	dotted quarter	protracted
guru	G	2	quarter	long
laghu	L	1	eighth	short
druta	D	1/2	sixteenth	shortest
virama	V	½ or 1/4	.	A fractional extension of L or D

Additionally, the historical shift to desi tala patterns infers a preference toward structural patterns and surface rhythms which are marked by shorter durational sequences. Unfortunately, the beat cycles of desi tala systems are exceedingly difficult to determine given the array of categorizations in the numerous differing lists of desi tala. The numerous desi classification systems as proposed by a number of Indian metrical theorists include: a list of 108 desi tala known as *anga* tala, a list of 120 desi tala, a list of 72 tala which correspond with the system of 72 *melakarta* scales, and the list of 9 talas known as *navasandhi* tala. While an in depth survey of each of the aforementioned classification systems is beyond the scope of this dissertation, a partial examination of the two largest collections (the list of 108 and 120 talas) should yield a general overview. The list of 120 desi tala, as formulated in chapter five of the S*angitaratnakara*, establish their durational values through either divisions or multiples of a value assigned by the convention of *laghu* (for definition see 'modern tala practice'). These durations are provided in table 2.9.

Eugene Rowell's examination of the 120 desi tala reveals a propensity towards a clear demarcation of specific durational spans at the beginnings and endings of tala patterns. Twenty-six of the talas end with *pluta* though only two tala patterns begin with this durational form. *Guru* is fairly evenly spread between endings and beginnings (twenty-six and thirty-seven respectively)

while thirty-five talas begin with druta while only sixteen end with this duration.

Many of the longer, more complex patterns show clear signs of internal organization often utilizing repetitions of a rhythmic sequence plus an irregular string of durations at cadential points. Conversely, the shorter patterns do not show the same propensity toward sequential repetitions. Only three of the talas consist of a single repeated pattern (or double foot). Eleven of the shorter patterns are palindromes, a continuation of the structural legacy of earlier marga tala practice. Though many of these talas have been described in terms of the encoded system of the trisyllabic metric system known as *ganas,* the 120 desi tala fail to reflect the influence of this code as no underlying tendency toward tertiary metric templates exists. Indeed, the system fails to utilize a consistent sequence of any of the eight possible trisyllabic permutations of L and G.

To pursue this point further, it will be useful to ascertain the total pattern length of the 120 talas in terms of matras (measures). Of the 120 talas, eighty-five consist of a whole number of matras and thirty-five of a fraction. The 'thirty-five' talas occupy a total number of matras that fall within the numerical series 1, 2, 4, 8, 16, and 32; of these only twenty-one occupy a span that lie within a ternary series of numbers. Most of the 'twenty-one' cannot be regarded as triple meters as the analysis of their internal structures imply binary divisions with alternatively metered cadences.

Indeed, binary meter is the most characteristic feature of this repertoire, both in terms of the total length and internal division of the patterns. Hindering our full understanding of this repertoire is the lack of evidence which indicates what specific talas were actually performed and accordingly distinguishing actual practice from that of talas which were developed through theoretically conjectured systems is exceedingly difficult if not impossible to assert.

The anga tala system which employs one-hundred and eight distinct talas is made all the

more tractable in that a large number of these talas contain an *avartan* (each repeated cycle of a tala) with an unusually large amount of *aksharas* (number of beats in a cycle). The largest 'cycle,' (meter) is one-hundred and twenty-eight beats long. Such a cycle is of course incapable of being perceived as a singular meter. Indeed, a large number of the anga talas must be functionally regarded as mixed meter forms and thus remain firmly outside of the salient range of perception which harnesses the tractable/perceivable length of a singular cycle. Additionally, the one-hundred and eight talas of the anga system are further reduced by virtue of the fact that the survey is restricted to NI beat cycles.

The rotational elements of a tala is determined by virtue of the *vibhaags* (the accented sections of a tala) which are unique to each and every tala. In the *Suladi Saptha* tala system (addressed in the following pages) these accents are established through the combinatorial use of the *anudhrutam* (a single beat), the *dhrutam* (two beats), and the *laghu* (a variable number of beats of either 3, 4, 5, 7, or 9). The sheer length and complexity of some of the cyclic forms of the anga tala have feasibly necessitated the utilization of a system of accents (one to sixteen beats) which can express the longer durational cycles associated with the larger cardinalities of the anga talas. This of course restricts the analysis of beat cycles as tala forms which utilize accents with larger durational values make no recourse for further reductions into twos and threes. The meters and rotations of the smaller beat cycles of the anga tala system are provided in table 2.10[48]

Much like the one-hundred and twenty desi tala collection, the one-hundred and eight desi tala collection show a marked preference for binary metric forms. Indeed, one is capable of dividing each rotation of these meters into a binary base, whereas in the case of rotations which employ groups of three, they are either employed at the traditionally flexible cadential points or

[48] *Meters of the Anga Tala*, *www.angelfire.com*/mb/mridhangam/108talas.html.

are never sustained for long enough to constitute their analysis as tertiary. Subsequently, the integration of ternary meters must be deemed as a post-desi tala development. Presently, both modern North Indian and South Indian tala employ binary and ternary meters which are normally treated with melodies that are divisible into subsections of equal length. Modern meter practice is constructed of either *casturasra* (binary) meters of 4, 8 or 16 beats to the measure, or *tryasra* (ternary) meters of 6, 12 or 24 beats. *Samkirna* meters (mixed meters) of 5, 7, 9, 11, 13, and 15 are comparatively rare.[49]

[49] D.R.Widdess, "Rhythm and Time Measurement in South Asian Art-Music: Some Observations on Tala" (Proceedings of the Royal Musical Association, Vol. 107, 1980-1981): 132-133.

Table 2.10 Meters of the Anga tala

Anga Tala	Beats of Cycle (Meter)	Rotation
Laghu Sekhara	5	4+1
Kreeda	5	2+2+1
Antarakreeda	7	2+2+2+1
Dombuti	10	4+1 + 4+1
Gaarugi	11	2+2+2+2+2+1
Sama Tala	13	4+4+2+2+1
Chatus Tala	14	8+2+2+2
Shimhalilaa	14	4+2+2+2+4
Jagajjhampa	15	8+2+2+2+1
Prataapa Sekhara	17	12+2+2+1
Gaja Lila	17	4+4+4+4+1
Raagavardhana	19	2+2+1+2+12
Vardhana	20	2+2+4+12
Yati	20	8+4+4+4
Vishama Kankaala	20	4+8+8
Sama Kankaala	20	8+8+4
Khanda Kankaala	20	2+2+8+8
Poorna Kankaala	20	2+2+2+2+8+4
Makunda	20	4+2+2+4+8
Abhinandana	20	4+4+2+2+8
Dhenkika	20	8+4+8
Nandana	20	4+2+2+12
Nissaaruka	20	4+8+8
Malla Tala	21	4+4+4+4+2+2+1
Mattika	22	8+2+12
Sarabba Lila	22	4+4+2+2+2+4+4

2.10 Modern Tala Practice

In both Hindustani and Carnatic traditions the performance practice of *ragas* is usually comprised of sections which are differentiated by distinct metric schemata which generally utilize un-metered introductory passages (alap), followed by metered movements which often integrate serialized levels of temporal density and/or tempo modulations which proceed from slow to fast. These temporal systems relate to the concept of *laya*, most generally equivalent to the modern Western definition of 'rhythm.' Laya defines three fundamentally connected levels of tempo: slow (*vilambit*), medium (*madhya*), and fast (*drut*). These three tempos are ascertained in relationship to a fixed pulse known in Hindustani practice as the *matra* (unit of measurement, or beat), or as the *aksara* (syllable) in Carnatic practice. Additionally, laya defines the concept of rhythmic density, a temporal practice which generates an impression of tempo change through the subdivision of each beat into two or more equal parts. In Hindustani practice the matra (beat) may be subdivided into two, three, four, six, or eight, while subdivisions of the beat into five, seven, etc, and more complex fractional divisions (4:3) exists primarily in instrumental solos. The Carnatic terminological equivalent to laya is *gati* and *natai*, both of which denote the 'normal' subdivision of a note (two or four divisions) or the less common subdivisions of three or six (tisra), five (*khanda*), or seven (*misra gati/natai*).

The measurement of time with the use of claps, silent waves and other various cheironomic gestures, known as *kriya*, establish a set pattern which delineates the first beat (*sam*) among other accentual pulses within a metric cycle. As a general rule the kriya and its correspondent tala are repeated without change as moves to other meters are exceedingly rare. The kriya acts as both a pedagogical and performative aid in a number of genres, playing a central

role in *dhrupad* and Carnatic concert music. Small cymbals (*talam*) often replace the metrical gestures of the kriya in non-classical religious genres, notably, Carnatic *nagasvaram* or *Newar* temple singing. In the examination of northern Hindustani and the southern Carnatic music one must be cautioned against delineating ascriptions of tala through kriya practice. As Powers and Widdess note:

> It is a fundamental principle of ta¯la that while the pattern of irregularly spaced audible claps marks the rotation [i.e., not rotation as a kind of permutation as defined earlier] of the cycle, it does not necessarily indicate the rhythmic organization of musical events within the time-span so measured. Not only is there an almost infinite variety of possible rhythmic configurations within any ta¯la cycle, but a ta¯la may even be characterized by an internal rhythm [i.e., meter] different from that implied by the clap-pattern. Thus the Karnatak Jhampa¯ ta¯la, in its most common misra¯ variety, is structured by claps as 7-1-2, but the characteristic rhythm of melodies in this ta¯la is (2-3)-(2-3)…. Similar internal rhythms operate to a greater or lesser extent in many of the other ta¯las of both the Karnatak and Hindustani systems.[50]

Indeed, a number of the tala patterns, at least in terms of their corespondent kriya, do not directly represent the "metric entrainment that circumscribes and guides them."[51] In most instances the characteristic surface rhythm melodies are more likely to direct the experience of a meter-underpinning more than the abstractly conceived constructs of tala itself. In Hindustani practice, the *tabla* replaces the accentual gestures of the kriya with a set pattern of strokes known as *theka* (literally 'support') which creates the formative basis for the rhythmic variants which exist within the traditions of most Hindustani genres. Contrastingly, in dhrupad the *pakhāvaj* drum is less confined to the supportive role of the theka, thus emphasizing freely conjectured improvisatory excursions with only occasional returns to a demarcation of the theka. In general,

[50] Powers, "Rhythm and tala," ezproxy.library.yorku.ca/subscriber/article/grove/music/43272pg7#S43272.3.4.

[51] Powers, *The New Grove Dictionary of Music and Musicians*, "Theory and Practice of Classical Music: Rhythm and Tala," (second edition, MacMillian Publishers, 2001), 198, qtd. in London, *Hearing In Time*, 166.

the various stylistic schools of tala known as *gharanas* are unified in their use of common compositional forms, repertoires, and styles.

2.11 Suladi Sapta Tala

The *suladi sapta* system has become universally accepted as the standard modern tala system of classification, though the *chapu*, *chanda*, and *melakarta* tala are also in regular use. The suladi sapta system contains seven families of talas each of which can incorporate one of the five jati. A tala must reference one of the jati, a system which establishes thirty-five possible talas. Each of the five jati all contain a distinct amount of *aksharas* (beats in a measure) which consist of either: three beats (jati *thisra*), four beats (jati *chatusra*), five beats (jati *khanda*), seven beats (jati *misra*), or nine beats (jati *sankeerna*). The seven tala families (*dhruva, matya, rupaka, jhampa, triputa, ata, and eka*) and the number of aksharas for each of the thirty-five talas is tabulated below (table 2.11). The system uses three of six possible *angas* (or limbs) represented by the gestural symbols of the kriyas. The three angas are: the *anudhrutam* which is a single beat notated as 'U,' the *dhrutam* which is a pattern of two beats notated as 'O,' and the *laghu,* a durational value determined by the associative value of the chosen jati. For example, the tala *khanda- rupaka* consists of cycles of measures in 7/4 which are comprised of two beats (the durational value of rupaka) plus the five beats of its associative jati (the durational value of laghu).

Each of the three angas may be further divided into any one of the five *ghatis,* based off of the durational values of the five jati. Thus, any one of the anga may be divided into either three, four, five, seven, or nine beats, leading to five interpretations of each of the thirty five

'meters' for a 'theoretical' total of one-hundred and seventy-five possible talas. Nonetheless, the more complex divisions generally exist strictly in percussion solos and rarely if ever constitute the backbone of actual tala practice.

Numerically organized the thirty-five possible meters available in the tala-jati relationships are as follows: 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 20, 22, 23, and 29. Curiously, the system does not account for 15 or 19, an inclusion which would constitute every numerator from 3 to 20. Additionally, it may be observed that a number of these meters exist simultaneously in one or more of the tala-jati combinations. The meters categorized accordant to the amount of its occurrences within the system are presented in table 2.12

Table 2.11 Meters of the Sulada Sapti tala system

Tala	Anga Notation	*Tisra*	*Chatusra*	*Khanda*	*Misra*	*Sankeerna*
Dhruva	lOll	11	14	17	23	29
Matya	lOl	8	10	12	16	20
Rupaka	Ol	5	6	7	9	11
Jhampa	lUO	6	7	8	10	12
Triputa	lOO	7	8	9	11	13
Ata	llOO	10	12	14	18	22
Eka	l	3	4	5	7	9

The system reveals that twenty five of the possible thirty-five meters are represented by only nine meters with precisely the same amount of beats. These re-occurrent meters are distinguished by their specific beat cycles, thus, these nine meters (or, twenty-five) distinguish themselves from the set of meters which are limited to merely one expression of a beat cycle (not accounting for the musical surface variants of the five ghatis).

Most Hindustani talas involve non-prime N cycles, especially even N cycles, because

there is a strong tendency for symmetrical half-measures (e.g., Jhapta tala, based on a 10 cycle distributed as 2-3 + 2-3). Conversely, while Carnatic theory contains a number of prime N cycles, in practice most are non-prime. In the Sulapta system of talas, variants of the Dhruva tala (often constructed with a *laghu* comprised of four beats) as constructed by a laghu of either three, four, seven, or nine units, produces meters of N cycles with cardinalities of either 11, 14, 17, 23, and 29. "Where the laghu equals three, the result is an unproblematic beat cycle of the form 3-2-3-3. For the other talas there are serious violations of maximal evenness. Moreover, when the laghu is five, seven, or nine, the short "beat" is considerably less than one-half the duration of the long, and thus serious contradictions result. Consequently it is doubtful that these talas represent metric patterns."[52]

Table 2.12 The amount of re-occurrent meters in Sulada Sapti

Meter	Amount of Occurrences in System
5	2x
6	2x
7	4x
8	3x
9	3x
10	3x
11	3x
12	3x
14	2x

The sheer durational length of the laghu which contain five, seven, and nine beats limits our ability to accurately determine the representative beat cycles. Nonetheless, reductions into beat cycles comprised of twos and three may still be ascertained if the longer laghu limbs contain

[52] London, *Hearing In Time*: 168.

information regarding the representative subdivisions of the ghatis. Instead, what we see is a system which defines larger architectural grouping strategies (segmentation) which generally defy reductionist models of analysis (twos and threes) as premised on smaller subdivisional units.

Rupaka (given that there are less factors with only two segmentations) seems like a more reasonable place to conjecture specific rotations. Rupaka meters in five are derived by adding 2+1 jati (therefore, 2+3), however in eka, which also has a meter in five, we are not capable of defining its rotation (in the reductionists model of twos and threes), indeed, nor for any of the meters of the eka family. The seven beat cycle of Triputa-Tisra is expressed as 3+2+2, while in the Jhampa-Chatusra meter of seven the segmentation of 4+1+2 suggests [2+2]+[1+2], or 2+2+3. The Khanda-Rupaka segmentation of 2+5 suggest either 2+2+3 or possibly the rarely (if ever) expressed rotational expression of 2+3+2 (though unlikely, there is no way of telling). The ten beat cycle of Ata-Tisra is expressed as 3+3+2+2, while the Jhampa-Misra segmentation of 7+1+2 or 7+3 ambiguously reduces. The Matya-Chatusra (a ten beat cycle) has a segmentation of 4+2+4, thus indicating a binary or divisive expression (2+2+2+2+2). Similarly, the Rupaka-Sankeema (2+9) and the Triputa-Misra in (7+2+2) generate ambiguous reductions. Indeed, the talas which incorporate either the jati of khanda, misra, or sankeema, all have indeterminable beat cycles. Thus, only the tyisra and chatusra families are capable of expressing unambiguous beat cycles.

2.12 Related Meters: Metric Modulation

Examining how cultures perceive relationships between differing meters yields a number of insights regarding a process of generating differing meters from a single germinating form, often called metric modulation. London's lack of comparative meter analysis has ultimately

avoided one of the most intriguing and salient features inherent in world music traditions, namely, the perceived relationship between differing meters.

A number of Caribbean and Latin American dance genres suggest very specific modulatory processes between various metric forms. The *contradance* and *quadrille* dance variants which permeated the Caribbean during much of the 19th century have been formally linked to a vast compendium of popular genres, namely, the Cuban *danzon* (which has been formally linked to *son* – the precursor to modern salsa), the Puerto Rican *danza*, the Dominican *merengue*, and the Haitian *meringue* in 5/8.[53] A surprising number of these genres utilize quintuple based meters, some of which include: the well known *aguinaldos*, the songs which mark Venezuelan Christmas festivities;[54] the Venezuelan *fulia*, the *parranda*, the d*iversion oriental*, the *bambuco andino*, the Creole forms of the *mare-mare;*[55] and the Venezuelan *bambuco tachirense*, a style markedly similar to the traditional Colombian bambuco (a popular Colombian style which flourished during the late 19th to early 20th centuries). Many of these quintuple styes may also typically be interpreted in 6/8 or 2/4.

Andres Ramon's observation, that Venezuelan merengue is commonly interpreted by Colombian *joropo* musicians in either 6/8 or 5/8, while merely describing the fact that *golpes* (percussive attacks on the soundboard of guitars) demarcate the relative given meters accents, unfortunately, never fully explains the specific beat level changes which facilitate this modulatory process. Conversely, Frantz Casseus' description of the 'dominant rhythmic' cycle associated with *loa,* one of the Afro-Haitian deities (attributable to the particular rhythms of specific voodoo

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53 Peter Manuel, *Creolizing Contradance in the Caribbean* (Temple University Press, 2009), 1.

54 Isabel Aretz, "Ethnic Musics of the Guianas, Venezuela, and Colombia" (Meeting of Experts on "Musical Traditions in Latin America," Caracas, Venezuela, 1971): 8. http://unesdoc.unesco.org/images/0000/000008/000805eb.pdf.

55 Andres Rodriguez, "Utilizacion de Elementos de la Musica Venezolano para la Ensenanza de la Flauta Traversa" (M.M. thesis, Universidad Simon Bolivar, March, 2007): 6-7, http://www.musicaenclave.com/trabajosdegradopdf/tesisandreseloyrodriguez.pdf.

rituals), aptly describes how percussion based ensembles routinely alter or reinterpret the five attacks of two distinct rhythmic patterns into quintuplets, namely, the rhythm of two eighth-notes followed by three eighth-note triplets or the rhythm of one eighth, one sixteenth, one eighth, one sixteenth, and one eighth-note (21212).[56] Interestingly, Casseus also observes that these three distinct rhythms may be played simultaneously as a means of generating heightened levels of rhythmic tension.

Similarly, it has been proposed that the Haitian 5/8 meringue also emerged as a re-contextualization of the five note rhythmic pattern, known in the Spanish Caribbean as the *cinquillo*, or in the French Caribbean as the *quintolet*. This pattern (2-1-2-1-2, a variant of the tresillo) is an icon of Haitian, Cuban, and Puerto Rican contradanza variants, a pattern which has historically dominated Haitian folk, salon, and popular music, as well as the Puerto Rican danza and Cuban danzon traditions. Indeed, a remarkable amount of the aforementioned styles/genres may be inter-changeably performed in either five or six and Casseus' explanation likely describes the sort of process utilized in the vast majority of the aforementioned quintuple based genres. Similarly, a corpus of traditional English folk-songs have shown the ability to preserve lyrical and melodic characteristics within varying metric interpretations. Songs sung in duple meter are most often alternatively rendered in ternary meters, though one specific English folk song collection reveals the use of three distinct metric renderings (3/4, 4/4, and 5/4) of the popular and well known ballad typically called *Lord Bateman* (a.k.a. *Young Beichan*, Child Ballad No.53).[57]

The earliest known notation of the meter and rhythm of the Haitian meringue is in the *Petite grammaire musicale* (1882), a music primer co-authored by Occilius and Occide Jeanty, a

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[56] Frantz Casseus, *The Complete Works of Frantz Casseus - Volume I: Music for Solo Guitar*, Edited by Mark Ribot, Tuscany Publications, 2003), 11.

[57] Paul Kiparsky, *A Modular Metrics for Folk Verse*, 6-7. http://web.stanford.edu/~kiparsky/Papers/hayes.pdf

father and son team of Haitian composers. Occilius, the director of the *Central School of Music* in Port-au-Prince, and Occide, a gifted composer who eventually became the director of the *Musique du Palais* (the Haitian president's military band), provided two possible notations: the first form consists of five even pulses over a duple meter, while the second form utilizes the traditional quintolet notation of the Cuban danzon (2-1-2-1-2). By the late 19th and early 20th centuries, the performance practice of Haitian meringue shifted from the traditional interpretation of the cinquillo pattern to a lyrical approach which tended to even out the syncopation creating a resultant shift towards an even quintuplet. The alternate transcription of the 'Jeanty' cinquillo rhythm codified what Haitian salon pianists had been doing routinely since the nineteenth century; the application of a rubato style which was intrinsically in line with other cinquillo-based dance genres of the Caribbean, most notably, in the Puerto Rican genre of the *elastic tresillo*. Nonetheless, the unique rhythmic notation of the meringue initiated at least forty years of debate on how the meter might best be notated.

The 'proper' notation of the Haitian meringue exists largely within the social and political constructs that have characterized a history steeped in the complexities of a pre- and post-revolutionary Haitian identity. Often musicians attitudes toward the 'proper' notation of the Haitian meringue have paralleled concerns regarding the best means through which to present Haitian culture to a wider cosmopolitan audience. Justin Elie's (1883-1931) utilization of alternating measures of 2/4 and 5/8 in his composed set of six meringues (*Meringues Populaire* - published in New York City in 1920) underscores a long standing tension in Haitian identity on how best to portray the lineage of the genre. Generally, the advocates of 5/8 tended to view the transcriptive aesthetic as one which reflected its 'African' lineage, while the advocates of duple meter notation saw the need for Haitian music to be broadly interpretable by foreign audiences;

especially American audiences which were viewed as potential consumers of Haitian sheet music, though, only if the rhythms and meters were easily readable.[58]

In Bulgarian music practice the process of metric modulation subsumes either the addition or subtraction of a single 'beat' as a means of establishing one of two new possible meters. Thus, 6/16 may modulate to either 5/16 by subtraction or to 7/16 by addition. Bartok's early transcriptions had created evidence of another approach as exemplified by a source melody which he notated in 10/16 as 2+3+3+2, while one of its variants was transcribed in 6/8 as 1+2+2+1. Bartok's example is notably distinct as the metric variant is established by reducing all beat cycles by one, while the earlier example strictly adheres to additions or subtractions of only one of the attacks of a metric cycles non-isochronous beat subdivisions. Rice further notes that Bulgarian instrumentalists treat melodies in six and seven as naturally interchangeable. While meters in 3/8 and 3/4 are extremely rare, meters such as 6/16 (or 6/8) exists numerously in melodies for *ovaro horos* which, by the addition of a single note, transform naturally to the melodies of the *ruchenitsa* in 7/16 (or 7/8). Extremely rare examples extend the modulation to as many as four distinct meters, as in the case of the song *Tsone milo chedo.* While typically notated in 13/16 it is transformed into the *Petrunino horo*, the *Elenino horo*, and the *Buchimish*, thus forming the four distinct meters of 12/16, 13/16, 14/16, and 15/16.

In traditional Korean court music, the repertoire of *kayagum* and *kasa,* which borrow considerably from the melodic and ornamental traditions of the binary metered folkloric improvisatory styles of *p'ansori*, *minyo*, and *sinawi*, are built around a rhythmic cycle that moves from compound and simple triple meter (3/8 to 12/4) to an additive form of 10/8. A *kayagum-sanjo* performed in its entirety can have up to ten sections (movements) each distinguished by a

[58] Manuel, *Creolizing Contradance,* 225.

slight increase in tempo and conjunct change in meter. The first section, the *chin-yang-jo* is a very slow movement in 3/8 with a metronome marking of roughly thirty five for the dotted quarter note. In the final movements, the meter changes from 12/8 to 10/8 utilizing rapid tempos with quarter notes in and around two-hundred and eight to two-hundred and thirty bpm. These faster movements create complex syncopated polyrhythms and rhythmic cycles which stand out as unusually unique to Far East Asian practice, thus dispelling the "widespread but ill-informed assumption that Korean culture derives from or simply imitates that of China and Japan."[59]

In the kasa repertoire, three songs exist in quintuple forms: two in 5/4 (entitled, *Ch'osa-ga* and *Yangyang-ga*) and a third song (*Sangsa-pyolgok*) utilizing a cycle of two bars of 5/4 (10/4). Further evidence of twenty and ten beat cycles exist in the Korean instrumental traditions of the *Yongsan hoesang, Yomillak,* and *Pohosa* (or, *Hwanghach' ong*). These three instrumental traditions all utilize twenty beat cycles followed by a ten beat variant which employs a simply binary compression of the initial twenty beat pattern. Indeed, many of the ten beat examples utilize an exact (albeit compressed) melodic replication of the melody as initially realized in a twenty beat form. The essential difference between twenty and ten beats is simply one of tempo. While the Korean language does not traditionally have a word for either quintuple or triple meter, these meters nonetheless find a pervasive expression within traditional Korean genres.[60]

The drum patterns of the Yongsan hoesang, Yomillak, and Pohosa all express ten as 3+2+2+3. Similarly, the repertoire with six beat groupings also utilizes two distinct rotational expressions within its binary division. Thus, the drum falls on beats one and three in the antecedent triple subdivision, and on beats one and two in the consequent triple subdivision. "The

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[59] Howard Keith, "Korea: Introduction - Connections with China and Japan," *Oxford Music Online*, http://www.oxfordmusiconline.com.ezproxy.library.yorku.ca.

[60] Lee Hye-ku, "Quintuple Meter in Korean Instrumental Music," *Asian Music* 13, no. 1 (1981): 119.

fact that the antecedent and consequent halves (in both the quintuple and triple meters) have reversed rhythms may be explained by noting that a pair of quintuple bars or triple bars constitutes one musical phrase. If a single type of drum pattern were employed, it would flow on interminably, with no indication of the end of a musical phrase. On the other hand, if the consequent quintuple has the reverse rhythm of the antecedent, the end of the phrase stands out and the musical punctuation is clear."[61] Though the drum patterns in quintuple meters utilize antecedent or consequent halves of a phrase, the lines of the melodic instruments invariably divide the meter into 3+2 regardless of the drums' rotational form.

In addition to the kayagum, the Yongsan hoesang also utilizes a multi-movement work in which each successive section is incrementally faster. The suite is comprised of five movements. The first four movements grow gradually faster while consistently maintaining quintuple meter throughout, while the introduction of triple meter marks the final expose of the comparatively rapid fifth movement. The succession of movements suggests a relationship which deems tempo as relative to meter, thus, the slower the tempo, the longer the meter. The basic rhythm of quintuple meter, as found in *Karak tori* (half-note, quarter-note, and half-note) is transformed into triple meter by simply reducing the half notes of the original basic pattern into that of quarters. Similarly, the sixteen-beat (two conjunct eight beat measures each of which consist of 3+2+3) rhythmic cycle of a kagok song (*Nong*) is altered into a ten-beat rhythmic cycle simply by altering an original note value with that of another. The resultant modification gives the effect of a faster tempo. Indeed, this relationship between quintuple and eight beat rhythms continues to exist in present day practice. Interestingly, traditional Korean music makes no specific use of quadruple meter forms. The following table of meters and their relative tempos accounts for relationships

[61] Idem., 120-121.

which occur in practice.

Table 2.13 The order of time signatures as relative to tempo (slow to fast):[62]

octuple meter	3+2+3 beats
quintuple meter	2+1+2 beats
triple meter	1+1+1 or 2+1
duple meter	1+1

Korean music makes no use of septuple or sextuple meters. In practice the four meters portrayed in the above table have been paired down to just three meters as the antiquated octuple meter has become virtually obsolete with only a few surviving song examples existing exclusively within the kagok repertoire. Korean rhythm, strictly uses the representative ratios of the above table (3, 2, and 1).

Asiatic NI meter traditions are recognized as existing within three distinct sources: the aforementioned Korean multi-movement suites, a genera of Thai theater music in 7/4, and the music of the Uyghurs. While the Korean and Thai examples exist within neatly packaged geo-political borders, the music of the Uyghurs, most generally associated with the Turkic peoples, one of fifty some recognized ethnicities within Central Asia (8.68 million people according to the 2004 Chinese census), does not. Uyghur communities exist throughout Central Asia as well as Pakistan, Kazakhstan, Kyrgyzstan, Mongolia, Uzbekistan, and Turkey. The multi-movement suites of the Uyghur, known as *muqam* employ sung poetry, dance songs, and instrumental sections which are typically performed by small ensembles of singers who are led by a *muqamchi* (lead singer), accompanied by plucked or bowed lutes and the *dap* (a frame drum), though ensembles which present the music strictly as an instrumental form often employ the kettle drum

[62] Idem., 123.

and shawm. Contemporary scholarship acknowledges four distinct regional genres of the muqam: the twelve muqam of the Kashgar-Yarkand region, the *Turpan muqam*, the *Qumul muqam*, and the *Dolan muqam*. While a number of these multi-movement works strictly adhere to common metric forms, a number of muqam may employ meters in five, seven, thirteen, or seventeen (the later two meters existing in the *Turpan*, a six movement suite which is ordered as: an opening 'un-metered' song, a slow song in three, a slow song in either 5/4, 13/8 or 17/8, followed by three songs each in 4/4). Nonetheless, such suites rarely employ more than one NI metered movement which is generally framed by songs in common metered forms.

In the dance tradition of the *zweifacher* (associated with Southern Germany, Austria and Switzerland, though French, Italian and Slovenian dance variants in or near the Alps have also been recorded), the utilization of mixed rhythms, the result of dance steps from both duple and ternary dance traditions, have established a distinct process for generating NI meters. The word zweifacher (its first documented use was in 1780) may be loosely translated as 'two times' or the prefix 'zwei' which may be alternatively translated as meaning not 'two' but instead, 'duality,' or that which exists within a dual condition or state; potentially, an expression which may be viewed as indicative of the two time signatures employed. Differing regional forms of the dance are variously named: *zweifache, zweifachen,* s*chweinauer*, s*chleifer*, *ubern fuaß*, *mischlich*, *neu-bayerischer*, *heuberger* or, *grad und ungrad* in the Bavarian Forest*, bayrischer i*n Palatine*, eintreter* in Upper-Palatine, or as the *mischlich* (literally translated 'mixed one') in the Kuhlandchen and Egerland of the German speaking areas of the Czech Republic. Not only are these dances known by a variety of regionally associative names, but the array of variants are also danced in a variety of ways. Together with traditional dances like the *boarischer*, zweifache continue to form a large portion of the repertoire of the South-German dance tradition.

The zweifacher is usually a mixture of Polka, Waltz, and Pivot steps. A vast compenduim of potential meters invariably emerge, a result of the variously employed combinations of ternary waltz steps (Oom-pah-pah rhythms) and binary pivots ("Oom-pa" rhythm - danced with one step on the 'Oom' beat). A series of Om-pa and Oom-pah-pah measures may constitute a string of pivot, schottische, mazurka, polka, or boarischer steps. Dance steps may vary from region to region as the durational length of 8 pivots, is equivalent to four polkas, or one full Schottische, thus establishing a number of interpretive possibilities.

A number of mnemoic tools are used to aid in the coordination of musicians and dancers. Primarily, the coordinative ease of performance is facilitated through a strong formative understanding of culturally inherent dance steps. Additionally, a number of music ensembles assign a bass percussionist the role of conducting or delineating time through percussive attacks which mark only the 'pah' of the oom-pa dance forms, or the 'pah-pah' of the oom-pa-pa dance forms.[63] Another well known mnenomic aid (as practiced by both musicians and dancers) is the use of lyrics as a means of remembering relative changes in meter.[64]Accordingly, the text and musical structure of the zweifache are clearly co-dependent.

The text of the zweifache has a musical prerequisite which associates each syllable with a beat (tactus) at any given metrical level. Linguistically, accented syllables must coincide with the begining of each measure and correspondent meter. The surface rhythms of the melodies become simple sequences of binary and ternary measures in which each beat (tactus) within each measure is marked with a simple strings of succesive quarter note (or eighth note, if they represent the

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63 "German Dance - Zweifache," http://www.germanfolkdancers.org, accessed October, 2012.

64 Patrizia Noel Aziz Hanna and Robert Vetterle, "Part I: Isochronous metrics, Bavarian Zwiefache: Investigating the Interface between rhythm, metrics and song," in *Towards a Typology of Poetic Forms: From Language to Metrics and Beyond: Language Faculty and Beyond – Internal and External Variation in Linguistics*, ed. Jean-Louis Aroui and Andy Arleo (John Benjamins Publishing Company, 2009): 80.

tactus, or 'beat'). This simple melodic feature greatly facilitates the coordination of all participants. The rhythms of this fundamental text setting (a rhythmic duplication of the tactus) are then offset by the linguistically generated rules which establish the most coherent and musically 'natural text setting,' a result of the specific prosodic feet which most naturally delineate the connection between music and the linguistic rhythms of distinct language groups. Thus, the surface rhythms of these melodies are in part constructed by the trochaic-dactylic rhythms of New High German. Conversely, Middle High German syllable structure creates ternary measures with either two or three syllables and binary measures with either one or two syllables. Thus, Middle High German could not have established a natural and clear demarcation of the metric changes of the zweifache.[65] The emergence of the song text and its relative metric rhythms could only have been established during the more recent stages of the development of the German language. The theory that a prosodic innovation established the foundational premise of the zweifache is largely favored by linguists who generally disregard the counter-claims by German musicologists who tend to support a 'creation theory' which instead propagates the notion of a developmental process instilled through the creative interplay and juxtaposition of well known dance genres.

2.13 Tempo Practices

Bartok's term “hyper-Bulgarian” meters established misconceptions regarding the definitive nature of Bulgarian tempo practice. Bartok's early transcriptions revealed that a small repertory of the Romanian variants consisted of eighth notes in and around 650 bpm (thus, the tactus based on three note groupings is a little over 200 bpm, while the tactus based on two note

[65] Hanna, “Part I: Isochronous metrics, Bavarian Zweifache,” 95.

groupings is a very brisk bpm of 325!). While Stoin's earlier definition had noted that that Bulgarian folk repertoire contains a wide array of tempos, Bartok, in a series of publications and important lectures (the Harvard lecture series) which greatly affected future musicological preconceptions, insisted that Stoin's traditional definition be expanded to include the brisk characteristic nature of tempo. When one compares 'Bulgarian' tempo practices (largely fueled by the Romanian variants) with those of other world music traditions it becomes evident that 'Bulgarian' tempos exist within a broader range and compass than the traditional tempo practices of other world music traditions. In the tradition of Bulgarian scholarship, tempo regions have relegated meters. Thus, a slow song in five is often portrayed in 5/4, while a medium tempo version is interpreted as 5/8, with the fastest of tempos marked in 5/16.

Unfortunately, the vast majority of ethnomusicological articles which describe the tempos of specific world music practices, rarely utilize specific values (i..e., tempos in milliseconds or beats per minute). In many instances, broad descriptive terms, such as 'moderate,' or 'fast,' though largely ambiguous (they are rarely qualitatively quantified within specific ranges e.g., fast [240-300 bpm]), may act as a means of more broadly describing performative traditions. What can be asserted is that 'Bulgarian' tempo practice, like jazz, constitutes a relatively distinct use of tempos well above 300 bpm, and in this sense, these two traditions distinguish themselves from the virtual entirety of world music practices.

2.14 Summary

London's proposed tempo constraints for isochronous meters (i.e., duple and ternary forms) still leaves us with questions regarding the practical range for non-isochronous meter lengths (i.e., cardinalities). Nonetheless, London's suggestion that the complexity of entraining to meters with greater cardinalities seems to be strongly supported in that the majority of actual world music examples aptly suggest the dominance of smaller and more tractable lengths. Given the striking similarity between the proposed meter ranges in the collections of the wazn, usul, and aksak traditions, the inclination is clearly to cap the length of meters to accordingly corespondent to these collections. Nonetheless, meters in seventeen, as observed in the Balkan peninsula and in the music of the Uyghurs (as found in the six movement suite of the *Turpan*), deserve inclusion. In addition, one might be inclined to add meters in twenty, especially in light of their special status in Korean drumming traditions.

As examined earlier, a linear realization of the thirty-five possible meters available in the tala-jati relationships, show the presence of meters in 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 20, 22, 23, and 29. Thus, the noticeable absence of meters in 15, 19, 21, 24, 25, 26, 27, and 28, suggest a system which inherently devalues (to the point of omission) meters with greater cardinalities. At this point, we might keep in mind London's assertion that a system which insists on inordinately long beats lengths (as comprised in the five, seven, and nine beat units of the laghu) produce meters in which the shortest beat (of the beat cycle) are considerably shorter than one-half the duration of the longest beat, thus creating serious contradictions which question the viability of defining these talas as representative metric patterns. Thus, we might best construe these particular talas not as meters, but rather as segmentative strategies in the construction of

mixed additive meter forms. While I have yet to find a specific musical transcription or audio example of a 'traditional' song in a meter of nineteen we might keep in mind Bolzano's insightful comment that the ten-beat cycle in a 19-tone ETS and the 12-beat cycle in a 22-tone ETS are inherently diatonic, and thus are capable of mimicking the structurally inherent smoothness of distributively even and maximally even rhythms. In table 2 (see appendix, Non-isochronous meter extensions of London's metric tree) a utilization of the non-dividable 150 ms floor and the 6000 ms ceiling suggests that tempos at 100 bpm provide the opportunity to hear the very longest possible meter as 10/4, which given the 600 ms quarter note asserts this meter at the very edge of London's proposed ceiling (6000 ms). London's point however is that we are likely to attenuate to this 150 ms floor by dividing our 600 ms IOI into 300 ms IOIs thus more easily facilitating our entrainment of the 150 ms floor. Thus, in the absence of further musical details we are analytically compelled to assert this particular example not as 10/4, but rather as two measures of 10/8. Regardless, the very premise of this chapter was largely to remove theoretically conjectured meters, but rather to draw from the repertory of actual world music practices as a means of extrapolating the scope and range of metric forms. The zweifachen provides a unique example of meters with unusually long cardinalities and shows clear evidence that long beat cycles may be easily entrained when the associative patterns of the beat cycle are intrinsically connected to strong culturally ingrained patterns of memory. The system of merely connecting various dance forms has its strength in that each distinct dance form exists as a fully integrated and understood cultural dialect unto itself, and accordingly the process of connecting seemingly disparate dances is facilitated with some ease. Again we are nonetheless left with the analytical problem of whether the combined dances constitute a single meter or multiple mixed meters.

Importantly, London's notion of the presence of maximally even or perfectly symmetrical

half-measure seems to not bear out in the facts presented in the various studies examined. While all of the meters presented in Touma's list correspond to the proposed maximally even or perfectly symmetrical half-measures, both Fracile and Krustev's presentation of Balkan meter forms show ample evidence of meters which do not correspond with London's proposal. While the majority of Fracile and Krustev's meter are maximally even or perfectly symmetrical half-measures, the presence of a discernable amount of meters which do not fit this criteria, suggest that the proposed ambiguity of the downbeat has not deterred the actualization of these forms. Regardless, what is not in question is that the majority do fit the criteria of ME half-measures, which at least asserts the likelihood that their exists a hierarchy of preferred rhythmic or metric patterns.

CHAPTER THREE

NON-ISOCRONOUS METER SOURCES IN JAZZ

3.1 Tracing Metric Variability

Randy Sandke's examination of the history of metric variability in jazz provides a valuable contribution to a vastly under-represented topic in jazz scholarship. While Sandke offers a number of significant historical examples, his canonization of the jazz waltz as an urban tradition fully excludes the impact of various contributory voices (i.e., rural jazz waltzes and highly syncopated ragtime waltzes). Nonetheless, he aptly describes the first representative ternary (waltzes) and quintuple meter compositions as isolated compositional examples with no discernable connection to the fluidity of the emergent meter movement of the late 1940s.[66]

3.2 Waltzes: Tentative Beginnings

Given the view that jazz is a varigated music in which countless popular music aesthetics, traditions, and practices are absorbed and integrated, we are struck by the rather curious absence of waltzes, especially in light of the amount published within the Americas during concurrent periods. The repertory of early New Orleans dance bands, while including a

[66] Randy Sandke, "Roads Not Taken: Jazz Innovation Anachronisms," *Current Research in Jazz* 4 (2012): 1, http://www.crj-online.org.

small smattering of mandatory waltzes, existed largely as a duple metered tradition, one which paralleled the associative meters of historical African American song genres: the prison songs, ballads, marching band songs, and work songs, in general, what has long been viewed as the historical roots of jazz. Nonetheless, during the mid to late 1800s, waltzes, schottisches, polkas, and quadrilles (i.e., the popular music of the day), were commonly heard and in important African American music centers such as Texarkana (the Piney Woods region of East Texas – an area associated with the first stirrings of jazz), where even the poorest of homes tended to own a second hand piano, it was not uncommon to hear entire African American families singing such pieces as accompanied by the banjo, piano, and fiddle. Thus, the waltz constituted a formidable part of the American musical experience and likely influenced later ragtime composers to dabble in the genre.

In ragtime literature, little attention has been given to the ragtime era waltzes. Ted Tjade's research has recognized over two hundred and sixty waltz compositions by ragtime performers, and while the vast majority of these pieces border on being cliché Victorian parlor pieces, a handful show the legitimate hallmarks of classic ragtime, primarily its associative syncopation as defined by *Christensen's Rag-Time Instruction Book For Piano* (1909).[67] Christensen, who operated a franchise of ragtime piano instruction schools, published a series of self-study instruction manuals which simplified ragtime piano into "three movements," what Christensen, an advocate of the "classic rag," viewed as the three basic syncopated patterns which constitute the fundamental essence of classic rag.

[67] Ted Tjaden, *Ragtime Waltzes* (2006), http://www.ragtimepiano.ca/rags/waltz.htm.

Figure 3.1 Christensen's first of three fundamental ragtime patterns

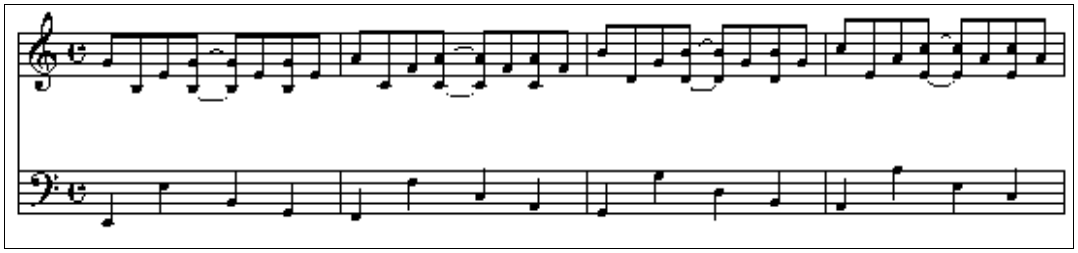
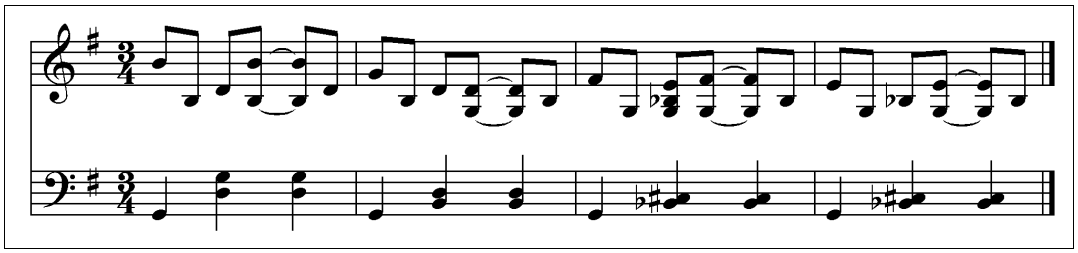
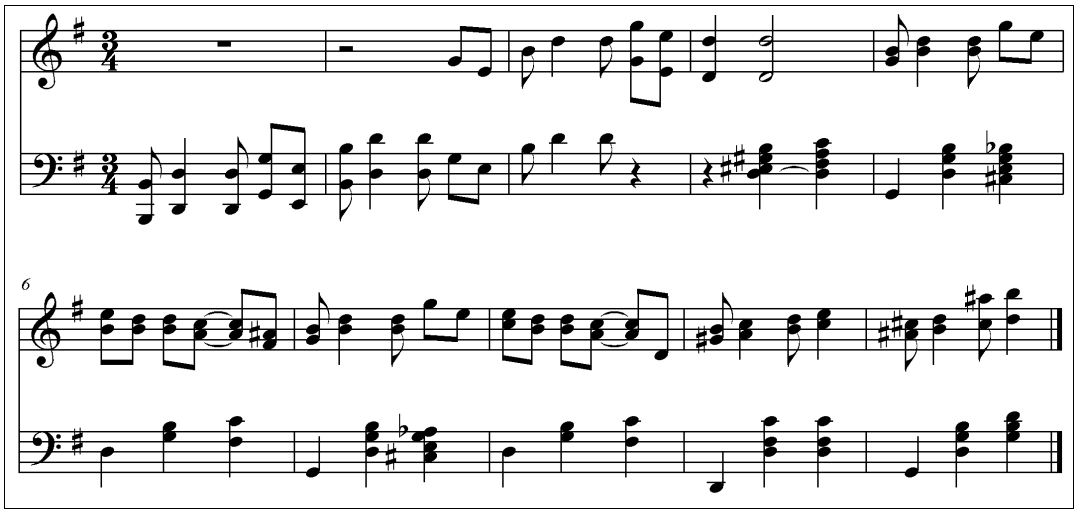


Figure 3.2 Christensen's ragtime waltz



Christensen describes the classic ragtime waltz as a simple subtraction of the last two eighth notes of the "first movement," and while the mere removal of the fourth quarter note as a means of generating another meter may seem rather simplistic (this topic will be more thoroughly addressed at a later point), it is nonetheless, one of several modulatory approaches used by countless world music traditions, most notably in the modulatory practices of the Balkan Peninsula where 6/8 and 7/8 are commonly interchangeable. Tjaden suggests a list of fifteen possible ragtime era waltzes which employ the structure of Christensen's proposed variants. In figure 3.3, the opening measures of Scott Joplin's composition "Pleasant Moments: Ragtime Waltz" (New York, NY: Seminary Music Co.) clearly demonstrates Christensen's prerequisite characteristics.

Figure 3.3 Opening measures of Joplin's Pleasant Moments: Ragtime Waltz



Twelve notable examples of highly syncopated ragtime waltzes (chronologically presented) include: “Echoes From the Snowball Club: Rag Time Waltz” by Harry P. Guy (Detroit MI: Willard Bryant, 1898), “Neome Waltzes” by Louise Gustin (Detroit MI: Whitney Warner Publishing Co., approx. 1900), “Bethena: A Concert Waltz” by Scott Joplin (St. Louis, MO: Bahnsen Music Co. Ltd., 1905), “Pleasant Moments: Ragtime Waltz” by Scott Joplin (New York, NY: Seminary Music Co., 1909), “Tobasco: Rag-Time Waltz” by Charles L. Johnson (New York, NY: Jerome H. Remick, 1909), “Eileen: Waltz” by Ernest J. Schuster (Indianapolis, IN: Warner C. Williams, 1909), “Floreine Syncopated Waltz” by Ernest J. Schuster (Indianapolis, IN: Warner C. Williams, 1909), “Star and Garter Ragtime Waltz” by Alex Christensen (Chicago, IL: Christensen School, 1910), “Mandy's Ragtime Waltz” by J.S. Zamecnik (Cleveland, OH: Sam Fox, 1912), “Glittering Stars: Rag-Time Waltz” by Henry A. Marcella (Copyright: Henry Marcella, 1916), “The Covent Garden: Rag-Time Waltz” by Henry A. Marcella (Chicago, IL: Christensen School of Popular Music, 1917), and “River Shannon: Syncopated Waltz” by James I. Russel (New York,

NY: M. Witmark & Sons, 1922).

The relatively small number of legitimate ragtime waltzes and the fact that their existence has been concealed by a plethora of unsyncopated waltzes partly explains why a number of scholarly descriptions of early jazz waltzes completely removes the ragtime era waltz from discussion. Indeed, the distinction between rags and early jazz is difficult to assert as the repertoire of countless early jazz bands (e.g., the ODJB) consisted of ragtime and early dance music.[68] Barry Kernfeld, whose article on early jazz waltz genres (*The Grove Dictionary of Jazz*), while positioning rural jazz string and jug bands firmly within the associative traditions of jazz, completely avoids all mention of ragtime. Similarly, Sandke's characterization of the relative obscurity of early jazz waltzes avoids all mention of a possible connection between ragtime and the early history of the jazz waltz. Conversely, Jelly Roll Morton's publisher, Walter Melrose, observed that "All Jelly did was to come along and write additional numbers in the style that goes back to Scott Joplin in the '90s."[69] Similarly, David Oliphant further demonstrates the intersections and discourses that historically connect rag to early jazz.

> During Joplin's St. Louis years, from 1901 to 1907, Jelly Roll Morton was supposedly working on the composition of one of his most performed tunes, *King Porter Stomp*, which has been dated to 1902 or 1905. Joplin apparently added to and arranged what would become *King Porter Stomp*, but according to Campbell Brun, a white pianist who first heard Joplin's music in 1898 in Oklahoma City, Morton and later Joplin himself told Brun that 'Jelly Roll arranged it over again.' True or not, it is clear that Joplin had an impact on Morton, for Jelly Roll himself stated that Scott Joplin was 'known throughout the world as the greatest ragtime writer that ever lived,' a tribute uncharacteristically accorded by Morton to one of his contemporaries. Louis Armstrong even considered Joplin 'the principle source of Jelly Roll's ideas.'[70]

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[68] Edward A. Berlin, *Ragtime: A Musical and Cultural History* (University of California Press, 1980), 15.
[69] Dave Oliphant, *Texan Jazz* (University of Texas Press, 1996), 21.
[70] Idem.

In Henry Martins and Keith Waters' assessment, Joplin's most enduring legacy is his interpretive replacement of even eighth notes with that of the dotted-eighth-sixteenth note rhythm. Joplin's composition *Troubadour Rag* (1919) foreshadows the lop-sided lilt of swing eighth notes lines so characteristic of the later jazz era. Edward A. Berlin suggests that after 1913 ragtime composers shifted toward a less syncopated compositional style which made ardent use of the dotted eighth- and sixteenth-note rhythm. Berlin proposes that the new compositional aesthetic of dotted rhythms merely reflected a compositional desire to emulate the performance practices of pianists who were already re-interpreting even eighths as either dotted rhythms (dotted-eighth-sixteenth) or as triplet based rhythms (2+1).[71]

The earliest phonographic legacy of waltzes first emerges among the recordings of early string and jug bands, going back at least to “Missouri Waltz” by Dan and Harvey's Jazz Band (1918, Col. 738), and including other notable examples by the Memphis Jug Band such as “Jug Band Waltz/Mississippi Waltz” (1928, Vic. 38537), the “Mississippi River Waltz” (1928, Victor -38537-A), and “Jug Band Waltz” (1928, Victor-38537-B). By the 1930s, the depression and the devastating effect of the radio on record sales reduced the output of jug and string band phonographs to a virtual standstill. These early rural based waltzes, with their lively dance tempos and syncopated rhythms, accompanied the notoriously 'hot' rural barn dances. Comparatively, the urban dance genres centered around highly syncopated and lively duple metered songs, while the rarely utilized waltzes were comparatively staid and rhythmically stiff. The earliest recordings of waltzes in the style of early New Orleans jazz are two examples recorded in 1920 by the *Original Dixieland Jazz Band* (ODJB).

[71] Berlin, *A Musical and Culture History,* 149.

> Perhaps it was the management of the Palladium that suggested the band add waltzes to their repertoire. In any case, the two instances that were released, *Alice Blue Gown* and *I'm Forever Blowing Bubbles*, though not the most inspired material, show the band comfortably adapting their New Orleans ensemble style to good effect, with the cornetist slightly embellishing the lead, the clarinetist embroidering quasi-ad-lib obbligati, and the trombonist sliding through its tenor harmonies and counter lines.[72]

Another impressive example of an early jazz waltz composition is James P. Johnson's piano piece "Eccentricity" (1921, Newark, New Jersey, QRS 1011000, though it was first recorded as a piano roll in 1918, New York, Artempo 12997). Interestingly, this highly syncopated piece begins with an introduction in 4/4, which is followed by a repeated vamp in three. Sandke points out that 4/4 introductions to waltzes were not uncommon during this period (e.g., Johann Strauss Jr.'s "Kaiser-Walzer Op. 437," Scott Joplin's "Harmony Club Waltz" (1896), and Juventino Rosa's "Sobre las olas").

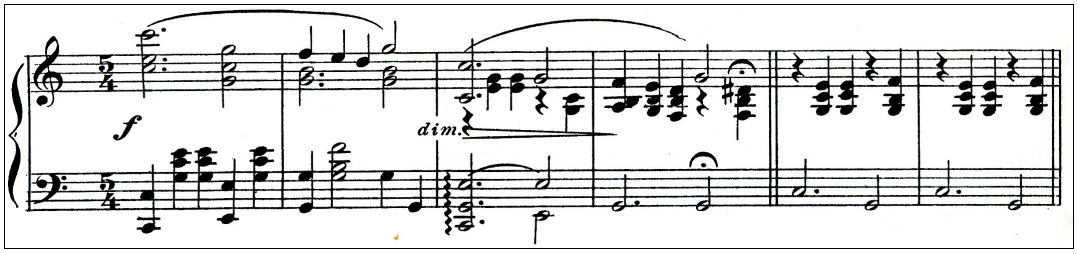
3.3 Early Quintuple Based Examples

Interestingly, the recording history of quintuple metered songs predates the phonographic legacy of jazz waltzes. Composed in 1914 by James Reese Europe (co-written by Ford Dabney), the quintuple based song entitled "Castles Half and Half" represents Europe's collaboration with the enormously popular dance duo of Vernon and Irene Castles. While jazz historians generally credit Bennie Goodman, Artie Shaw, and John Hammond for establishing the first inter-racial groups, the pairing of Europe's orchestra, largely considered to have been the most popular and influential all black orchestra of the early 20th century, and the hugely popular and revered 'high-society' white husband and wife dance team of the Castles, established an inter-racial

[72] Sandke, *Roads Not Taken*, http://www.crj-online.org.

entertainment group approximately twenty years earlier. Additionally, the Castles are credited with helping to popularize a number of ragtime dance forms, most notably the *Turkey Trot*, *Grizzly Bear*, and *Fox Trot*, the later of which was premiered in Irving Berlin's first Broadway show (*Watch Your Step*, 1914) and helped to popularize a dance style which was by far the most popular of American fast dance forms well through the late 1940s (though Vernon Castle acknowledges the fox trots' popularity as an African American dance form well over a decade before the Castles' credited popularization of the form). Americas insatiable craze for new dance styles and the marketable popularity of the Castles (the preeminent dance couple of the Americas) likely prompted the introduction and conjunct marketing of the half and half. While Sandke credits the authorship of the genre to the Castles, its provenance nonetheless remains unclear as the credited popularization of 'new' styles was known to garner considerable monetarily profits, thus creating the potential incentive for claims of authorship.

Figure 3.4 Opening Measures of *Castles Half and Half*



The “Castles Half and Half,” which was published in Leslie Clendenen's book, *Dance Mad: The Dances of the Day* (1914), describes the genre as a 'hesitation waltz' in which three steps occur on the first, fourth, and fifth beat. The genres characteristic texture, which is comprised of measures of incessant quarter notes (accentually divided as 3+2) is somewhat reminiscent of the prevalent textures of the Haitian *meringue* in 5/8. Given the Castles'

willingness to embrace and appropriate African American dance culture (albeit, in a stylized form deemed appropriately suitable in a censored and racially segregated America) one has difficulty imagining that two of the most informed modern dancers of their time would have been wholly unaware of the hugely popular Caribbean and Latin American quintuple based dance genres, especially in light of their repertoires' integration of other popular Caribbean dance genres, particularly the Brazilian *Maxixi* and the Argentinean *Tango*.

Curiously, the other examples of half and half genre, the "Francine Half-And-Half" by Norman Leigh; "The Celebrated Half And Half" by F. Henri Klickmann; and the "Half & Half: A 'Castle' Creation" by Arthur N. Green, were all released in 1914, at which point the style seems to have completely disappeared. All four of these pieces are unsyncopated lyricless multi-strain instrumentals with tempo markings of either *moderato* or *andante moderato.* While Sandke's suggestion that the sudden disappearance of the genre may be explained in terms of its coincidence with the distractions of the 1st World War, I might conversely suggest that its inherently unsyncopated texture was simply incapable of capturing the rhythmic imagination of an American audience which had become accustomed to the associative energy of syncopated African American dance genres. For ultimately, what underscores Christensen's view of serious composition was his assertion of syncopation as a foundational premise.

The next occurrence of quintuple based songs are two rather tentative examples, a recording by Lloyd Scott's Orchestra entitled "Symphonic Scrunch" (January 10, 1927), and a recording by McKinney's Cotton Pickers, written and arranged by trumpeter John Nesbitt, entitled "Stop Kidding - Neckbones And Sauerkraut" *(*July 12, 1928). Both recordings merely utilize a single measure of five which is framed among measures in four (the primary meter

employed). Both examples, while clearly in 4/4, briefly interject a single measure of five in an introductory passage, a phrase which might easily "be taken as a mistake except that it is played in perfect synchronization by the banjo, piano and drums, and is repeated verbatim three times in succession."[73] Remarkably, what follows is a twenty-five year hiatus in quintuple based composition examples. Ternary based examples are similarly scant, with the mere emergence of only three definitive compositional examples through a twenty-seven year span.

3.4 An Emergent Continuum of Ternary Based Practices

Typically, most accounts of jazz history position Fats Waller's composition "The Jitterbug Waltz" (1942, Bb 11518) as the earliest definitive example of the newly emergent tradition of jazz waltzes, what Barry Kernfeld views as an isolated swing era example while encapsulating a continuum of waltz contributions firmly within the associative era of bebop. Chronologically, early bop waltzes include: Thelonious Monk's composition "Carolina Moon" (1952, BN 1603); "Lover" by Rogers and Hart, as performed by Dave Brubeck (1955, *The Dave Brubeck Quartet*, Columbia CL 699); "Waltz for Debby" by Bill Evans (*New Jazz Conceptions*, 1956, Riv. 223); Sonny Rollins's composition "Valse Hot" (1956, *Sonny Rollins Plus 4*, Prst. 7038), which is also included as one of six waltz tracks ("Blue Waltz," "Valse Hot," "I'll Take Romance," "Little Folks," "Lover," and "The Most Beautiful Girl in the World"), two of which ("Blue Waltz," "Little Folks") are compositions by Max Roach on his album entirely dedicated to jazz waltzes (1957, *Jazz in Three-Four Time,* Mercury, 826-456-2); Ahmad Jamal's composition "The Girl Next Door" (1958, *Complete Live at the Spotlite Club 1958*, Gambit 2007); Evans's performance

[73] Sandke, *Roads Not Taken*, http://www.crj-online.org.

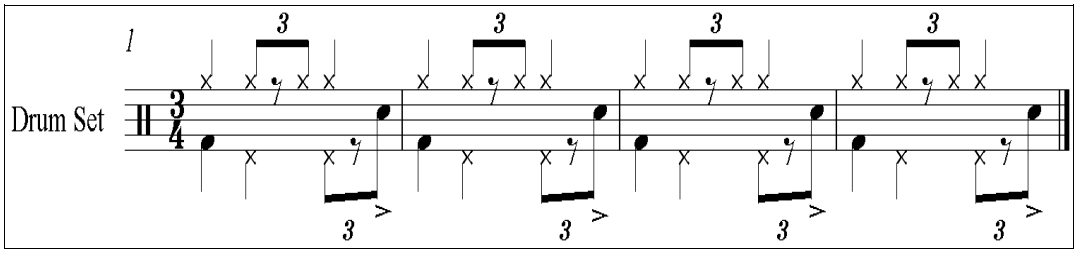
of the standard “Some Day My Prince Will Come” (1959, *Portrait in Jazz*, Riv. 1162); “Bluesette” (1961, ABC-Para 482) by Toots Thielemans; and “Gravy Waltz” (1962, *Softly But With Feeling*, Verve VS 8448) by Ray Brown.

Other ternary meter developments of the period include Miles Davis's composition in 6/8, “All Blues” (1959, *Kind of Blue*, Columbia); Kenny Dorham's composition in 6/8, “Tahitian Suite” (1956, *Kenny Dorham and the Jazz Prophets*, ABC-Para. 122), recorded a mere two weeks after Rollins' recording of “Valse Hot,” and Mongo Santomaria's composition “Afro Blue” (1959, Mongo, Fantasy), a work in 12/8 with a bass line comprised of six quarter notes – a 6:4 hemiola. Such a small and tractable early repertory suggest a form which was still in the very earliest formative stages of its compositional and performative integration. Importantly, it should be noted that approximately half of the aforementioned waltzes were composed by Tin Pan Alley composers, and while the availability of popular waltzes had existed for a considerable amount of time, it curiously remained a largely unintegrated component within jazz repertory until at least the mid 1950s.

In the context of this dissertation, some efforts have been made to trace NI jazz meter practice, and while such specificity is largely a luxury accorded in the context of a supportive academic research environment, it in no way reflects the average listeners' experience during that time. In all likelihood, even the musicians at the epi-center of such developments may have largely been unaware of practices and developments. McCoy Tyner has suggested that the perceived rarity of the waltz continued to exist well through the early 1960s. Responding to the unprecedented success of John Coltrane’s quartet recording of “My Favorite Things” (1961), McCoy claimed that it was probably the only jazz waltz heard since Sonny Rollins' seminal recording of “Valse Hot.” The assumption that popular audiences, not to mention collectors and

recording aficionados, would have heard all the aforementioned repertory, a small and tractable collection of urban jazz recordings (at least up to 1959) seem unlikely, and as Tyner has suggested, audiences were in reality only aware of the most popular representative examples which likely constituted a mere handful at best.

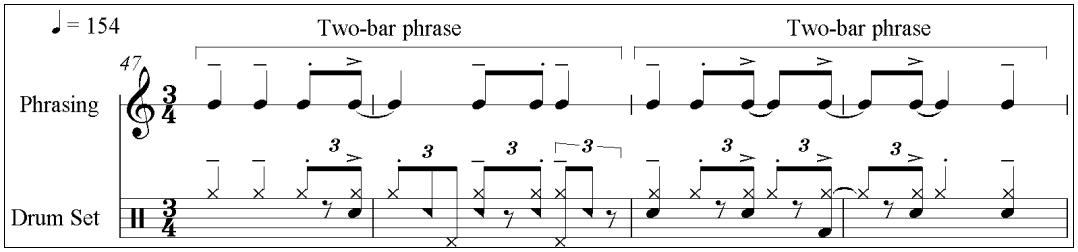
Figure 3.5 *Blues Waltz* bars 1-4: Max Roach's jazz waltz concept



Much of the success attributed to Coltrane's waltzes revolved around the significant contributions of Elvin Jones. Barry Elmes' analysis of Max Roach's jazz drumset waltz patterns (figure 1.5), on his 1957 recording, *Jazz in 3/4 Time* (an album entirely dedicated to jazz waltzes), observes that Roach's accompaniment is more or less based on the same one bar pattern.[74] Roach's approach involves a steady ride cymbal and hi-hat pattern, a bass drum placed on beat one of every bar, and a snare drum which is placed on the third upbeat. Elmes suggests that this overtly conservative approach, while setting a precedent for countless drummers, simply reflected the fact that in 1957 jazz waltzes were still considered to constitute a largely unexplored domain.

[74] Barry W. Elmes, "Elvin Jones: Defining His Essential Contributions to Jazz" (M.A. thesis, York University, 2005): 84-85.

Figure 3.6 *Greensleeves* bars 47-50: accompaniment to the first four bars of the melody



Typical of the period, Jones himself had limited experience with the genre, having recorded only one prior waltz "Glitter and Be Gay" on Tommy Flanagan's trio album *Lonely Town* (1959). In the ensembles' interpretation of "Glitter and Be Gay," only the melody is stated in waltz time while all of Flanagan's conjunct solo choruses are provided in 4/4. Conversely, a significant component of Coltrane's repertoire required Jones to more thoroughly investigate waltz settings. In Jones' seminal recording of "My Favorite Things," he organizes waltz patterns into two-bar cycles, thus expanding the palette of possible grouping strategies as similarly employed in his credited historical use of three, four, and five beat figures which are additively configured as non-isochronous beat cycles at the eighth-note triplet level (thus, 12/8).

> His approach is necessarily different due to his reliance on the eight-note triplet grid. With nine eighth notes to the bar (instead of six), it is impossible to divide a bar of ¾ into two equal halves. Jones' method requires him to award five eighth notes to the first half of a ¾ bar, but only four to the second half. This unequal rhythmic division creates the characteristic 'push-pull' or 'tension and release' effect evident in Jones' drumming on such performances as Afro-Blue and Your Lady. [*sic*][75]

[75] Elmes, "Elvin Jones: Defining His Essential Contributions to Jazz," 87.

3.5 Bebop: An Explorative Revolution

The language of bebop, while having been previously explored in the 1930s by the Swing era heavyweights of Coleman Hawkins, Lester Young, Roy Eldridge, Art Tatum, Duke Ellington, and Jimmy Blanton, nonetheless, distinguished itself from all earlier periods in its use of distinctly brisk tempos. Importantly, faster tempos produce swing lines with less durational dissynchrony between successive eighth notes. The allowable (performatively possible) dissynchrony, or associative lilt between successive eighth notes decreases or increases incrementally as a direct proportional consequence of changes in tempo. Conversely, the markedly slower tempos of the pre-bebop era were particularly conducive to applying the lilt of swing era eighth-note lines, long viewed as one of the most salient and enduring features of jazz.

To construct a view of just how markedly distinct such associative tempos were, it should be noted that the aforementioned Swing-era heavyweights also explored a relatively broad range of tempos. Jimmie Lunceford's (1902-1947) 1934 Decca recording session of the Cole Porter composition “Miss Otis Regrets” (1934) is briskly performed around 290 to 300 bpm. By the mid-1930s, Lunceford's band, crowned the “King of Syncopation” by Fats Waller, had become renowned for their torrid tempos. The Kansas City Orchestra's Victor label recording of the Bennie Moten composition “Toby” (1932), similarly demonstrate brisk tempos in and around 300 bpm. Moten's band, comprised of Count Basie (piano), Eddie Durham (guitar), Hot Lips Page (trumpet), Ben Webster (tenor saxophone), Eddie Barefield (clarinet/alto saxophone), Dan Minor (trombone), Walter Page (bass), and Willie Hall (drums) “went on to define the loose, blues-influenced style, with a four-bar pulse, which became the predominant local jazz genre, and

underpinned the work of later Kansas City bands like those of Count Basie and Jay McShann."[76]

Page's walking bass lines were a radical departure from the stylistically older "two-feel" established by his predecessor, the tuba player Vernon Page. Frank Driggs notes that Kansas City boogie-woogie pianists such as John William "Blind" Boone (1864-1927) established the first instances of walking bass lines. Boone's masterpiece, "Blind Boone's Southern Rag Medley No. Two: Strains from the Flat Branch" (1909) includes one of the first occurrences of a walking bass line and demonstrates how "Boone's development of the walking bass line provided the rhythmic foundation for boogie-woogie piano, and ultimately enabled Kansas City bands to move from traditional 2/4 beat rhythm dominated by the tuba to a more fluid 4/4 rhythm driven by the double bass. Walter Page, a member of the Blue Devils, Bennie Moten's Kansas City Orchestra, and the Count Basie Orchestra, used the walking bass line as a means to revolutionize the rhythm section, developing a hard-swinging style that become the hallmark of Kansas City Jazz."[77] This revolutionary transition from 2/4 to 4/4 in turn provided the template which facilitated Jones' resounding shift to 12/8; a revolution in non-isochronous beat cycles. With Moten's untimely death, the remnants of the band, now under the leadership of Basie, would go on to establish the formative beginnings of Basie's orchestral sound, which by 1937 had established itself as the the premier band of the Kansas City jazz-style. Nonetheless, Basie's sound, while recalling many of the signature traits of Moten's earlier style (in particular, the "riffing" style of the horns), seems to not have inherited the associatively brisk tempos of Moten's band.

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[76] Alyn Shipton, *A New History of Jazz* (Bloomsbury Academic, 2008), 167.

[77] Frank Driggs and Chuck Haddix, *Kansas City Jazz: From Ragtime to Bebop – A History* (Oxford University Press, 2005), 32, http://site.ebrary.com.ezproxy.library.yorku.ca.

3.6 Recording Technologies: The Art of Tempo

The extent to which we can rely on early phonographic technology as a means of accurately depicting the range of performative jazz tempos remains questionable; especially in light of the historical limitations of recording/play-back lengths and their relative implications in the restriction of viable performative tempo ranges. Henry Martin's more general assessment of the limitations surrounding the early recordings of *King Oliver and the Creole Jazz Band*, show a significant discrepancy among the descriptive accounts of performative practice. “The recordings are probably at best only an approximation of the group's live performances. For example, Baby Dodds was required to keep time on woodblocks instead of his usual drums. Certainly the roughly three to four-minute length of the recordings did little to capture their live sound – one listener describes a live performance of 'High Society' that ran to forty minutes!”[78] Though Martin addresses the discrepancy between the available recording lengths and actual performance practice, little has been asserted in regards to tempo itself.

Problematically, the first introduction (1878) of Thomas A. Edison's newly invented (1877) tinfoil phonograph produced recordings which were barely audible; and several play-backs inevitably resulted in the permanent destruction of all recorded information. By 1886, partly fueled by the developments of inventive competitors, Edison resumed his efforts, and in the following year produced a relatively permanent and far more audible recording on wax cylinders. Edison's initial intent was to market the device as a dictation tool, though poor initial sales prompted the notion of developing a small scale production of recordings strictly for entertainment value. The first commercially available phonographs were large, expensive, battery

[78] Henry Martin and Keith Waters, *Jazz – The First Hundred Years* (3rd Edition, Clark Baxter Publications, 2012): 56-57, http://books.google.ca/books?id=qVoWAAAAQBAJ&pg=PT82&lpg=PT82&dq=henry.

driven-units, though by the late 1890s less expensive spring-driven models were sold to the public at large, primarily exhibitors whose performances of the device at fairs and other public places garnered considerable attention and relative profits. Both the wax cylinder and the first lateral-cut discs (patented in 1887 by the American inventor Emile Berliner - *Berliner Gramophone* trademark) produced similar play-back lengths of approximately two-minutes. Dissolved under legal disputes, Berliner Gramophone re-emerged as the *Victor Talking Machine Company*, a company which dominated the market for years, largely the result of its introduction of both the 10-inch discs (1901), and 12-inch discs (1903). The 10-inch (over 3 minutes of music) and 12-inch discs (over 4 minutes of music) recording/play-back times constituted the industry standard until at least the introduction of the (*LP*) *Long-play* recordings (1948). Longer play-back lengths constituted a marketing coup and accordingly, great efforts were made to increase the length of available recordings. Edison, in an attempt to thwart the marketing advantage of the disk responded by producing four and a half minutes of play-back lengths in the introduction of the *Amberol cylinder* (1909). The expiration of pertinent patents for disc manufacturing (1919) inevitably decentralized production, which in turn further facilitating its presence in available markets. By 1929, cylinder technology, which through the 1910s had lost much of its market to disc based technology, prompted Edison to entirely cease all related production.

The consequent dominance of the earliest models of Berliner machines seems to have arbitrarily established the industry standard of 78 rpm, which lasted at least until the advent of the newly improved micro-groove technology of long-play recordings (33 1/3 rpm).[79] While early disc speeds ranged from 60 to 130 rpm (in conjunction with various disc sizes) the standardized format of 10-inch and 12-inch discs at 78 rpm have distinct implications for production. The

[79] Oliver Read, *History of Acoustical Recording The Recording and Reproduction of Sound* (2nd Edition, Howard W. Sams & Co., Indianapolis, 1952): 15.

adoption of an industry standard forced musicians and producers to effectively utilize available recording lengths, largely as an appeasement of consumer expectations which likely associated shorter recording lengths with earlier inferior technologies.

To put the implications of play-back lengths into perspective we might consider the standard thirty-two bar Tin Pan Alley composition within various bpm (beats per minute) settings. Pre-LP 12-inch discs, which were capable of playing over four minutes of music, were largely dedicated to classical, choral, and operatic works, while 10-inch disks were designated primarily for popular musics. Accordingly, all jazz recordings from 1917 to at least 1948 were restricted to just over 3 minutes of available recording/play-back time. This has resounding implications for pre-LP era jazz recordings which utilize thirty-two bar forms. For example, at 60 bpm a single measure of 4/4 takes four seconds. Accordingly, a single thirty-two bar chorus requires two minutes and eight seconds. At this tempo a second chorus is simply not possible. Thus, the ballad tempos associated with Bill Evans exist strictly within the newly emergent liberties of LP technologies. To best illustrate the restrictions imposed on tempos the following chart (table 3.1) not only shows the available choruses at affiliated tempos, but also the correspondent amount of un-used recording/play-back time; a legitimate consumer concern which likely prompted marketing and conjunct production efforts to maximize the potential of the newly established recording lengths.

Lawrence Gushee's analysis of King Oliver's group, show that the ensemble played in three principle tempos, reflecting three compositional types which he lists as: fast/ragtime tempos at about 196-212 bpm, medium/pop song tempos at about 144-180 bpm, and slow/blues tempo at about 108-128 bpm. Gushee's characterization of medium pop songs and fast ragtime tempos speaks nothing of the actual length of such forms, but let us temporarily assume that these two

categories might easily constitute our aforementioned thirty-two bar song form, a staple of both early and later jazz repertoires. The following chart shows that tempos around 144-152 bpm, while under-utilizing approximately one fifth of the available recording time, may easily rectify this problem by simply utilizing standardized arrangements which employ typical four- to eight-bar intros and outros, thus leaving a under-utilized amount of recording time (15% or less). Tempos from 196-212 bpm maximize the performance length of available recording times. The relative absence of thirty-two bar ballad tempos in the range of 40 to 76 bpm becomes increasingly clear. When 40% or more recording time is un-utilized then even the insertion of "eight up-front" fails to significantly alter the dilemma. An extremely small window of salient tempos emerge from about 80 to 104 bpm, at which point the window rapidly shuts as the un-used recording length is again, potentially problematic. Indeed, if the available amount of choruses within respective tempos is not maximized then the problem of un-used recording time is further exasperated.

In reviewing the CD re-issue of Bill Evans' landmark recording of *My Foolish Heart* (1961), Ted Gioia, the jazz critic and music historian, observed that "if the beats were any further apart you might doubt that there was any strict tempo at all.....musicians such as Parker and Gillespie showed how jazz could move faster than anyone thought possible, this trio achieved the same extraordinary results at the other end of the metronome range"[80] Nonetheless, the emergence of ballad tempos must be contextualized within both the creative vision of particular individual artists (and their collectives) as well as the emergent liberties of relative technologies.

While we might expect to locate representative pre-1948 LP ballad tempos within early cinematography, Krin Gabbard's survey of jazz related films suggests that painting an accurate

[80] Ted Gioia, "The Dozens: Essential Bill Evans," review of *Bill Evans: My Foolsih Heart*, www.jazz.com.

picture of African American practice is relatively impossible. “Consider Charlie Parker. At least in terms of what is known to exist, Parker was filmed for fewer than ten minutes during his fourteen years as a recording artist. Bebop was almost entirely ignored by Hollywood during Parker's life, so we can scarcely expect to see him popping up in movies.”[81] Additionally, as Gabbard suggests, the casual racism of the twenties repressed African American content and as such the first jazz recordings in 1917 were entirely by white musicians. One year later, the release of *The Jazz Singer*, while acknowledging black participation in jazz, did so by enlisting a white jazz singer in black-face. Michael Rogin points out that in the 1920s most white Americans associated jazz with white practitioners, crowning Paul Whiteman “The King of Jazz,” Irving Berlin as “Mr. Jazz Himself,” and Sophie Tucker as “The Queen of Jazz.”

While films and pre-LP discs severely limit our ability to accurately access the performative tempos associated with jazz ballads (at least in the context of thirty-two bar forms), we are nonetheless left with a much more accurate account of the brisker tempos in jazz. Accordingly, we may conclude that the emergence of the associative tempos of Parker exemplify an appreciable increase of approximately 60 bpm from the associative tempos of prior eras. Indeed, jazz and Bartok's “hyper-Bulgarian tempos” seemingly share similar tempo ranges and in this sense are distinct from virtually all other world music practices (this uniquely shared tempo range has definitive implications and will be more thoroughly addressed at a later point). While the very fastest Swing era pieces existed in and around 300 bpm, Parker and Dizzy Gillespie would well exceed such tempos, reaching markings as high as 360 bpm.

[81] Krin Gabbard, *Jammin' at the Margins: Jazz and the American Cinema* (The University of Chicago Press, 1996), 6.

Table 3.1 The Implications of tempos and play-back lengths

Bpm/Quarter Note in Seconds	Length of Bar	32 Bar Song	Available Choruses	Un-used recording Time
40 – 1500 ms	6000 ms	3 min 20 sec	1 (= 200 sec)	0 seconds
50 – 1200 ms	4800 ms	2 min 34 sec	1 (= 154 sec)	46 sec = 23 %
60 – 1000 ms	4000 ms	2 min 8 sec	1 (=136 sec)	64 sec = 32 %
63 – 952 ms	3808 ms	2 min 2 sec	1 (= 124 sec)	76 sec = 38 %
66 – 909 ms	3636 ms	1 min 56 sec	1 (= 116 sec)	84 sec = 42 %
69 – 870 ms	3480 ms	1 min 51 sec	1 (= 111 sec)	89 sec = 44.5 %
72 – 833 ms	3332 ms	1 min 47 sec	1 (= 107 sec)	93 sec = 46.5 %
76 – 789 ms	3156 ms	1 min 41 sec	1 (= 101 sec)	99 sec = 49.5 %
80 – 750 ms	3000 ms	1 min 36 sec	2 (= 192 sec)	8 sec = 4 %
84 – 714 ms	2856 ms	1 min 31 sec	2 (= 182 sec)	18 sec = 9 %
88 – 682 ms	2728 ms	1 min 27 sec	2 (= 174 sec)	26 sec = 13 %
92 – 652 ms	2608 ms	1 min 23 sec	2 (= 166 sec)	34 sec = 17 %
96 – 625 ms	2500 ms	1 min 20 sec	2 (= 160 sec)	40 sec = 20 %
100 – 600 ms	2400 ms	1 min 17 sec	2 (= 154 sec)	46 sec = 23 %
104 – 577 ms	2308 ms	1 min 14 sec	2 (= 148 sec)	52 sec = 26 %
108 – 556 ms	2224 ms	1 min 11 sec	2 (= 142 sec)	58 sec = 29 %
112 – 536 ms	2144 ms	1 min 9 sec	2 (= 138 sec)	62 sec = 31 %
116 – 517 ms	2068 ms	1 min 6 sec	3 (= 198 sec)	2 sec = 1 %
120 – 500 ms	2000 ms	1 min 4 sec	3 (=192 sec)	8 sec = 4 %
126 – 476 ms	1904 ms	1 min 1 sec	3 (= 183 sec)	17 sec = 8.5 %
132 – 455 ms	1820 ms	58 sec	3 (= 175 sec)	25 sec = 12.5 %
138 – 435 ms	1740 ms	56 sec	3 (= 167 sec)	33 sec = 16.5 %
144 – 417 ms	1668 ms	53 sec	3 (= 159 sec)	41 sec = 20.5 %
152 – 395 ms	1580 ms	51 sec	3 (= 153 sec)	47 sec = 23.5 %
160 – 375 ms	1500 ms	48 sec	4 (= 192 sec)	8 sec = 4 %
168 – 357 ms	1428 ms	46 sec	4 (= 184 sec)	16 sec = 8 %
176 – 341 ms	1364 ms	44 sec	4 (= 176 sec)	24 sec = 12 %
184 – 326 ms	1304 ms	42 sec	4 (= 168 sec)	32 sec = 16 %
192 – 313 ms	1252 ms	40 sec	5 (= 200 sec)	0 sec = 0 %
200 – 300 ms	1200 ms	38 sec	5 (= 192 sec)	8 sec = 4 %

While the emergence of such tempos centered around the works of Parker and Gillespie, Babs Gonzalez's assessment suggests that the entirety of the movement actually centered around approximately twenty musicians and that by 1947 “bebop” was merely a label used by marketing strategists to describe an array of musical styles of which only some maintained the spirit of its early experimenters. Eric Porter views this spirit of experimentation within a collective ethos as centered around an African-American identity steeped in a culture of black nationalism. The Pan-Africanist “popular discourse” of the 1940’s, which was based on a historical awareness of divergent yet shared experiences under European and Euro-American domination, lead to an aversion to racial categories and assumptions regarding “primitivist” stereotypes, ultimately leading to the resistance of the historical identities to which they were expected to conform.

The emergence of bebop (1940s) as a concertizing music for audiences, radically altered its historical and intrinsic lineage to dance. The language of jazz, while still inherently connected to a rhythmic language with definitive origins in historical dance genres, began (1960s) to explore the newly emergent liberties, particularly in the realm of tempo and steady pulse, the latter of which, while still a central component of most bebop ensembles, could now be altogether abandoned (i.e., the works of Ornette Coleman). The exploration of tempos deemed to be far too fast or slow to provide dancers with a pulse of discernible/perceivable regularity created the impetus towards a strategic facilitation of surface rhythms and subdivisional patterns that corresponded to these 'new' temporal ranges (e.g., ballads with the newly possible thirty-second note subdivision). When asked about the dominant role of rhythm in his improvisational thinking, Gillespie stated that “I hear rhythms, mostly, and then I put notes to them.”[82]

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[82] Alfred Wilmot Fraser, “Jazzology: A Study of the Tradition in Which Jazz Musicians Learn to Improvise” (Ph.D. dissertation, University of Pennsylvania, 1983): 182, qtd. in Paul Berliner, *Thinking In Jazz: The Infinite Art of Improvisation* (The University of Chicago Press, 1994), 158.

The *American Federation of Musicians*' ban on all studio recording activities (August 1st, 1942 to November 11th, 1944) somewhat diminishes our understanding of the developments of bebop during its early formative stages. Accordingly, the 1945 landmark recordings of Gillespie and Parker are what many view as the beginnings of bebop's phonographic legacy; the very first of these releases being the Gillespie/Parker composition "Shaw Nuff," and "Ko-Ko," both of which are distinguished by tempos in and around 300-360 bpm.

By 1945, Gillespie's integration of Afro-Cuban rhythms, successfully highlighted in his 1942 composition "A Night in Tunisia" (co-authored by Frank Paparelli), demonstrated the inherent potential in re-envisioning the cultural sources of historical practice. This marriage between 'new' world music rhythms and jazz, in part facilitated by Gillespie's successful integration, established a new inclusionary climate, which in turn facilitated and fostered further explorative work, particularly as a process which integrates the unique rhythmic insights of world music traditions and practices.

3.7 Emergent Voices: Non-isochronous Meter Practices

The emergence of a continuum in NI meter related jazz practices seems to have largely been spurred by the critical success of Brubeck's album, *Time Out* (Columbia CS-8192, 1959). Despite the commercial success of *Time Out*, the first jazz album to sell a million copies, its explorative work in the realm of meter generated a significant amount of controversy. According to Brubeck: "Goddard Lieberson, President of Columbia Records, chose "Blue Rondo [a la Turk]" and "Take Five" the single from our *Time Out* album, and he had to fight company policy as well as his own sales department to release it. We were told it would never work, since these

pieces were not in four four time and nobody could dance to them [. . .] Since its first release, I haven't been able to play a concert anywhere in the world without someone screaming for Take Five."[83]

Following the critical release of *Time Out* are two other notable quintuple examples: Stanley Turrentine's composition, "As Long as You're Living," (1960, co-written by T. Turrentine and Julian Priester) as performed on Max Roach's album *Max Roach: Quiet As It's Kept*, and Art Pepper's composition "Las Cuevas de Mario," as performed on his album *Smack Up* - both of which were likely in part fueled by the success of Brubeck. In any case, Brubeck's subsequent albums, *Time Further Out* (Columbia CS-8940, 1961), which includes, the 5/4 compositions, "Far More Blue," and "Far More Drums," and the 7/8 composition, "Unsquare Dance," was most certainly spurred by the critical success of his initial explorations in meter. Brubeck's subsequent release, entitled *Countdown: Time in Outer Space* (Columbia, 1962) promisingly expands the repertoire of meters with the addition of: meters in 7/8 in the Brubeck composition "Three's a Crowd," 10/4 in the Brubeck composition "Countdown," and 11/4 in the Paul Desmond composition "Eleven Four." Three additional Brubeck compositions in five ("Castilian Blues," "Castilian Drums," and "Waltz Limp") are also included. Brubeck's entire discography distinguishes this album as the ensembles most concerted effort in NI meter forms, definitively providing the very first examples of jazz performative practice in meters of seven, ten, and eleven. Brubeck's following release, *Time Changes* (Columbia CS-2127, 1963) includes one compositional example in 10/4 ("Unisphere").

The other representative examples of NI metered compositions from the 1960s include: Allyn Ferguson's 5/4 composition "Diabolus," as played on the album, *The Buddy Rich Big Band:*

[83] Juul Anthonissen and Doug Ramsey, *Dave Brubeck – Time Signatures: A Career Retrospective* (liner notes, reissued/remastered 4-CD box, Columbia 52945, 1992).

The New One (1967); Jake Holmes' 5/4 composition “How to Deep my Mind on You,” as played on the album, *Woody Herman: Light My Fire* (1968); Jake Holmes' 7/8 composition “High School Hero,” on the album *Woody Herman: Heavy Exposure* (1969); and two of Johnny Richard's compositions (Quintile [5/4] and *Septour From Antares* [7/4]) as recorded on Stan Kenton's album *Adventures in Time* (1962). The contribution of Don Ellis' NI metered compositions (in addition to his pedagogical efforts) warrants an examination unto its own. This of course is not an extant list (see appendix 1) as the limited capabilities of my search efforts must surely have 'stones unturned.' Nonetheless, it aptly represents the vast majority of historical examples from the turn of the 20th century up to about 1969, at which point, as I had suggested earlier, the overall increase (i.e., 1970s and on) in NI examples severely convolutes the observational potential inherent in an analysis which is contained within a body of relatively tractable sources.

Although Brubeck is largely accepted as a seminal figure in explorative meter practice, his motivations have been viewed as a process which only makes cursory references to the NI meter practices of world music traditions, as his compositional process never explicitly integrated or applied specific traditional practices through a concerted study of such practices. Nonetheless, Brubeck's recordings confirmed that a performers mastery of historical jazz aesthetics could still be capable of maintaining and capturing idiomatically coherent swing lines even in meters foreign to historical practice. Similarly, Kenton's first commercial release of compositions in metrical cycles of five and seven further supported the notion that skilled improvisers could still swing in differing meters. Kenton, who remained unfazed by the poor reception of *Adventures in Time*, continued to arrange and perform NI meter compositions until his final recordings in 1976.

3.8 Critical Reception

While Brubeck is often cited as the earliest known use of NI meter practice in jazz it may in fact be the albums unfloundering popularity which inadvertently propelled such claims as Lennie Tristano's (1919-1978) utilization of quintuple and septuple meter on his self entitled album *Tristano* (1956, Atlantic 1224) was released three years before Brubeck's seminal recording. Recorded in Tristano's home studio in 1954 (or 1955), the composition "Turkish Mambo" is likely the first documented example of true poly-metric jazz. "Via tape multitracking, the blind pianist superimposed five layers of structured time: the steady pulse of a closed hi-hat-cymbal and three (successively entering) piano motifs, one in 7/16- time, another in 6/8, and a third in 5/8. Finally, Tristano used this multi-layered, constantly shifting texture as a back-ground for an improvised piano solo line."[84] This album also includes innovative overdubbing techniques in the composition "Requiem," while two other compositions ("Line Up" and "East 32nd") make use of altered tape speeds. While not generally characteristic of Tristano's style, his album *Descent into the Maelstrom* (1953) also utilizes poly-metric overdubbing.

Unlike Brubeck, the initial critical response to Tristano's albums, an often overlooked figure in jazz history, garnered mixed reviews, though, the second of two Keynote sessions (1947), an album which forecast Tristano's later work in NI meters, garnered considerably favorable reviews, prompting the *Downbeat* journalist Michael Levin to state that Tristano's phrases in 5/4, 3/4, or 6/4 against the pulse of 4/4 assert "no reason to limit jazz to 2/4 and 4/4 for the rest of its existence."[85]

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[84] Peter Nicklas Wilson, "Living Time: Ancient to the Future. Concepts and Fantasies of Micro – and Macro-Time in Contemporary Jazz," *American Studies* 45, no. 4, Time and the African-American Experience (2000): 569.

[85] Eunmi Shim, *Lennie Tristano: His Life in Music* (University of Michigan Press, 2007), 32.

Tristano insisted that drummers remain particularly sensitive to the polyrhythmic implications of his phrasing. According to Jack McKinney, "He considered the drummer as a timekeeper, and he was particularly adverse to drum solos by bombastic players who make more noise than music. He was also averse to drummers who accented beats 2 and 4, as most were in the habit of doing. He wanted a relatively even rhythmic flow from the drummer in order to accommodate his melodic ideas, which emphasized long lines that often superimposed different rhythms over the basic 4/4 pattern."[86] Bassist Peter Ind, with his extensive experience in Tristano's rhythm section, observed that Tristano's polyrhythmic extension of the bop vocabulary was rarely understood by drummers. Attempts to play generic jazz fills between Tristano's phrases led to unusual clashes, thus prompting Tristano to encourage the drummer to never interrupt the basic pulse regardless of the polyrhythmic implications of his phrases. Typical of Tristano's combative style was his assertion that the greatest obstacles in the development of jazz existed among a group of critics who were plagued by the historical paradigm of jazz as an unalterable tradition.

> There are many people who refuse to let jazz grow beyond their capacity to hear and understand it. There are others whose response to jazz is so completely emotional that they are unwilling to concede the aesthetic and intellectual progress that is demonstrated in bebop. There is a group of critics whose inability to understand and discuss bebop forces them to cling violently to the old familiar patterns....The musicians who refuse to yield to the new are a little less objectionable since a feeling of security forms such an important part of any man's existence. On the other hand, if these same musicians deny the validity and the necessity for progress, then they must be ruthlessly disregarded.[87]

Historically, a number of traditionalists and jazz purists have argued that the conventions associated with jazz performative practice would be severely constrained within the unconventional framework of NI meters. Critics maintained that the rhythmic freedoms and

[86] Safford Chamberlain, *An Unsung Cat: The Life and Music of Warne Marsh* (Scarecrow Press, 2005), 57.
[87] Idem.

liberties associated with historical jazz practice, (i.e., hemiolas, three beat figures, anticipation and suspension) are devices which are connected to a polyrhythmic language of surface rhythms which inherently map to a model in which tension and release are constructed in relationship to binary meters. Others branded this explorative period as a contrived commercial gimmick which merely exploited the market potential for works which trumpeted the explorative climate of the 1960s. John Mehegan, a leading theorist and educator of the 1960s and 1970s, even went so far as to claim that "anything that was not in 4/4 could not possibly be considered jazz."[88] Conversely, the highly esteemed jazz writers, Gunther Schuller and Leonard Feather, both of whom held considerable sway in influencing public discourses surrounding jazz, viewed NI meter practices favorably.

3.9 Ellis' Contributions

Historically, jazz has been viewed as a derivative intersection between European and African musics, which while portraying a rather simplistic historical model, nonetheless, describes the fundamental axis of cross-currents and influences. Conversely, the earliest proponents of NI jazz meter practice, Tristano, Brubeck, and Kenton, all largely existed within a field of of NI meter practice which made no explicit cultural references beyond the cultural dialects historically associated with jazz discourse. Accordingly, Don Ellis' overt utilization of 'alternative' cultural sources marks the beginning of a period in the 1960s when a considerable counter-cultural revolution fostered a philosophical paradigm which had aligned itself to the

[88] John Mehegan, *Jazz Rhythm and the Improvised Line* (New York: Watson-Guptill Publications/Amsco Publications, 1962), qtd. in Don Ellis, *The New Rhythmic Book* (The Don Ellis Memorial Library, Ellis Music Enterprises, 1972), 12, qtd. in Sean Patrick Fenlon, "The Exotic Rhythms of Don Ellis" (Phd dissertation,The Peabody Institute of John Hopkins University, May, 2002): 68-69.

various philosophical schools of traditional Asian and South Asian practices. Indeed, Ellis' musical actualization of the 'East meets West' paradigm marks the beginning of a new inclusionary paradigm which ultimately sought to articulate and contextualize jazz in historically foreign practices.

Ellis also marks the emergent beginnings of a correspondent literature which specifically contextualizes jazz composition and arranging within a broader inclusionary field of cultural sources. Conversely, Tristano, Brubeck, and Kenton's exploratory meter work is more fundamentally steeped in a aesthetic of intellectualism (European art music) in that their use of NI meters was generally generated as a self-referential compositional device more in line with the explorative model which characterized the modernist aesthetic of the 1950s.

Ellis' early exploration of time signatures directly referenced his academic studies (1963-65) as a graduate student of the Department of Ethnomusicology at the University of Southern California, Los Angeles (UCLA). Studying under the tutelage of UCLA's North Indian percussion and sitar master Hari Har Rao, Ellis had the fortune of being introduced to other notable South Asian musicians, most notably, Ravi Shankar. Published for J*azz Magazine* in 1965, Ellis and Rao co-authored the article *An Introduction to Indian Music for the Jazz Musician.* In the introductory passage Ellis and Rao boldly state that "Indian classical music possesses the most highly developed, subtle and complex system of organized rhythm in the world. The best and most technically advanced jazz drummer that has ever lived is a rank novice compared to a good Indian drummer when it comes to command of rhythms,"[89] while paradoxically stating that "It should now be easy to see the relationship of Indian music and jazz. A good jazz drummer in keeping (for example) the structure of a twelve bar blues in his head while playing various cross rhythms

[89] Don Ellis and Hari Har Rao, "An Introduction to Indian Music for the Jazz Musician," *Jazz Magazine*, April, 1965, qtd. in Fenlon, "The Exotic Rhythms of Don Ellis," 28.

is doing essentially the same thing that an Indian drummer does. The difference lies primarily in the far greater variety and subtlety (not to mention difficulty) of the Indian rhythmic patterns."[90] The release of this publication coincided with Ellis' formation of the *Hindustani Jazz Sextet (*Rao on sitar), an ensemble which blended classical Indian music with jazz. While the ensemble never commercially recorded, the considerable attention garnered resulted in an important and influential endorsement by Downbeat Magazine and Stan Kenton, who in 1966 collaboratively commissioned Ellis' composition "Synthesis," a work which was simultaneously performed by both the *Hindustani Jazz Sextet* and Kenton's *Neophonic Orchestra*.

Ellis' early recordings also reflect his on-going fascination with tempo and rhythm, namely in his extensive use of accelerandos and ritardandos, primarily as a means for compressing and expanding a proposed temporal envelope. In the liner notes for Ellis's first release, *How Time Passes* (1960), Gunther Schuller explains how the album was inspired by Karheinz Stockhausen:

> Don Ellis joins the growing ranks of musicians concerned with the freeing and expansion of tempo and meter. Once again Ellis's forays into the world of non-jazz contemporary music were the source of inspirations. In this instance, the impetus was his reading of a highly specialized and complex article on the function of time also titled [. . .] How Time Passes [. . .] by the young German avant-garde composer Karheinz Stockhausen. The composition [How Time Passes] makes use of 'increases and decreases in tempo,' which are led by the improvising soloist of the moment. The stretching of tempo is applied also to the the main statement. Quite logically the tempo increases on the ascending scalar pattern. In the current concern in jazz with new time relationships and the elasticity of time, this piece is undoubtedly one of the most successful efforts.[91]

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[90] Idem.

[91] Gunther Schuller, *How Time Passes (*liner notes, LP, Candid 8004, 1960), qtd. in Fenlon, "The Exotic Rhythms of Don Ellis," 18-19.

In the following year, Ellis released his second album, entitled *New Ideas* (1961), which similarly showed Ellis' interest in temporal expressitivity, particularly in his composition "Four and Three" (1956). The composition utilizes a fifteen beat cycle composed of three measures of 4/4 followed by one measure of 3/4. By 1961, Ellis was awarded the honor of the *DownBeat Magazine New Star Award*, and while critics widely acknowledged Ellis' ability as a jazz trumpeter, the overall reception to his compositions remained mixed as many considered Ellis' compositional approach to be far too gimmicky.

Sean Fenlon's PhD dissertation, while examining a number of Ellis' literary efforts, focuses on his most notably pedagogical effort (*The New Rhythmic Book,* 1972), a work which was primarily written to assist members of his orchestra with various strategies in NI meter settings. According to Ellis, a particular challenge was "to learn to tap one's foot unevenly. Usually the 5's come most easily, then the 7's and 9's follow – each one usually being progressively more difficult."[92]

In 1971, the Bulgarian musician Milcho Leviev, the leading jazz composer, film scorer, and pianist in his native country, joined Ellis' orchestra, in turn providing a supplemental chapter with (chapters were also provided by Ellis' bassist and drummer, Dave McDaniel and Ralph Humphrey) additional insight into Eastern European meter strategies. Fenlon also briefly examines Ellis' second pedagogical effort (*Rhythm: A New System of Rhythm Based on the Ancient Hindu Techniques,* 1977), an unpublished book of which only a few extant copies are know to exist. Fenlon notes that this following effort is a more concerted scholarly (incorporating more tutorials with supplemental etudes) attempt, thus avoiding the tangential biographical accounts of Ellis' studies with Rao which so characterize the writing style of the *New Rhythm*

[92] Ellis, *The New Rhythmic Book,* 7, qtd. in Fenlon, "The Exotic Rhythms of Don Ellis," 32.

Book. Ellis' rhythm book first examines groupings in fives and sevens, inevitably addressing longer more complex patterns comprised of elevens, nineteens, and so forth. Additionally, rhythmic super-impositions within constant metrical frameworks are examined. Nonetheless, Fenlon observes that a careful examination of *The New Rhythm Book* reveals that previous articles and quotations make up much of its content and in this sense it fails to add, but instead acts to simply distill Ellis' concepts into a single and tractable source, thus providing a general overview of Ellis' organizational approach to time.

In contemporary jazz, the awareness of Indian music has shifted its focus from the historically dominate role of North Indian Hindustani practice to that of the Carnatic music of South India.

> Since sitarist Ravi Shankar's rapid rise to celebrity in North America and Europe in the early 1960s, Hindustani music has dominated the Western concept of Indian music. Similarly, Hindustani music's dominance in the Western imagination reflects India's colonial history. It is not an accident that the tabla and sitar of Hindustani music, and not the mridangam and vina of Karnatic music, have underscored Western fantasies of an exotic India. Rather, it is by consequence of the centralization of power in the northern half of the subcontinent, and a reflection both of the development of Westernized Indian elites in the north, and ongoing traffic in culture between the metropole and its margins.[93]

Tanya Kalmanovitch's examination of the historical connection between jazz and Indian music positions Shankar's sitar firmly within the soundtrack of America's popular imagination, noting that his connection to Coltrane and the Beatles was part of his meteoric rise which quickly established him as the sole figurehead of the entire Indian classical music tradition. Coltrane's iconic status paired with his deep engagement with Hindustani music introduced countless jazz

[93] Tanya Kalmanovitch, "Jazz and Karnatic Music: Intercultural Collaboration in Pedagogical Perspective," *The World of Music* 47, no. 3, The Music of "Others" in the Western World (2005): 136.

musicians to Indian music. Conversely, John McLaughlin's study of Carnatic practice is likely the first instance of a jazz musician who was not directly referencing North Hindustani music practices. In 1971, following the considerable success of McLaughlin's first incarnations of his *Mahavishnu Orchestra*, McLaughlin enrolled as a student at Wesleyan University where he studied Karnatic music on the vina with Dr S. Ramanathan. "Here he met Karnatic violinist L. Shankar, a PhD student in the ethno-musicology program. They played later that year with Zakir Hussein, son of Ravi Shankar' s accompanist Alia Rakha. Not long after, McLaughlin abandoned the successful Mahavishnu project (in his own words "the loudest and fastest group on the planet!") for the acoustic quartet Shakti in which he collaborated exclusively with Indian classical musicians."[94]

More recently, a number of jazz musicians have come to recognize that the pedagogical systems of Carnatic tala have a specific utility within Western systems of musical education. The aptitude of Carnatic pedagogy in Western jazz pedagogy has recently been formalized in Ronan Guilfoyle's (with whom I briefly had the pleasure of studying with during my studies at the Banff Summer Jazz Program, 2001) book, *Creative Rhythmic Concepts for Jazz Improvisation*, which incorporates a clear framework in which to assimilate Carnatic practice.

3.10 Tracing Literary Sources

In general, literature which constructively engages NI meter strategies remains curiously scant. A brief survey of popular music publications, while showing a general increase in publications which address NI meters, would suggest that major publishing houses have

[94] Idem., 141.

recognized profitable margins in books which address such topics. Unfortunately, the contents of such popular publications also show a marked tendency toward addressing the topic in the shallows of its depths. In the representative publications of North American university research journals, research which examines world music practices exists primarily within the disciplines of ethnomusicology.

While Charles Seeger is credited for offering (at the New School for Social Research in New York) the first known American university ethnomusicology courses (1930s), the definitive establishment of American ethnomusicology programs first emerged in the late 1950s to early 1960s. While both Indiana and Wesleyan University had established small programs, the epi-center of ethnomusicological endeavors existed at UCLA, which under the guidance of Seeger and Mantel Hood, the later of which studied with the great Dutch ethnomusicologist Jaap Kunst, initiated the Institute of Ethnomusicology (1961).[95] During the same period, Princeton, as centered around the music-intellectual powerhouses of Sessions and Babbitt, fostered serious work in the fields of music theory and composition, while Yale, under the influence of Schrade, established the other strong program of its time, one which focused primarily on music history and less on composition and theory.

Some perspective can be gleaned from a rather sparse summary of American ethnomusicology programs. For example, Ellis's graduate work in the ethnomusicology program of UCLA (1963-65) existed during the infancy of such programs and thus his educational experience, while increasingly common-place in contemporary academic settings, was relatively unique for its time. Perhaps the most radical yet obvious difference between historical and present day graduate programs exists in the breadth of a new paradigm of information and accessibility.

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[95] Joseph Kerman, *Contemplating Music: Challenges to Musicology* (Harvard University Press, 1985): 27.

Research which examined the relationship between jazz and Indian music practices was simply unavailable to Ellis. Presently, the research of Gernot Blume (*Blurred Affinities: Tracing the Influence of North Indian Classical Music In Keith Jarrett's Solo Piano Improvisations*), Gerry Farrell (*Reflecting Surfaces: The Use of Elements from Indian Music in Popular Music and Jazz Popular Music*), and Warren Pinckney (*Jazz in India: Perspectives on Historical Development and Musical Acculturation*), among many others, all constitute the scope of similarly related jazz scholarship in a continuously growing body of modern discourse.

Blume's dissertation is a particularly illuminating examination of the relationship between the rubato like pacing of the introductory passage of a raga performance (*alap*), and the temporal strategies employed in Keith Jarrett's solo piano works, in particular the *Köln Concert* (ECM) which was heralded for its contemplative sense of motion and space. Less bound by the temporal regularity of pulse, Jarrett's performances often parallel a number of principles in alap practice, particularly its use of cadential strategies. More recently, two dissertations on Don Ellis have been completed: *Don Ellis' Use of 'New Rhythms' in His Compositions: The Great Divide (1969), Final Analysis (1969) and Strawberry Soup* (1971) (UCLA, 2000) by Wayne L. Perkins, and *The Rhythmic Innovations of Don Ellis: An Examination of Their Origins as Found In His Early Works* (University of Northern Colorado, 2000) by Thomas John Strait. Perkins' dissertation is presented in two volumes. Volume I is an analysis of three compositions by Ellis, while Volume II is comprised of three original compositions by Perkins which demonstrates Ellis' influence in Perkins' compositional utilization of meters in 19/8, 15/8, and 7/4. Perkins includes an eight page biography on Ellis followed by a mere eight pages which attempts to introduce Ellis's rhythmic language, the use of unconventional meters in classical music, the rhythmic aspects of Indian classical music, and the history of metrical construction in jazz, all the while relating this to

Ellis's stylistic developments. To suggest that such content can be thoughtfully engaged in the context of Perkins' limited examination is problematic at best. Indeed, Perkins' rather sparse account of the history of meter in jazz begets more questions than answers. In the greater part of Strait's dissertation he examines Ellis' early compositional use of mixed-meters, polyrhythms, cross-rhythms, experiments with tempo, and metrical displacements. Both Perkins and Strait contextualize their discussion of Ellis's rhythmic process through an analysis of *The New Rhythm Book*.

All of the aforementioned dissertations seem to focus on and generally reflect the great influence which Indian culture has had on the West, and while dissertations which deal with Ellis may introduce elements of Bulgarian music practice, it can be generally asserted that the bulk of such dissertations tend to limit time, location and identity, thus lacking the broader inclusionary scope in an extended panorama of world music cultures, meanings, and practices.

3.11 Academic Course Work

As jazz moved toward a more abstract and inclusive polemic vocabulary, it became of paramount importance to establish an educational mandate which could successfully integrate cultural dialects previously foreign to practices. Accordingly, a number of prominent North American university and college jazz programs have most recently adopted a course catalogue which integrates a number of world music methodologies and systems into integrative programs which seek to assimilate world music dialects into the lexicon of jazz meter vocabularies. The Berklee College of Music presently offers two courses within their Jazz/World Music and Jazz/Global Music divisions: *South Indian Rhythmic Solfege 1*, and *South Indian Rhythmic*

Solfege 2. These courses explore both North and South Indian raga and tala, placing emphasis on the controlled use of polyrhythms and the superimposition of various rhythmic patterns within various metric cycles. Berklee's 2012-13 course catalogue also includes a number of ensemble and composition courses such as: *Playing in Odd Meters*, *New Approaches/Jazz Decomposition*, *Odd Meter Jazz*, *The Music of Steve Coleman*, and *Indian Music Styles and Techniques for Jazz and Contemporary Composition.* Similarly, the New School for Jazz and Contemporary Music offers the course *Advanced Rhythmic Concepts Ensemble*, a course which integrates various rhythmic superimpositions in both isochronous and NI meter settings, metric modulations, and multiple meter settings (mixed meter). Similarly, their course entitled *M-BASE Ensemble* gives prospective students the opportunity to examine the anatomy of M-BASE not as a superficial survey in soloing in NI meter settings, but rather as an extensive examination of the stylistically specific rhythmic strategies employed in the various ensembles of George Coleman, the leading advocate of M-BASE. As a means of liberating one from the conceptual shackles of the bar line students are encouraged to develop musical phrases free from the constraints of ideas constructed within the preconceptive strata of specific time signatures.[96]

This brief overview of some of the progressive programing in American university course catalogues represents a relatively recent trend in academic offerings, however, by and large, this is not indicative of university course programming as a whole. Indeed, the majority of North American course catalogues offer no such courses. Most university music programs still mimic the historical model of musicology (the history of Western art music) first established in European universities some fifty years before the war, particularly, in the universities of German-speaking countries. During the post-war period, the influential ranks of professors in American universities,

[96] The New School for Jazz and Contemporary Music (course/stylistic ensembles), www.newschool.edu.

who were primarily post war time immigrants of the European diaspora, brought with them the conservative and Euro-centric habits of historical academic discourse. Nonetheless, a number of discernible developments in post-WW II music scholarship, particularly, in North American ethnomusicology and theory (neither of which existed in the pre-war model of musicology), are principally explained in terms of the progressive influence of various enabling scholars and institutions. Historically, both Berklee (the oldest operative jazz educational institute in the Americas) and the New School have been at the center of progressive programing. Evidently, these particular institutions have continued to embrace a progressive model. Thus, what appears is the emergence of the first formative stirrings of educational models which extrapolate from the metric and temporal expressitivity of world musics in a newly emergent educational paradigm of inclusionary jazz.

3.12 Non-Scholarly Publications

A body of non-scholarly mainstream publications has also emerged. This literature may be generally categorized as books which either emphasize NI metered sight reading skills, or as books which address NI meters within specific styles or genres (e.g., progressive rock). Sight reading literature with a pedagogical focus seems to predominate. Early representative examples include the Louis Bellson and Gil Breines book *Odd Time Reading Text: For All Instruments* (Alfred Music Publishing, 1968) and Joel Rothman's book *Reading Can Be Odd* (JR Publication, 1963). More recent publications include *The Drummers Guide to Odd Time Signatures* by Rick Landwehr (Alfred Music Publishing) and *Jazz Drum Set Independence: 3/4, 4/4, and 5/4 Time Signatures* by Steve Fidyk (Mel Bay Publishing). A number of books emphasize NI meter settings

in various genres of rock. Representative examples include: *A Funky Thesaurus: For the Rock Drummer* by Charles Dowd (Alfred Music Publishing), *Odd Meter Bass: Playing Odd Time Signatures Made Easy* by Tim Emmons (Alfred Music Publishing), and the third chapter (*Odd Time Signatures)* in the book *Progressive Rock Guitar: A Guitarist's Guide to Styles and Techniques of Art Rock* by Glenn Riley (Alfred Music Publishing). Jamey Abersold's well known play-along series includes the recent publication of *Odd Times: Workout in Odd Time Signatures* (Abersold, 2000).

While a more thorough examination of such publications is beyond the scope of this dissertation, it suffices to acknowledge that the very existence of such literature suggests a discernable level of interest has warranted the publishing industry's continued commitment to a roster of representative works. Briefly examining such literature reveals a propensity toward describing benign surface details which rarely add meaningful or insightful commentary.

3.13 Summation

Interestingly, a number of historical accounts of meter practice have observed a special relationship which exists between differing meters. Christensen's process in which waltzes are simply generated from 'rags' in four and Sandke's observation that American ragtime waltzes are known to employ extended introductory material in four, both demonstrate that composers recognized meters not as isolated expressions, but rather as inter-connected species. In addition, descriptions of the quintuple meter song genre of the 'half and half' as hesitation waltzes similarly describe an intrinsic relationship between differing metric forms.

A resounding body of ethnomusicological research has also uncovered similar links

between NI meters and common practice meters, yet few scholars have engaged in a comparative analysis of modulatory processes. The 21st century climate of inclusionary jazz has also increasingly explored various approaches in metric modulatory processes. Recent theoretical discussions of meter, while rarely engaging in a comparative cultural examinations of metric modulatory processes, has nonetheless contributed a number of important studies which may be industriously combined to assert a more resounding picture of the special relationship between various meters. Perhaps the most striking development in theoretical discussions of meter exists within the body of psycho-acoustical research which has been utilized in an attempt to discernibly delineate the perceptual and cognitive parameters of singular metric cycles. The resultant findings of such research define a workable set of temporal parameters/limits as constrained by relative tempo regions. Such research rarely contextualizes its findings within specific cultural examples. While such theories remain a formidable component of the hypothesized compositional process developed in chapter four, some efforts have been made to separate the body of ethnomusicological research from the relative body of musicological theory. Simply, culturally decontextualized theories fail to assert a broader view of the diverse ways in which cultures specifically express the connection between differing meters.

The most significant historical events that facilitated jazz's contemporary relationship with meter (i.e., NI meter cycles and metric modulation) exist in the historical expansion from 2/4 to 4/4, to 12/8, which in turn facilitated the NI beat cycles first realized in the works of Elvin Jones. While Jones never engaged in metric modulation, his use of the inherent grouping strategies in meters with greater cardinalities, nonetheless expressed the mathematical and aesthetic implications of engaging NI beat cycles.

CHAPTER FOUR

PROPORTIONAL RELATIONSHIPS: METRIC MODULATION

4.1 “Some Other Time” – Shifting Periodicities

The increasingly common jazz practice of recontextualizing the meters of jazz 'standards' (i.e., Tin Pan Alley compositions) has very little literature (pedagogical or otherwise) which specifically addresses a process for generating a wide array of meters from a single song source. This might of course suggest that the process is generally construed along relatively visceral, if not intuitive lines, such that performers of such practices have generally disregarded the need to formalize such a process. Cultural evidence, such as the high level of aptitude for metric shifts among commonly experienced time signatures, especially among well known traditional songs (e.g. “Happy Birthday,” which is easily sung in either three or four), suggest that modulations from quadruple to ternary based meters (or visa versa) are more accessibly facilitated, partly the result of the dominant occurrence of binary and ternary meters; what London would view as the perceptual ground that directs our propensity toward modulatory practices that align to perceptually salient forms. Thus, our ability to entrain to an array of seemingly more abstractly removed time signatures (e.g. 13/8) is still fundamentally premised around the notion that modulatory shifts in meter are best facilitated through the proportional changes within the more

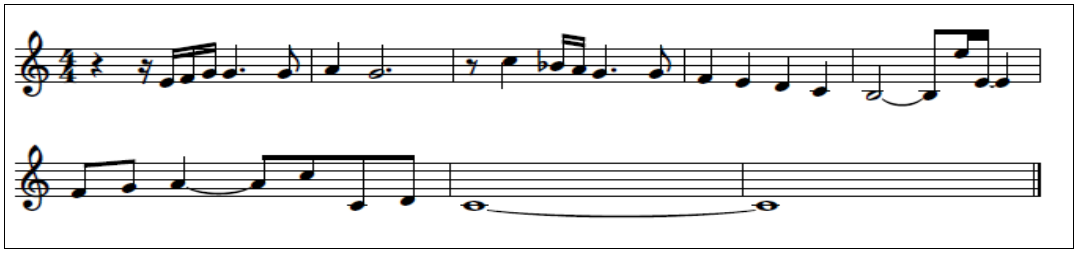
perceptually tractable terrain of twos and threes. Accordingly, shifts from 4/4 to the wide array of time signatures employed in the following demonstrative examples inevitably utilize the perceptual gambit of twos and threes. The proportional shifts proposed suggest a system, or methodological approach, which best enables the perceptual and performative facilitation of meters less commonly experienced or understood.

The various modulatory approaches examined within earlier chapters premise the following metered arrangements, primarily of the jazz standard aptly called “Some Other Time” (Leonard Bernstein, 1944). Bill Evan's recording (2005, *The Complete Village Vanguard Recordings, 1961*, Riverside 3RCD-4443-2), treated with the same interpretive depth which had come to characterize Evan's heralded recordings of numerous standards, helped to fortify the song's position as a staple within jazz repertoires. Admittingly, I was struck by the composition's title, an appropriate metaphor for a song which would ultimately be subjected to a number of modulatory metric renderings. Nonetheless, such whimsical metaphors aside, the piece also utilizes a relatively varied set of rhythms, an important consideration as musical song examples which are rhythmically repetitive inevitably become analytically redundant. Conversely, rhythmic diversity establishes the analytical challenges associated within a small component of the repertoire as a whole. Any glance through the array of typical jazz song books (i.e., Real Books) will aptly reveal the proclivity toward a high degree of rhythmic repetition, either between measures themselves or between the associative melodic phrase lengths. Conversely, the first eight measures of “Some Other Time” not only demonstrates measures which utilize rhythmic divisions more common of the repertoire as a whole (i.e., measures two, four, and six with their respective use of quarters, half, and eighth notes), thus allowing us to address the sort of modulatory shifts more typical of the repertoire as a whole, but additionally providing measures

with a variety of sixteenth note rhythms. This allows not only for an analysis which addresses the more generic rhythmic conditions typical of jazz repertoire (i.e., the shortest durational note values are commonly at the eighth note level), but also allows us the challenge of addressing the small repertory of standards which utilize sixteenth note subdivisions (e.g. compositions such as "Round' Midnight," "Joy Spring," etc.).

Though figure 4.1 utilizes sixteenth note rhythms, it is important to assert that such rhythms can also be interpreted at other subdivisional levels, a common practice in the performative interpretation of jazz lead sheets. Thus, while the first, third, and fifth measures (figure 4.1) all contain rhythmic subdivisions at the sixteenth note level, there nonetheless exists the possibility of shifting the subdivisional levels proportionally. Most typically, proportional shifts among differing durational periodicities reveal interpretive moves from eighth note triplet based subdivisions to that of similarly based sixteenth note configurations. Interpretive shifts among specific rhythmic cells are best facilitated by substituting a given rhythmic cell with its isomorphic counterparts, that which is gesturally or figuratively perceived as most similar (figure 4.2) at the new subdivisional level. Accordingly, rhythmic cells which exist in the durational span of two contain an isomorphic counterpart in three.

Figure 4.1 "Some Other Time" – Measures 1-8



Undoubtedly, even in unaltered metric settings (i.e., 4/4 time) there exists a wide array of interpretations which may radically alter the rhythmic content proposed by any number of lead sheets (which are often interpretive readings themselves). Nonetheless, while the entirety of a dissertation topic might easily examine the various means in which performers alter aspects of the rhythmic content within measures or phrase lengths, what is specifically being addressed here is a procedure which limits the amount of durational contractions and expansions to rhythmic expressions which are perceived to be the closest gestural counterpart at conjunct subdivisional levels. These isomorphic counterparts are generated proportionally.

Figure 4.2 Isomorphic rhythms

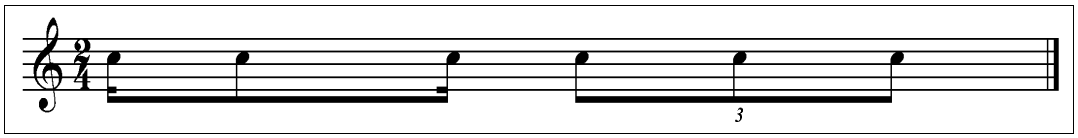


Figure 4.3 mimics the process described in the expressive rubato like interpretation of the quintolet (2+1+2+1+2) into the associative quintuplet rhythms of the Haitian meringue, a process of yielding tuplet groupings (or visa versa) through direct proportional changes to a particular beat in a beat cycle.

Figure 4.3 A quintolet to a quintuplet

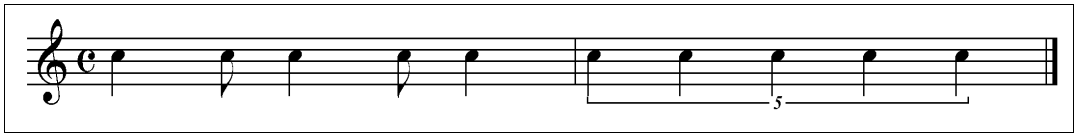


Figure 4.4 recontextualizes the melody presented in figure 4.1 by shifting from the sixteenth note level to the triplet eighth note level, its closest isomorphic counterpart. The

utilization of such rhythmic shifts are commonly employed in performative practice and at no point threaten the melodic or gestural integrity of the original melodic source. Such changes are merely perceived as subtle inflections. Similarly, the common interpretive use of rhythmic anticipation also acts to minimize the perceived interpretive deviation from a source and in no way threatens the core of its melodic identity. Figure 4.5 demonstrates the use of anticipations in conjunction with the newly established subdivisional triplet level employed in figure 4.4.

Interjected anticipations, while never threatening the gestural balance of a melodic source melody, is nonetheless intrinsically connected to increased or decreased levels of syncopation which has resounding implications in the overall aesthetic as heightened levels of syncopation are generally construed as creating a perceived sense of forward motion. Indeed, virtually all performative interpretations of standard song sources may ultimately be explained entirely in terms of durational changes among beat levels in conjunction with the ample interjection of anticipations (i.e., anticipation requires a metric framework).

Figure 4.4 Shifts to isomorphic rhythms at the beat level

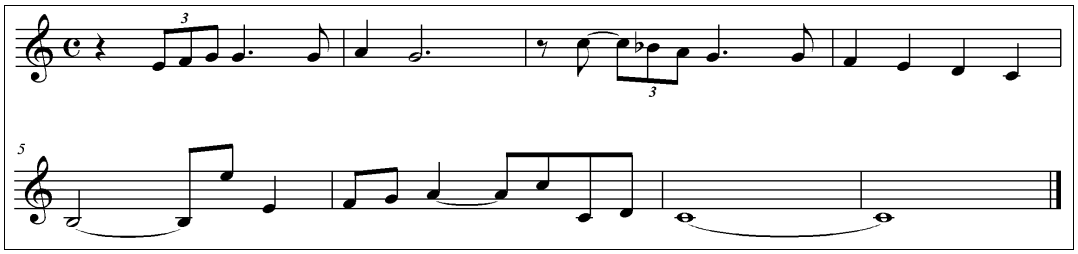
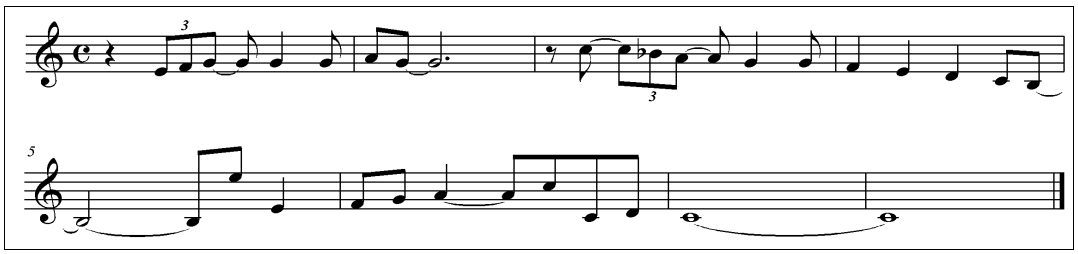


Figure 4.5 With the addition of anticipations



The challenge presented in the *aksak* practice of reducing or expanding a particular beat level (among all conjunct measures) requires one to determine the specific beat level change and how best to facilitate the most representative proportional rhythm (i.e., isomorphic rhythms) at the newly established beat level. Conversely, Elvin Jones' historically documented shift from 4/4 to 12/8, asserts that each and every beat level (in this case the beat level is the tactus itself) is expanded in the accommodation of ternary subdivisions. This process is markedly distinct from the aksak practice of manipulating some, but not all beat levels.

4.2 Integrating differing modulatory approaches

Importantly, the seamless integration of Jones' system (i.e., changes among all beat levels) with that of aksak practice accords us the procedural advantage of abstracting a more immediate path from 4/4 to 10/8, 11/8, 13/8, or 14/8 (meters with significantly greater cardinalities). The fact that meters with larger cardinalities (i.e., ten or more) tend to direct our entrainment to ternary subdivisions (e.g., eleven expressed as 3+3+3+2 versus 2+2+2+2+3) allows us to take advantage of 12/8 as a ternary platform for shifts to similarly large cardinalities. One particular advantage of time-lines which are dominated by ternary divisions, particularly in

the expression of meters with larger cardinalities, is that the conjunct reduction or expansion of beat levels is more easily tractable. Problematically, beat cycles in meters with large cardinalities, constructed predominantly with twos rather than threes, may, in certain instances, establish an inordinately monotonous and excessive amount of beats in a beat cycle (e.g. 19/8 as 2+2+2+2+2+2+2+2+3). Conversely, time-lines which are predominantly constructed with threes reduce the amount of beats in a beat cycle which further increases our chances of entraining to a more tractable field of numeric operatives (e.g. 17/8 as 3+3+2+3+3+3 rather than the less salient beat cycle of 2+2+3+2+2+2+2+2). Thus, the *aksak* practice of deriving modulatory shifts through the expansion or contraction of only one specified beat level, accords us, by virtue of the simplicity of the initial shifts from 4/4 to 12/8, a more accessibly facilitated introduction of meters which would otherwise seem to be more abstractly connected to the meter originally sourced. In particular, it allows prospective students to create a visceral path to meters which might otherwise be construed as abstractly conjectured constructs (i.e., abstractly contrived from a source). This two tier path to meters predominated by ternary subdivisions may inevitably be discarded when prospective students have aptly internalized the comparatively simplistic shifts at the level of tactus (4/4 to 12/8), thus allowing students to focus on generating the possible non-isochronous meter options through beat level changes. In compositions with sixteenth note based subdivisions (e.g. “Some other Time”), shifts to Jones' 12/8 grid are most easily constructed by recontextualizing the sixteenth note configurations into eighth note triplets (e.g. beat two in figure 4.4).

Figure 4.6 Jones' proportional changes at each beat level

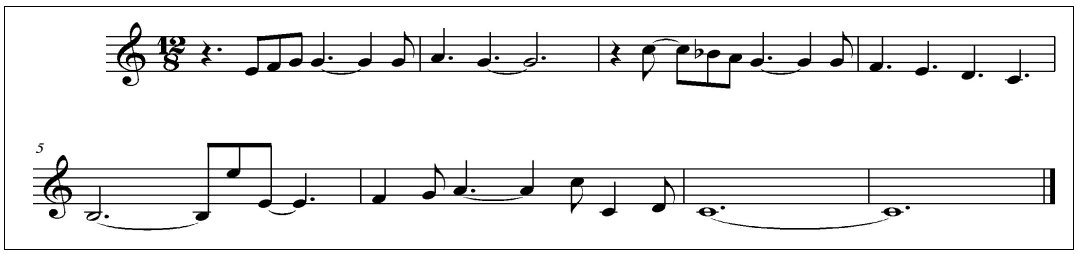


Figure 4.7 demonstrates the aksak practice of reducing each half measure by a single eighth note. Meters in 4/4 which experience changes at each half measure facilitate shifts to 3/4 or 5/4 (figure 4.9), while expansions or contractions which are restricted to a single half' measure facilitate shifts to meters in 9/8 or 7/8. Similarly, contractions or expansions of 12/8 half measures produce meters in 11/8 or 13/8 (at the measure), while changes at both half measures facilitate shifts to meters in 10/8 or 14/8.

Figure 4.7 Reduction of 4/4 at both half measures

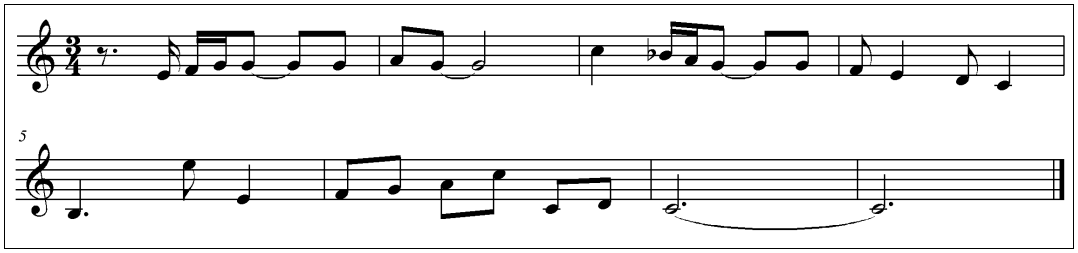


Figure 4.8 is generated by reducing the second quarter note of each half measures (in this case the beat cycle of 2+2+2+2 becomes 2+1+2+1). Critically, a number of these rhythms might be repositioned to more strongly coordinate with downbeats, thus reinforcing the implicit accents of the given meter at hand (in particular, the opening three sixteenth notes might subsume a less syncopated rhythm thus reinforcing the downbeat of measure one). In other words, what is being

proposed here is that the proportional changes may merely be used to establish a working template which may in turn be further subjected to a series of rhythmic changes (i.e., rhythmic anticipations and proportional changes). Working templates accord arrangers and composers a fundamental platform for further subjection (e.g. ornamentation).

Figure 4.8 “Some Other Time” in 6/8

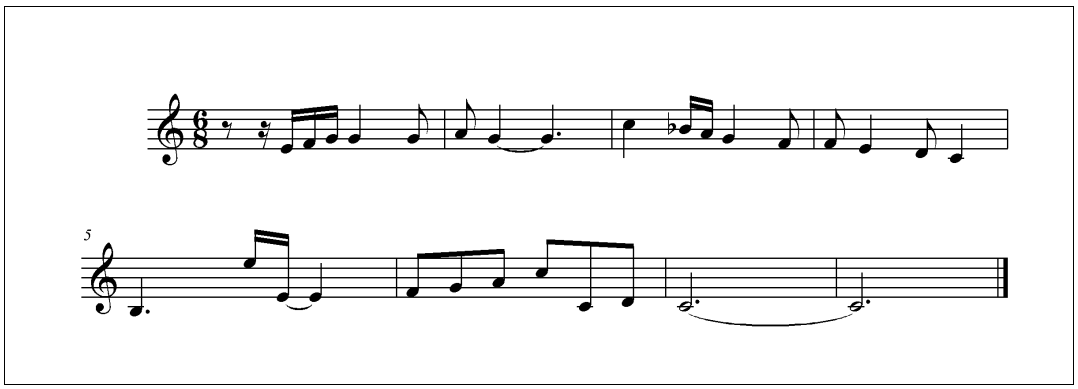


Figure 4.9, an expansion of the third eighth-note at both half-measures, demonstrates the challenge of asserting what specific beat (of the beat cycle) might best facilitate the accordant shift in meter. From a perceptual standpoint, durational shifts of a given beat level are most easily facilitated on accented quarter note beats (in 4/4, traditionally viewed as beats one and three). Nonetheless, in certain instances, the expansion of off-beat eighth notes, while generated more abstractly (in that these reference points are less salient), may nonetheless assert a more artistically or aesthetically pleasing arrangement. Thus, while abstract arrangements might conjecture a wide array of specific places in which proportional changes might hypothetically take place, in actuality our ability to entrain to such shifts is largely dependent upon whether or not such durational changes occur in perceptually salient regions. Generally, these salient regions

align with the start or end of conjunct half measures, though, in certain instances, specific notes within melodic phrases may assert a stronger and more assertive point of departure. As discussed earlier, half-measures are not required to be perfectly even as maximally even half-measures remain as salient divisions in non-isochronous distributions.

Figure 4.9 Expansion of the third eighth note in both half measures

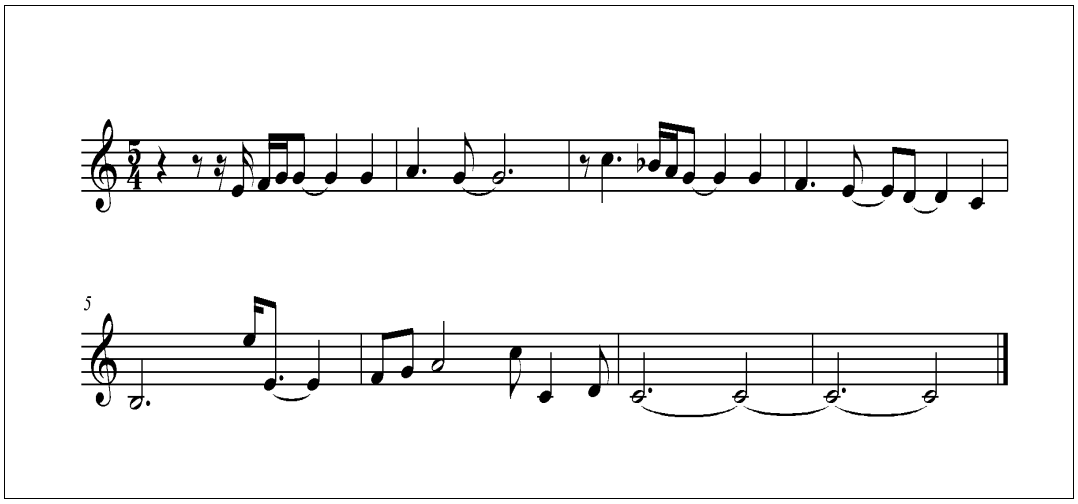


Figure 4.9 is one of the few representative examples which does not utilize proportional changes at the beginning of half-measures. These changes are nonetheless still connected to a perceptual anchor as conjunct beat level changes still coordinate with the onset of the highly salient tactus. Thus, figure 4.9, while departing from durational shifts at the onset of half-measures is still indicative of a number of aforementioned world music examples which change beat levels that do not necessarily coordinate with shifts at the onset of respective half-measures. Nonetheless, these shifts are still coordinated within the region of maximally even half-measures, thus asserting a more maximally even distribution of content. Additionally, the two durational

changes at each respective half-measure tend to be distributed evenly (or maximally) across the measure as a whole such that the two beat levels which experience durational changes are never two consecutive beats in a beat cycle. Christensen's removal of the last beat, a relatively rare example which seems to have no representative counterparts in the literature (i.e., I have yet to find a representative world music example) as a whole, most obviously is best contextualized within compositional examples in which the removal of the last beat of conjunct measures does not radically alter the rhythmic or harmonic integrity of the composition. Clearly, song examples which emphasize melodic phrases with the longest durational values (periodicities) at the end of a measure have the added advantage of establishing the principle of reduction while still preserving a relatively intact portrayal of the majority of the original rhythmic source.

Figure 4.10 Reduction at the half-measure

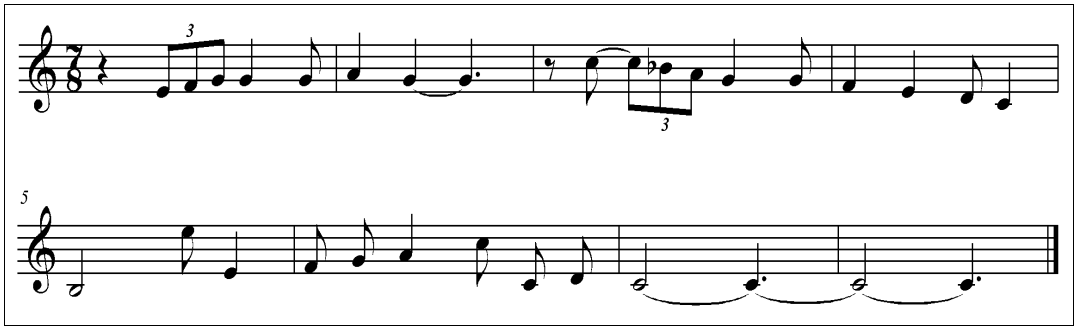
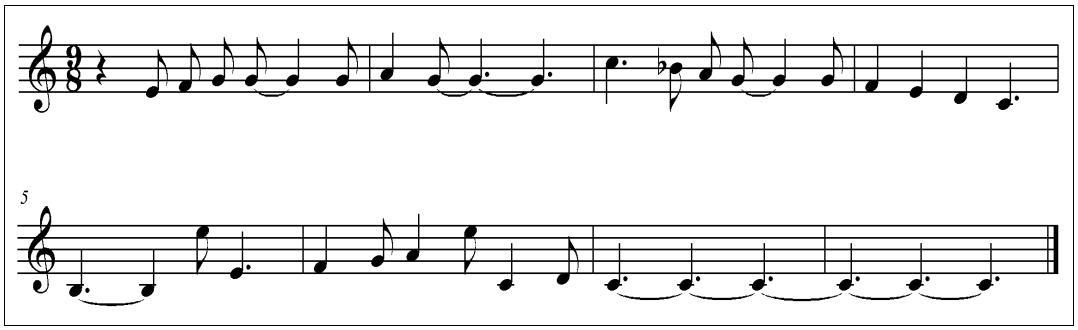
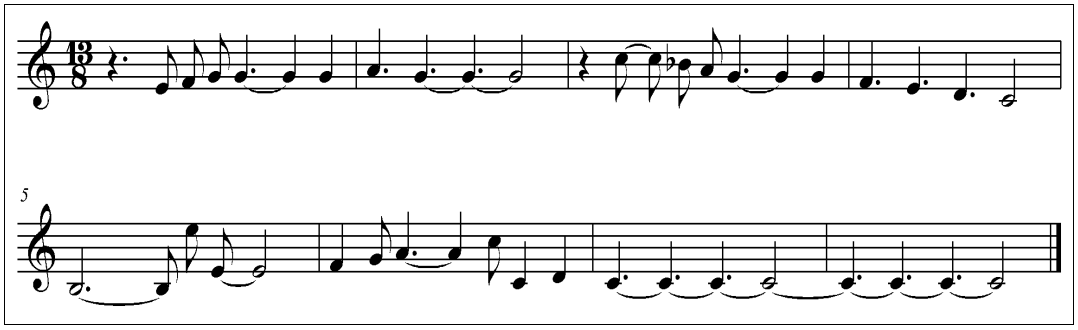


Figure 4.11 Expansion of a single half-measure



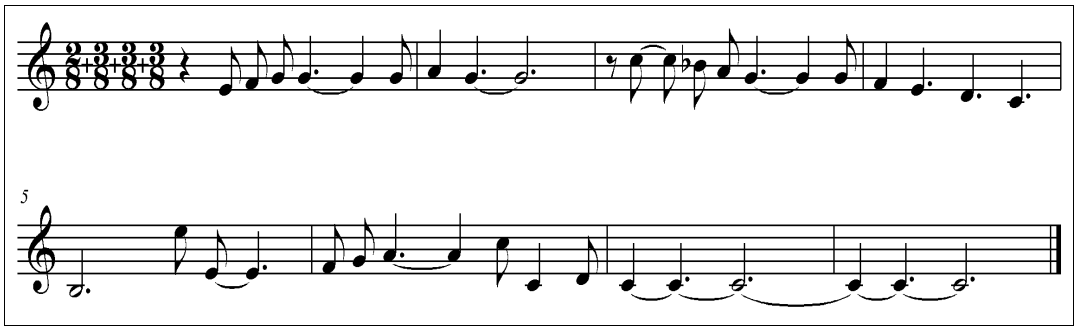
Figures 4.12 through to 4.16 are meters exclusively derived from Jones' 12/8 template. Again, the representative meters are derived proportionally by expanding or contracting a single beat within either single half measures (thus, 11/8 or 13/8) or within both half measures (thus, 14/8 or 10/8). It may be important to reiterate that the proposed meters in ten, eleven, thirteen, and fourteen have all been derived through a two tier process, namely, the initial expansion of each beat level followed by the respective proportional expansions or contraction of either one or two beats within the measure. A number of other meters may be derived through a similar two tier process. Thus, in Jones' model 15/8 is most naturally derived through 5/4. Accordingly, meters with greater cardinalities (e.g. 5/4 = 15/8, 6/4 = 18/8, 7/4 = 21/8) are simply derived at through the relatively natural delineated shifts to ternary divisions at all conjunct beat levels. As previously discussed, maximal evenness establishes perceptual and sensorimotor advantages. Thus, metric cycles such as N = 13, which can be comprised of maximally even six and seven beat measures allows us to optimize our periodic motor behavior to synchronize with the relatively even and smooth transitions associated with maximally even sets.

Figure 4.12 Expansion of 12/8 at the half-measure



Although the additive information provided in the notated time signature employed in figure 4.13 (2+3+3+3 = 11/8) establishes a greater degree of detail, it also subsumes a relatively fixed additive configuration. While fixed additive relationships increase our chances of entraining to any given meter (indeed, meters themselves our in essence defined by fixed proportionally durational configurations), they may also act to limit the potential expression of meters, for in actuality Jones' expression of 12/8 rarely limits the additive configurations to a single fixed source.

Figure 4.13 Reduction of 12/8 at the half-measure



In actuality, Jones' approach moves freely between various additive configurations and it is the push and pull of these various combinations that best facilitates an engaged improvisatory

terrain which configures twos and threes in a transient and improvisatory line of discourse. Thus, Jones' approach necessitates a more fluid less fixed approach to additive configurations and while all of the demonstrative examples have established relatively static surfaces, it should be noted that there exists the potential for reducing or expanding different beats among various measures. Nonetheless, the notion of metric tension implies that the rhythmic surface has in someway contradicted the meter at hand (e.g. heightened levels of syncopation or the avoidance of gravitationally important accents) and accordingly the advantage of establishing a specific additive configuration is that other configurations may be used to interject various levels of deviation or tension, thus establishing a more artistically relevant approach in a style which has historically been predicated on improvisations which control the levels of tension and release. The cadential patterns of Korean drumming traditions similarly demonstrate the notion of tension and release in its formalization of inverted time lines (palindromes) at cadential measures. We also know that palindromes were utilized in Marga tala practice though at this point little can be asserted regarding its relativity to cadential notions of tension and release (I have been unable to locate any representative literature which specifically addresses the function of palindromes in Marga tala practice). Nonetheless, the important point here is that in a dynamic rhythmic landscape we should well expect to experience a more transient surface which expresses varying levels of tension and release. Thus, these various musical examples clearly represent a relatively static portrayal of meter, a limitation largely instigated as a means of highlighting the specific proportional changes being addressed.

Figure 4.14 10/8

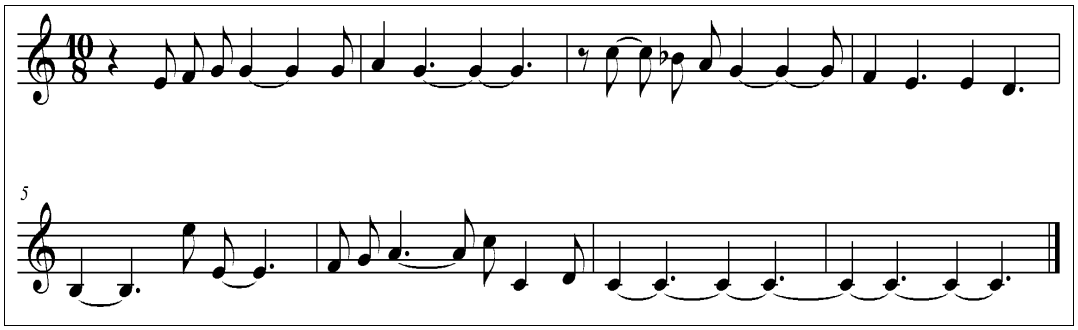
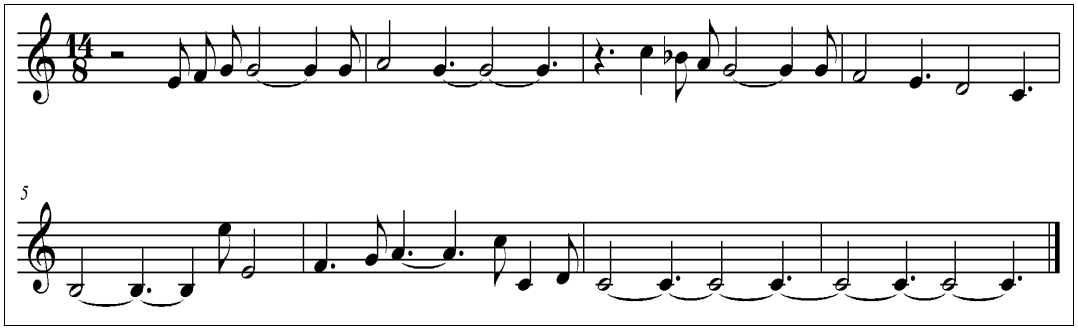


Figure 4.15 14/8



The harmonic or chordal implications of specific meters must be considered. The chords (and lyrics) to the above examples are intentionally omitted partly to acknowledge the diverse ways in which jazz performers (particularly among contemporary practitioners) harmonize standard repertoire. For those wishing to preserve the originally intended harmony problems abound. If distinct chords are relegated to conjunct quarter-notes within single measures than reductions may in certain instances reduce the vertical sonority to a mere eighth-note; a relatively impracticable amount of time for the vast majority of useable tempos. Thus, the preservation of harmonic density (i.e., chords at the quarter-note level) requires an expansion of the relative beat levels. Accordingly, jazz standards which contain a chord per measure allows the arranger a

greater degree of modulatory range. The vast majority of jazz standards tend toward either one or two chords per measure or some combination of the two, and accordingly, approaches which modify the durations of single half-measure, or both half-measures, preserve the originally intended harmony.

Much like manipulating beat durations at the half measure level, one can instead choose to manipulate beat levels in every other bar (e.g. 4/4 + 3/4). Such approaches have the distinct advantage of completely preserving half of the entire compositions measures. Additionally, performers have the added perceptual advantage of being able to make reference to the composition's originally intended meter which in turn likely increases the respective performative comfort levels. For example, 7/4 generated through two measures accords the distinct advantage of compounding two time signatures, each of which are composed of the highly salient and commonly experienced meters of 4/4 and 3/4 . This generated form of 7/4 is arguably the most common non-isochronous meter in present day practice. Figure 4.16 presents the classic jazz standard “All the Things You Are” (Jerome Kern, 1939), while figure 4.17 presents an isomorphic realization in 7/4 (e.g. Brad Mehldau's trio version demonstrates a similar presentation of “All the Things You Are”). From a pedagogical perspective, this mixed particular form of 7/4 facilitates a strong entry point into the world of non-isochronous meters, largely by instilling the prospective student with the sense that meters seemingly foreign may still be experienced along relatively visceral lines. Thus, much like the Bavarian dance forms, uncommonly experienced meters are interpreted as combinations or links between commonly or typically experienced forms.

Figure 4.16 Original source melody for “All the Things You Are”

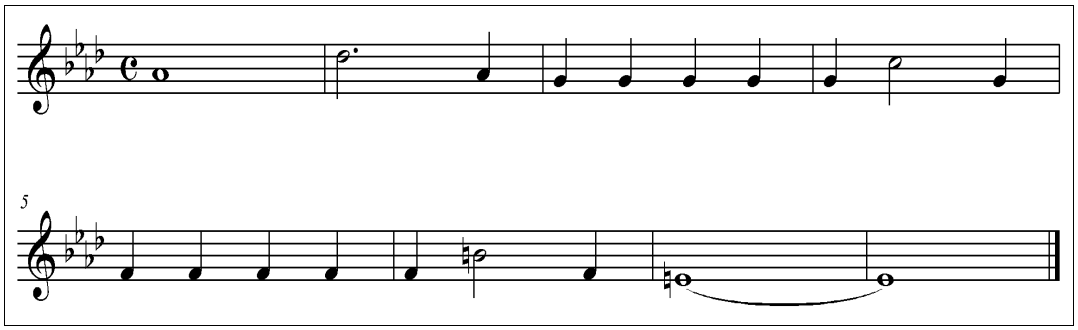


Figure 4.17 “All the Things You Are:” Mixed meter

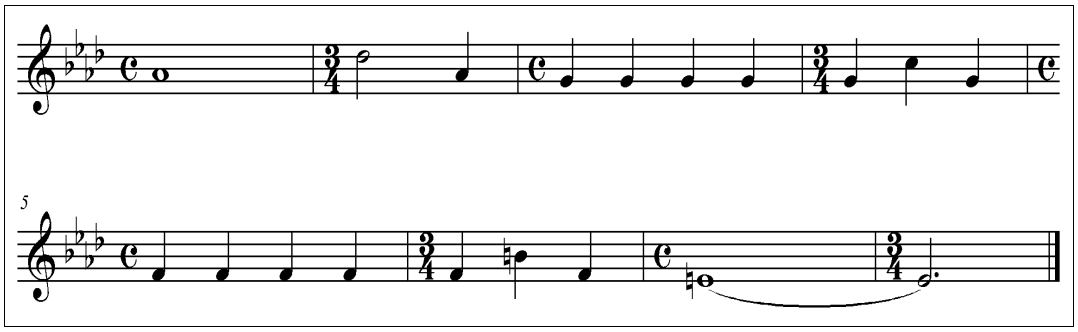
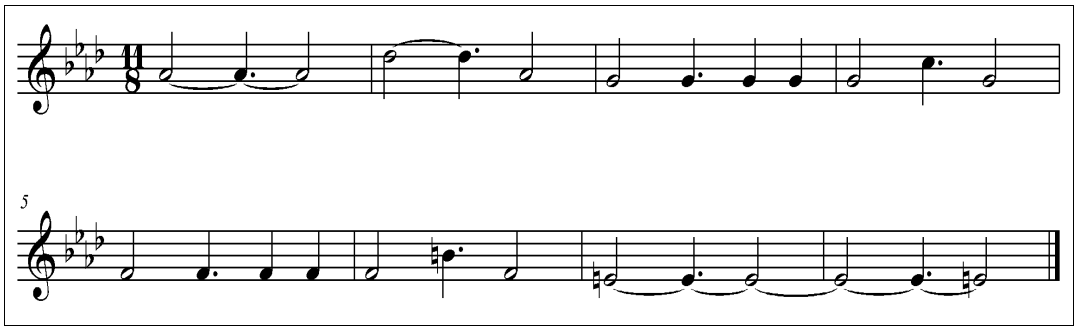


Figure 4.18 “All the Things You Are:” 11/8



Proportional changes have thus far been limited to single measures (or their respective half measures). There also exists the possibility of creating differing proportional changes among conjunct measures which facilitates shifts to meters with considerably larger cardinalities. Figure 4.17 demonstrates the use of maximally even measures (9/8 + 7/8 = 16/8 or 4/4), the first of the two measures being subjected to an eighth note expansion, while the second measure is subjected to an eighth note reduction. Figure 4.17, generated from the modified source melody in figure 4.16, demonstrates a rhythmic reconfiguration which asserts an unsyncopated field which in turn simplifies the potential for facilitating durational modulations at the level of the tactus (versus beats in a beat cycle). Such changes assert a far greater degree of deviation from a given source melody and as such are less capable of defining the previously asserted premise of generating meters with minimal amounts and types of deviations from a source. Additionally, figure 4.16 provides a number of pedagogical advantages as it provides the prospective student of meter studies the opportunity to deconstruct convoluted rhythmic terrains into an overtly simplified rhythmic geography. As well, figure 4.16 demonstrates a rhythmic language which is generally more indicative of a large component of the standard repertoire as a whole, a relatively unsyncopated compositional language (i.e., Tin Pan Alley) which has historically been subjected to the increasingly sophisticated levels of syncopation inherited by many of jazz's greatest practitioners.

Figure 4.18 creates maximally even halves of 19/8 and is generated from Gamer's diatonic time-line as conceived through his research regarding the isomorphic relationships between the 7-note diatonic scale in a 12-tone ETS and the diatonic sets in other ETSs. Substituting either twos for threes, threes for ones, or threes for twos morphs any diatonic time-line from a 12-tone ETS (Clough et al.) into its respective 7-note set in either a 16-tone or 19-tone

ETS (i.e., 12 = 2+2+2+1+2+2+1, or 16 = 2+2+2+3+2+2+3, or 19 = 3+3+3+2+3+3+2). Gamer's research (1967) also demonstrates diatonic sets in 22-, 31-, 34-, 41-, 53-, and 72-tone ETSs, though such cardinalities exist outside of our proposed definition of meter as existing within tractable measures. Nonetheless, Gamer's examination of isomorphic characteristics among salient cardinalities yields an additional means of asserting a modulatory approach which expresses the unique structure of smooth diatonic time-lines thus facilitating a hierarchization of the collection through a system of numeric transposition.

Similarly, figure 4.21 is generated as a maximally even two measure expression of a 19-tone ETS which is derived by altering each measure (in a two-measure system) of the source melody in figure 4.19, a relatively unsyncopated realization of figure 4.1 ("Some Other Time"). Figure 4.20 expands the first measure of figure 4.19 by one eighth note and reduces the second measure by one eighth note which in turn establishes maximally even halves of 4/4 (i.e., 4/4 = 16/8 as maximally even sets of 9/8 + 7/8).

Figure 4.19 Unsyncopated source melody

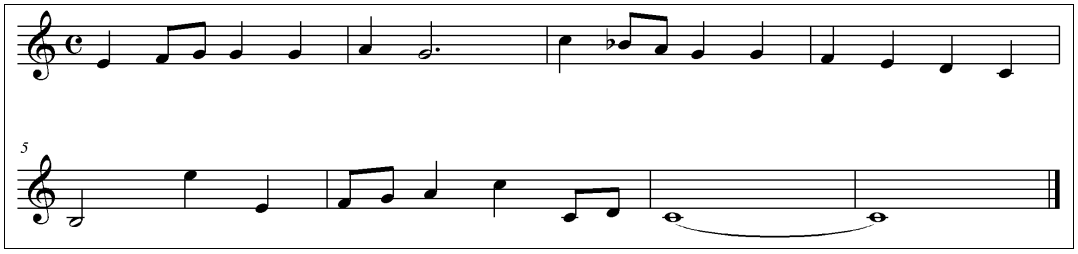
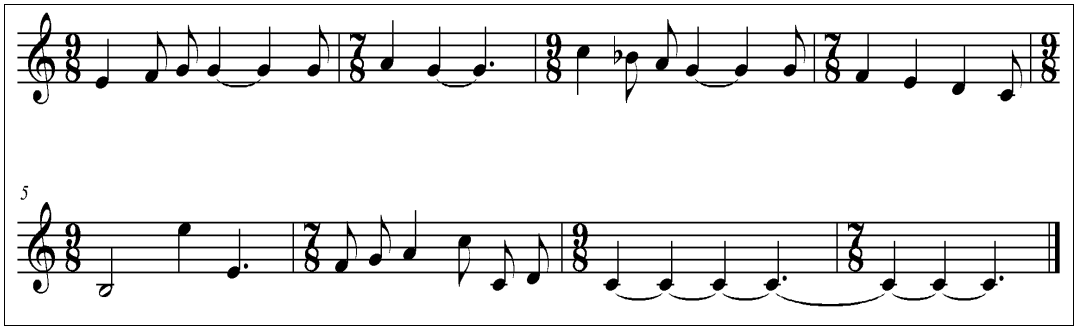
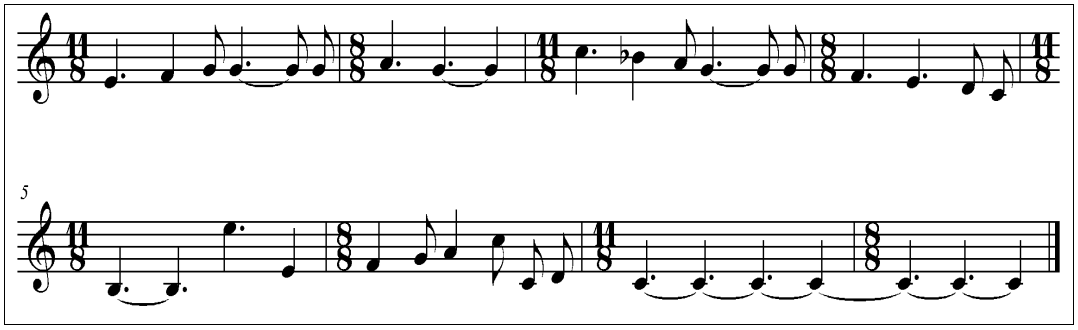


Figure 4.20 Maximally even half measures



Similarly, figure 4.21 utilizes the maximally even two measure set in figure 4.20 as a platform for generating Gamer's proposed diatonic time-line in a 19-tone ETS. Accordingly, the proportional relationships established in the beat cycle of figure 4.20 are inverted thus yielding the relative beat cycle in figure 4.21 (i.e., the two measure 7-beat cycle of 9/8+7/8 = [2+2+2+3] + [2+2+3] becomes 11/8+8/8 = [3+3+3+2] + [3+3+2]). Both figure 4.20 and figure 4.21 preserve the smoothness and distributional evenness associated with maximally even sets.

Figure 4.21 A 19-tone ETS meter



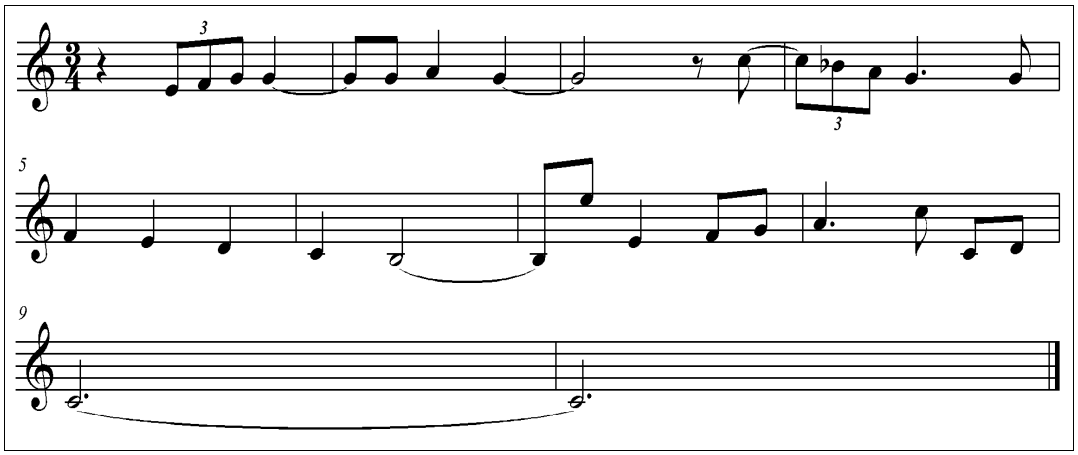
London's theoretically conjectured assertion (given his inability to find a single representative real world music example) that N cycles with IOIs of less than 150 ms create the possibility of establishing non-isochronous groupings which do not perceptually collapse into

twos and threes (i.e., London has proposed the possibility of two and three beat N cycles comprised of 4:3 or 5:3 relationships) has potential significance for a small component of the repertory as a whole. Compositions which contain simplistic melodic rhythms comprised of an unyielding surface of either two or three notes per measure lend themselves particularly well to reinterpretations which utilize 4:3 relationships. Compositions which employ an incessant reiteration of a simple rhythm comprised of no more than two or three attacks per measure (e.g. "A Child Is Born," "Giant Steps," "All the Things You Are," and "Someday My Prince Will Come"), distinguish themselves from the vast majority of repertoire. Thus, given the rhythmic makeup of the aforementioned compositions we should not be surprised in the least to see credible evidence of such pieces in the service of alternative metric interpretations. "Someday My Prince Will Come" lends itself particularly well to interpretation in 11/8 as a two measure N cycle comprised of 4+3+4. While the unprecedented amount of You-Tube videos of alternative metric renderings of the composition "Giant Steps" may in part be fueled by the associative harmonic challenges inherent in multi-tonic compositional settings, in all reality, the simplistic rhythmic terrain of the melody and the fact that "Giant Steps" is already associated with exceedingly fast IOIs establishes a naturally delineated proclivity toward reinterpreted metric casts, especially among meters of greater cardinalities which benefit from the perceptual tractability of decreasing the amount of beat cycles.

Figure 4.22 demonstrates Ari Hoenig's notion of preserving the melodic (and harmonic) source melody with the implied accentual downbeats of the alternative meter sourced. Harmonic shifts still align to the same melodic points and thus the formidable challenge is for improvisors to maintain a chordal accompaniment that rarely coincides with the first beat of a measure. The eight bar source melody in 4/4 is transformed into eleven measures (figure 4.22 does not show the

aforementioned eleventh measure, a bar of 2/4 comprised of a half note tied to the dotted half note in measure ten), ten of which are in 3/4, with an eleventh measure in 2/4. In such cases, the harmonic/melodic placement is ruled by the source melody while the accentual emphasis is ruled by the naturally delineated accents of the alternative time-signature employed.

Figure 4.22 Metric superimposition



To fully demonstrate Hoenig's preservation of a source melody, the appendix provides his arrangement of “Stella By Starlight.” This arrangement, regardless of the accentual surface of the variously interjected meters, fully preserves the original melodic and harmonic placement, albeit with the additional expectation that improvisors demarcate the naturally implied accents of the given meter employed.

4.3 Metronome techniques: Toward a new pedagogy

In jazz pedagogy, meter studies remain in their infancy as educators rarely provide students with an integral platform in which to understand and approach the assimilation of non-isochronous meter practices in a thorough and meaningful way. Nonetheless, important pedagogical contributions have been recently made that meaningfully address various systems for the development of non-isochronous meter practices. A particularly important tool in the potential arsenal of pedagogues lies in the recontextualization of practices historically associated with the use of the metronome.

The metronome, first patented in 1815 by Johann Maelzel, has historically been used by composers as a standard reference for tempo. On the other hand, performers have been somewhat divided on the issue of whether or not such a device is capable of asserting a heightened level of musicality. The proponents of metronomes, while waging the arguments of its critics, have importantly acknowledged that only a handful of musicians fully understand the associative techniques of its practice. Frederick Franz's book, *Prelude: The Musician and the Metronome* (1947) is widely acknowledged as the first publication which addresses the associative techniques of metronome practice. In chapter one (Metronome Techniques), he states:

> There are two schools of thought among musicians concerning this use of the metronome— one opposed and the other favorable. "Practicing with a metronome" has been criticized by some musicians as "making you mechanical." In some instances such criticism is largely a prejudice, the critic having gained the impression that one starts a metronome and simply continues playing with it indefinitely. In most instances, however, such criticism is excusable since so little has been published on specific techniques of metronome uses. It is hoped that those who oppose its use for learning and improving the control of rhythm will read with tolerance these methods, employed by those who favor it, and perhaps investigate their value by experimenting with one or two of them in their own

teaching or preparation for concerts.[97]

Alexander Bonus' dissertation, a comprehensive history of the mechanization of musicality, asserts that the evolutionary development "of a tradition of use for technologies depends upon developing social, historical, and educational contexts, and this cultural phenomenon is especially apparent in the history of automatic timekeepers and time tellers, Maelzel's metronome included."[98] In response for the need to recontextualize metronome techniques, the Grammy award winning, New York based jazz educator, composer, and trumpet player Dave Douglas, provided a stimulating master class (Banff Performance Arts Center, 2001) which involved the use of the metronome as an aid in the development of non-isochronous meter practices, an approach which has been previously discussed in the context of Selinsky's notion of projecting an isochronous beat level against a non-isochronous beat cycle. Accordingly, Douglas' metronome method utilizes isochronous beats of either two or three beats. Thus, a metronome set to a three beat value, projects IOIs comprised of dotted note values (i.e., either dotted eighths, dotted quarters, or dotted halves), while IOIs comprised of two beat values necessitate projections comprised of either quarter or half notes. Douglas also encouraged setting the metronome to a single attack per measure, which is variously positioned across the stratum of possible beat positions in a beat cycle. Thus, regardless of the meter employed, students were encouraged to utilize every possible position of a single beat comprised of either a single quarter or eighth note per measure (e.g. a metronome set to a single quarter note attack per measure in 5/4 has five possible quarter note positions). Douglas' approach might fruitfully be combined with Selinsky's notion of metric dissonance. That is to say, that students can benefit from understanding that the

[97] Frederick Franz, *Prelude: The Musician and the Metronome (*Office of the Yale University Press, New Haven Connecticut, 1947), 7.

[98] Alexander Evan Bonus, "The Metronomic Performance Practice: A History of Rhythm, Metronomes, and the Mechanization of Musicality" (Ph.D thesis, Case Western Reserve University, 2010): 363, https://etd.ohiolink.edu.

NI meters which are subjected to isochronous beat projections require a specific amount of measures before aligning with a metronome's beat, but more importantly, that each measure before alignment experiences differing relative positions, each with their own unique level of tension. Understanding the areas in a cycle that have increased levels of metric tension (in relationship to an isochronous beat projection) help potential students understand that specific regions (before alignment) are inherently more challenging than other regions of NI meters with projected isochronous beat patterns.

Most metronome techniques encompass the use of the Maelzel metronome, or at least a metronome fundamentally premised on Maelzel's tempo regions (i.e., 40-208 bpm). Jazz metronome techniques, which have paralleled historical meter practices (i.e., 4/4), largely revolve around the notion of mimicking the traditional jazz drumset high-hat pattern on the two and four. Problematically, a jazz metronome technique (i.e., beats two and four) as premised on a Maelzel metronome forces students to deal with a network of tempos based on an algorithm which produces vastly different incremental shifts in bpm markings within respective tempo regions. Thus increases in the accordant tempo regions of a Maelzel metronome are: the slowest tempo region from 40 to 60 bpm increases in increments of twos, the region from 60 to 72 bpm increases in increments of (e.g. 60, 63, 66, 69, 72,) threes, the region from 72 to 120 bpm increases in increments of fours, the region from 120 to 144 increase in increments of sixes, while the last available tempo region from 144 to 208 bpm increases in increments of eights. The associative challenges inherent in the brisk tempo traditions of jazz may in part be fueled by the fact that countless jazz musicians have been taught to use the metronome as a tool to gauge their fluency at various tempos, yet Maelzel's tempo map is inconsistent with the premise of incremental tempo increases, a pedagogical premise in the study of the accordant challenges associated with the

internalization of brisker tempos. Thus, the Maelzel metronome set to beats two and four at a tempo of 144 bpm asserts a relatively dramatic leap of 16 bpm between adjoining tempos (288 and 304 bpm respectively). The advent of contemporary digital metronomes has now rectified this problem as most metronomes now accommodate a greater range (approximately from 30 to 250 bpm) of tempos and progress in increments of ones.

Nonetheless, the network of tempos on the Maelzel based metronomes establishes the same network of tempos utilized in marga tala practice, the 4:2:1 relationship. That is, each and every tempo contains two additional octaves, each separated by 16 tempo markings. Thus, "the frequencies between pitch octaves, such as A 440hz, A 220hz, A 55hz, share a similar relation as the octaves of time, as with 55 bpm, 110 bpm, 220 bpm, etc."[99] The jazz guitarist and educator Mick Goodrick, an avid proponent of metronomes, encourages students to practice emulating all three octaves at any given tempo. "The main idea is that, if you really want to become comfortable within the entire range of the metronome, you need to spend an equal amount of time at all tempos. Of course, within a metronome, there's a whole bunch of possibilities; although their aren't as many as you think there are when you consider the octave factor."[100] Ultimately, Goodrick metronome concept underscores the importance of its use in determining the regions of which you are weakest; thus relegating the majority of your work to strategies for dealing with the accordant tempos.

A particularly unusual metronome, the *Billotti Trinome*, patented in 1963 by the inventors Paul Billotti and Leonard Werner Weiss, established a multi-beat metronome with three beat levers (bell, tick, tock). An additional speed lever (see table 4.1) engages speeds from 19 to 29

[99] Mick Goodrick and Mitch Haupers, *Factorial Rhythm – for all instruments: 4x3x2x1=24* (Mr. Goodchord Publications/Liquid Harmony Publications, 2003), 7.
[100] Idem.

revolutions per minute. The first beat lever, delineates beat one of a beat cycle (bell sound), while the other two beat levers establish various polyrhythms comprised of: 2 against 3, 4, 5, 6, 7, or 8; 3 against 4, 5, 6, 7, or 8; 4 against 5, 6, 7, or 8; 5 against 6, 7, or 8; 6 against 7, or 8; and 7 against 8. In the original patent document, Billotti and Weiss provide notational examples for each representative polyrhythm by showing the isomorphic relationship between the available polyrhythms/meters (e.g. 3 against 4 as generated either through 12/8 or 3/4). Copies of the notational examples from the original patent document have been provided in the conjunct appendix. Table 4.1, demonstrates the speed for each distinct rhythm in a polyrhythmic set and corresponds to the speeds engaged by the Billotti speed lever.

Table 4.1 The relative speeds of a Billotti Trinome[101]

8	152	160	168	176	184	192	200	208	216	224	232
7	133	140	147	154	161	168	175	182	189	196	203
6	114	120	126	132	138	144	150	156	162	168	174
5	95	100	105	110	115	120	125	130	135	140	145
4	76	80	84	88	92	96	100	104	108	112	116
3	57	60	63	66	69	72	75	78	81	84	87
2	38	40	42	44	46	48	50	52	54	56	58
1	19	20	21	22	23	24	25	26	27	28	29

The Trinome, virtually mythologized by its supposed role in John McLaughlin's study and development of polyrhythms (i.e., during his heralded explorative meter work with the Mahavishnu Orchestra), ultimately disappeared entirely from the market only occasionally resurfacing, primarily within the collections of a small entourage of music antique dealers. Nonetheless, a number of musicians have recognized the potential for utilizing a similarly based

[101] Paul Billotti and Werner Weiss Leonard, "A Multi-beat Instrument" (patent: US 3095775 A, July 2, 1963), http://www.google.com/patents/US3095775.

polyphonic multi-beat device. Of course, in our contemporary world, a place where most musicians have a basic working knowledge of various digital audio workstations (DAWs), such a device can simply be constructed. The resurgent interest in the Trinome largely reflects the growing body of metric savvy musicians who seek to organize a pedagogy for non-isochronous meter studies.

4.4 Summary

Indeed, the majority of this dissertation is ultimately centered around establishing various pedagogical protocols for asserting a means in which to actualize the development of NI practices. This protocol is primarily premised on combining theoretically conjectured notions of meter with the insights of ethnomusicological practices, a marriage between historically disparate disciplines. Ultimately, such combined observational forces should provide educators with a descriptive language which imparts a working model for the fundamental operatives in NI meter practices. Educational facilitators should thus be capable of organizing the fundamental differences among the generalized spectrum of world music meter practices, not only as a culturally contextualized practice, but also within the broader scope of theoretically conjectured definitions of meter. Students should inevitably be able to distinguish and define the operatives within distinct metric forms, thus acknowledging the inherent structural components within distributionally balanced expressions of meter (maximally even or distributionally even sets). Additionally, insights regarding modulatory practices should impart prospective students with a pallet of compositional meter approaches which may be utilized in the service of both musical arranging (reinterpreting standard repertoires) and performative practice itself.

In regards to a number of relatively recent technological developments, particularly in the fields of digital audio workstations (DAWs), little has been said. Nonetheless, it should be acknowledged that there exists the potential, particularly in light of relatively recent software developments, to utilize a number of differing temporal toolboxes within various DAWs as a means for proportionally expanding or contracting beat levels. While such proportional changes are presently possible (i.e., with the various quantization and warp tab tools) there is yet to exist a program which intentionally integrates such proportional changes as a 'field command' within the context of recontextualized meters. Nonetheless, composers are still capable of asserting field commands for bpm changes within regions (beats, measures, or entire sections), though such an approach puts the theoretical onus on the composer to establish the fractionally derived bpm change(s) at either the beat level or level of measure for all possible expansions and contractions in various modulatory settings. A number of particularly interesting programs allow composers to hear samples of various meters and lengths which synchronize to variously expanded and contracted beat levels, often with interesting and at times somewhat surprising results. Thus, samples from various metric sources are aligned to a conjectured downbeat and the primary beat level (what the software perceives as the primary audio spikes) for each prospective meter is synchronized. Given a viable market (a considerable case has been previously made for the success in the respective literary markets) it remains likely that DAW programers will respond to an ever expanding niche market by instigating software updates which addresses the needs of contemporary composers and performers who seek an ever expanding pallet of temporal tools.

CONCLUSION

This dissertation, a review and cross-reference of a number of phenomenological (music as heard) and theoretical studies (conceptually conceived), has provided a number of interesting and useful insights regarding the expressive range of meter practices. The representative literature examined has been used as a basis in which to expand the anthropological premise (cross-culturally contextualized) of London's definition of meter. Nonetheless, the compositional and performative application of these findings could be more thoroughly addressed. While "cross-cultural" studies often imply an antidote to the prevailing discourse of Euro-centric analysis, a more thorough examination might have included a discussion of the notable meter experiments of Conlon Nancarrow, Frank Zappa, Gyorgy Ligeti, Elliott Carter, etc.

Furthermore, this study is relatively devoid of discussions which examine how rhythm is utilized within the expressive traditions of dance, ritual, and theatre; an examination which would likely cast further light on the limits of tempo and the organization of motional gestures and rhythms. In particular, Chapter Three (Non-Isochronous Meter Sources in Jazz) might easily have been expanded to address the intrinsic relationship between jazz and dance, further illuminating the limits of tempo and motional expressitivity. While Chapter Three does little to advance the theoretical premise of this dissertation (in particular, the implications of this study for jazz pedagogy), it nonetheless gives us a fundamental overview of the compositional and performative history of non-isochronous meter practices in jazz. This historical narrative (NI meter practices in jazz), which was initially intended to be largely a supplemental component of this work, nonetheless, establishes a means for contextualizing the illusive subtext of theoretical conjecture; actual performance practice.

Lastly, the pedagogical implications of Chapter Four (Proportional Relationships: Metric Modulations) needs to be more comprehensively addressed. While the primary focus of Chapter Four revolves around an analytical case study of the isomorphic relationships (inverse structural mapping) between NI meter patterns of differing cardinalities, a more thorough examination of the pedagogical implications for jazz would greatly have benefited the work as a whole. Though the expansion of London's “metric tree” somewhat addresses the potential for organizing the stratum of durational possibilities (the durational periodicities available at any given tempo) within any given meter, it fails to present a system that organizes meters and rhythms in a linear model (i.e., an ordered matrix of meters which account for the degrees or levels of increased metric complexity.) Presenting the metric tree as a matrix of meters ordered accordant to the respective level of complexity would help to instill and formalize a pedagogy which coherently introduces the most salient (and culturally relevant) meters in preparation for an ensuing examination of meters with heightened levels of metric complexity.

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APPENDIX

Appendix A: NI and Ternary Metered Jazz Compositions 1900 – 1969

Year	Meter	Performer and/or Composer	Song Title	Style
1914	5/4	Europe/Dabney	Castles Half and Half	Half and Half
1914	5/4	Arthur N. Green	Half and Half: A 'Castle' Creation	Half and Half
1914	5/4	Norman Leigh	Francine Half-And-Half	Half and Half
1914	5/4	F. Henri Klickmann	The Celebrated Half And Half	Half and Half
1918	3/4	Dan and Harvey's Jazz Band	Missouri Waltz	Rural Waltz
1920	3/4	ODJB	Alice Blue Gown	New Orleans Jazz
1920	3/4	ODJB	I'm, Forever Blowing Bubbles	New Orleans Jazz
1921	3/4	James P. Johnson	Eccentricity	Solo Piano
1927	5/4	Lloyd Scott's Orchestra	Symphonic Scrunch	Early Big Band
1928	5/4	John Nesbitt (McKinney's Cotton Pickers)	Stop Kidding (Neckbones And Sauerkraut)	Early Big Band
1928	3/4	Memphis Jug Band	Jug Band Waltz (Mississippi Waltz)	Rural Waltz
1942	3/4	Fats Waller	The Jitterbug Waltz	Urban Jazz Waltz
1952	3/4	Thelonious Monk	Carolina Moon	
1953	5/4	Lennie Tristano	Descent into the Maelstrom	
1955	3/4	Dave Brubeck (Rogers and Hart)	Lover	
1956	6/8	Kenny Dorham	Tahitian Suite	
1956	3/4	Bill Evans	Waltz for Debby	
1956	3/4	Sonny Rollins	Valse hot	
1956	3/4	Max Roach	Blue Waltz	
1956	3/4	Max Roach	Little Folks	
1956	3/4	Max Roach	I'll Take Romance	
1956	3/4	Max Roach (Rogers and	Lover	

		Hart)		
1956	3/4	Max Roach	The Most Beautiful Girl in the World	
1957	3/4	Randy Weston	Little Niles	
1958	3/4	Ahmad Jamal	The Girl Next Door	
1959	3/4	Bill Evans	Some Day My Prince Will Come	
1959	3/4	Miles Davis	All Blues	
1959	12/8	Mongo Santomaria	Afro Blue	
1961	3/4	Toots Thielemans	Bluesette	
1961	3/4	John Coltrane	My Favorite Things	
1961	3/4	Miles Davis	Some Day My Prince Will Come	
1961	3/4	John Coltrane	Greensleeves	
1961	15/4	Don Ellis	Four and Three	4+4+4+3
1962	3/4	John Coltrane	Spiritual	
1962	3/4	Don Ellis/Rogers and Hart	Lover	
1964	3/4	John Coltrane	Afro Blue	
1964	3/4	John Coltrane	Your Lady	
1967	19/8	Don Ellis	33 222 1 222	
1967	3/4	Don Ellis	Sadness Shouldn't Go So Deep	
1967	3/4	Don Ellis	Let's Go to Sleep	
1967	5/4	Don Ellis	I Love Us	
1967	3/4	Don Ellis/Hank Levy	Passacaglia and Fugue	
1967	27/16	Don Ellis	27/16	
1967	7/8	Don Ellis	Beat Me Daddy, 7 to the Bar	
1967	10/4	Don Ellis	Concerto for Trumpet	
1967	9/4	Don Ellis	New Nine	
1967	11/8	Don Ellis	Upstart	
1967	10/4	Don Ellis	Alone	
1967	7/4	Don Ellis/Ron Myers	Turkish Bath	
1967	17/8	Don Ellis	New Horizons	2+3+2+3+2+2+3
1968	13/4	Don Ellis	Zim	3+3+7

1968	5/4	Don Ellis	Opus
1968	7/4	Don Ellis	A New Kind of Country
1968	7/4	Don Ellis	Mercy Maybe Mercy
1968	7/4	Don Ellis	Pussy Wiggle Stomp
1969	3/4	Randy Weston	Pam's Waltz
1969	33/8	Don Ellis	Bulgarian Bulge

Appendix B: Non-isochronous meter extensions of London's metric tree

♩	♪	♪₃	𝅘𝅥𝅯	𝅘𝅥𝅯₅	𝅘𝅥𝅯₆	𝅘𝅥𝅯₇	𝅘𝅥𝅯₈	𝅘𝅥𝅯₉	𝅘𝅥𝅯₁₀
60 bpm 1000 ms	500 ms	333 ms	250 ms	200 ms	166 ms	143 ms	125 ms	111 ms	100 ms
Meters	3/16 750 ms	5/16 1250 ms	3/8 1500 ms	7/16 1750 ms	2/4 2000 ms	9/16 2250 ms	5/8 2500 ms	11/16 2750 ms	6/8 3000 ms
	13/16 3250 ms	7/8 3500 ms	15/16 3750 ms	4/4 4000 ms	17/16 4250 ms	9/8 4500 ms	19/16 4750 ms	5/4 5000 ms	21/16 5250 ms
	11/8 5500 ms	23/16 5750 ms	6/4 6000 ms						
70 bpm 857 ms	429 ms	286 ms	214 ms	171 ms	143 ms	122 ms	107 ms	95 ms	
Meters	3/16 643 ms	5/16 1071 ms	3/8 1285 ms	7/16 1499 ms	2/4 1713 ms	9/16 1927 ms	5/8 2141 ms	11/16 2355 ms	6/8 2569 ms
	13/16 2783 ms	7/8 2997 ms	15/16 3211 ms	4/4 3425 ms	17/16 3639 ms	9/8 3853 ms	19/16 4067 ms	5/4 4281 ms	21/16 4495 ms
	11/8 4709 ms	23/16 4923 ms	6/4 5137 ms	25/16 5351 ms	13/8 5565 ms	27/16 5779 ms	14/8 5993 ms		
80 bpm 750 ms	375 ms	250 ms	188 ms	150 ms	125 ms	107 ms	94 ms		
Meters	3/16 563 ms	5/16 938 ms	3/8 1125 ms	7/16 1313 ms	2/4 1500 ms	9/16 1688 ms	5/8 1875 ms	11/16 2063 ms	6/8 2250 ms
	13/16 2438 ms	7/8 2625 ms	15/16 2813 ms	4/4 3000 ms	17/16 3188 ms	9/8 3375 ms	19/16 3563 ms	5/4 3750 ms	21/16 3938 ms
	11/8 4125 ms	23/16 4313 ms	6/4 4500 ms	25/16 4688 ms	13/8 4875 ms	27/16 5063 ms	14/8 5250 ms	29/16 5438 ms	15/8 5625 ms
	31/16 5813 ms	8/4 6000							

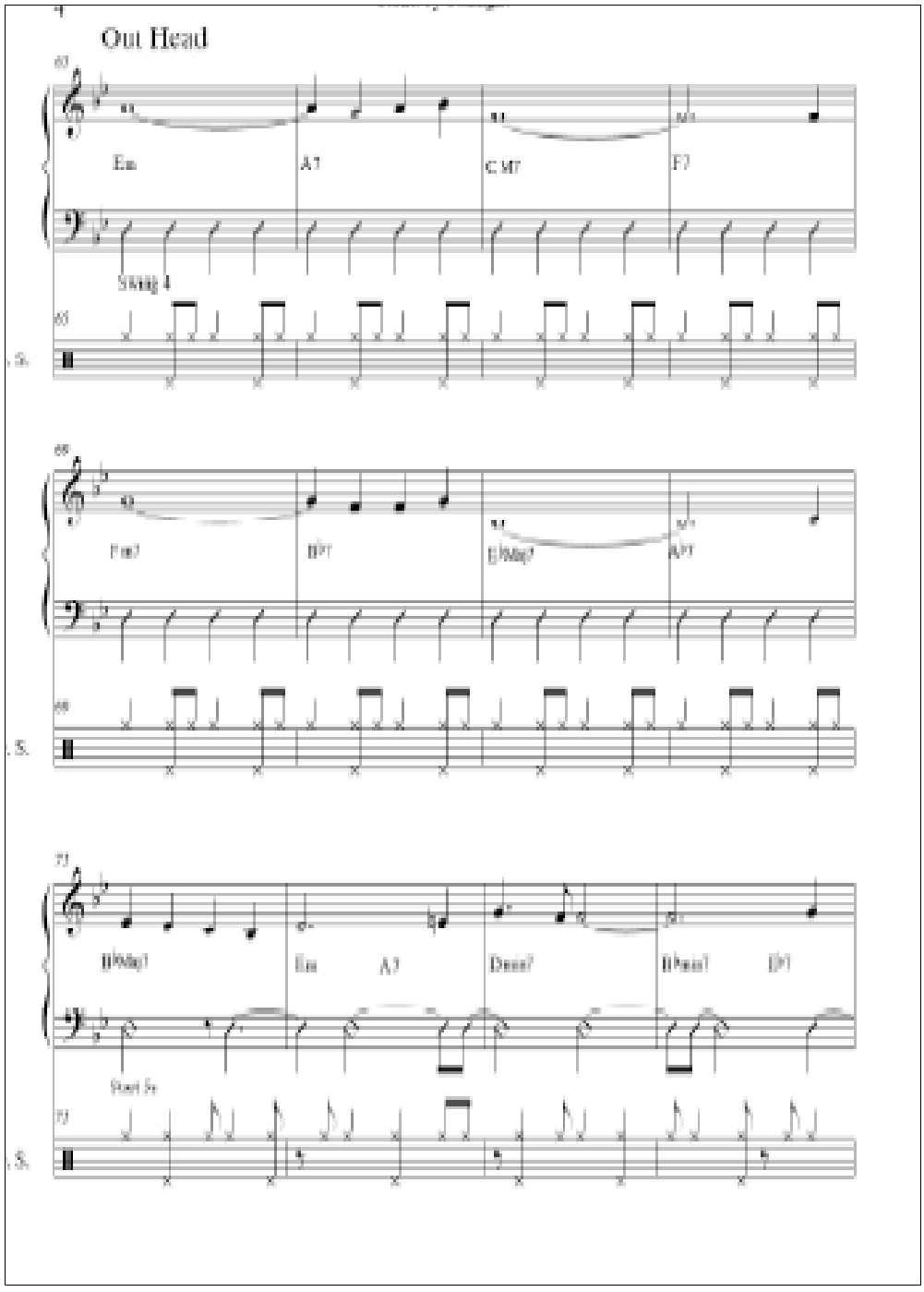
		ms							
90 bpm 667 ms	334 ms	222 ms	167 ms	133 ms	111 ms	95 ms			
	3/16 500 ms	5/16 835 ms	3/8 1002 ms	7/16 1169 ms	2/4 1336 ms	9/16 1503 ms	5/8 1670 ms	11/16 1837 ms	6/8 2004 ms
	13/16 >	7/8 >	15/16 >	4/4 >	17/16 >	9/8 >	19/16 >	5/4 >	21/16 3500 ms
	11/8 >	23/16 >	6/4 >	26/16 >	13/8 >	27/16 >	14/8 >	29/16 >	15/8 5000 ms
	31/16 >	8/4 >	33/16 >	17/8 >	35/16 >	9/4 6000 ms			
100 bpm 600 ms	300 ms	200 ms	150 ms	120 ms	100 ms				
Meters	3/16 450 ms	5/16 >	3/8 >	7/16 >	2/4 >	9/16 >	5/8 >	11/16 >	6/8 1800 ms
	13/16 >	7/8 >	15/16 >	4/4 >	17/16 >	9/8 >	19/16 >	5/4 >	21/16 3150 ms
	11/8 >	23/16 >	6/4 >	26/16 >	13/8 >	27/16 >	14/8 >	29/16 >	15/8 4500 ms
	31/16 >	8/4 >	33/16 >	17/8 >	35/16 >	9/4 >	37/16 >	19/8 >	39/16 5850 ms
	10/4 6000 ms								
110 bpm 545 ms	273 ms	182 ms	136 ms	109 ms	91 ms				
	3/16 409 ms	5/16 >	3/8 >	7/16 >	2/4 >	9/16 >	5/8 >	11/16 >	6/8 1635 ms
	13/16 >	7/8 >	15/16 >	4/4 >	17/16 >	9/8 >	19/16 >	5/4 >	21/16 2861

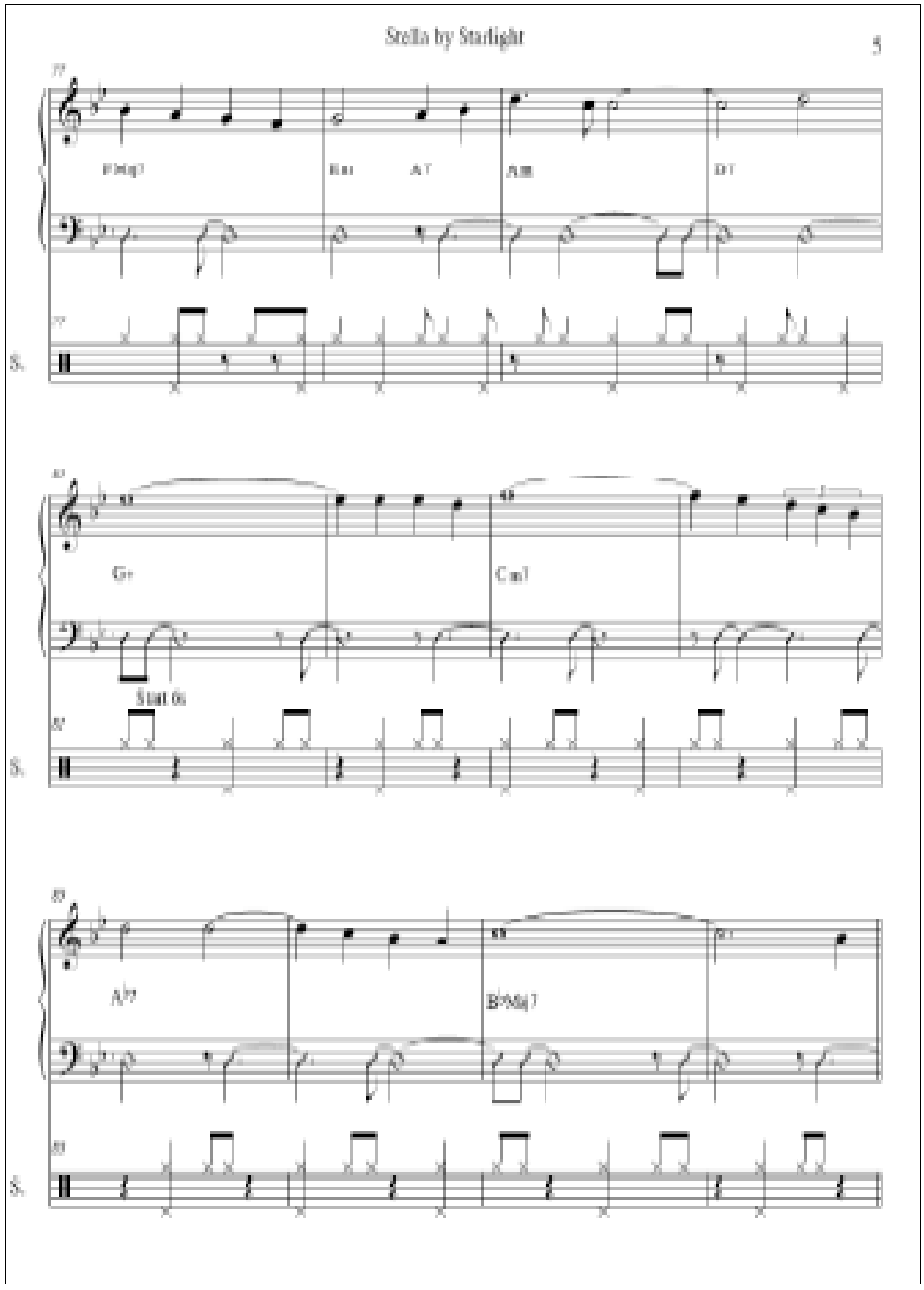
									ms
	11/8 >	23/16 >	6/4 >	26/16 >	13/8 >	27/16 >	14/8 >	29/16 >	15/8 4088 ms
	31/16 >	8/4 >	33/16 >	17/8 >	35/16 >	9/4 >	37/16 >	19/8 >	39/16 5314 ms
	10/4 >	41/16 >	21/8 >	43/16 >	22/8 5995 ms				
120 bpm 500 ms	250 ms	167 ms	125 ms	100 ms					
130 bpm 461 ms									

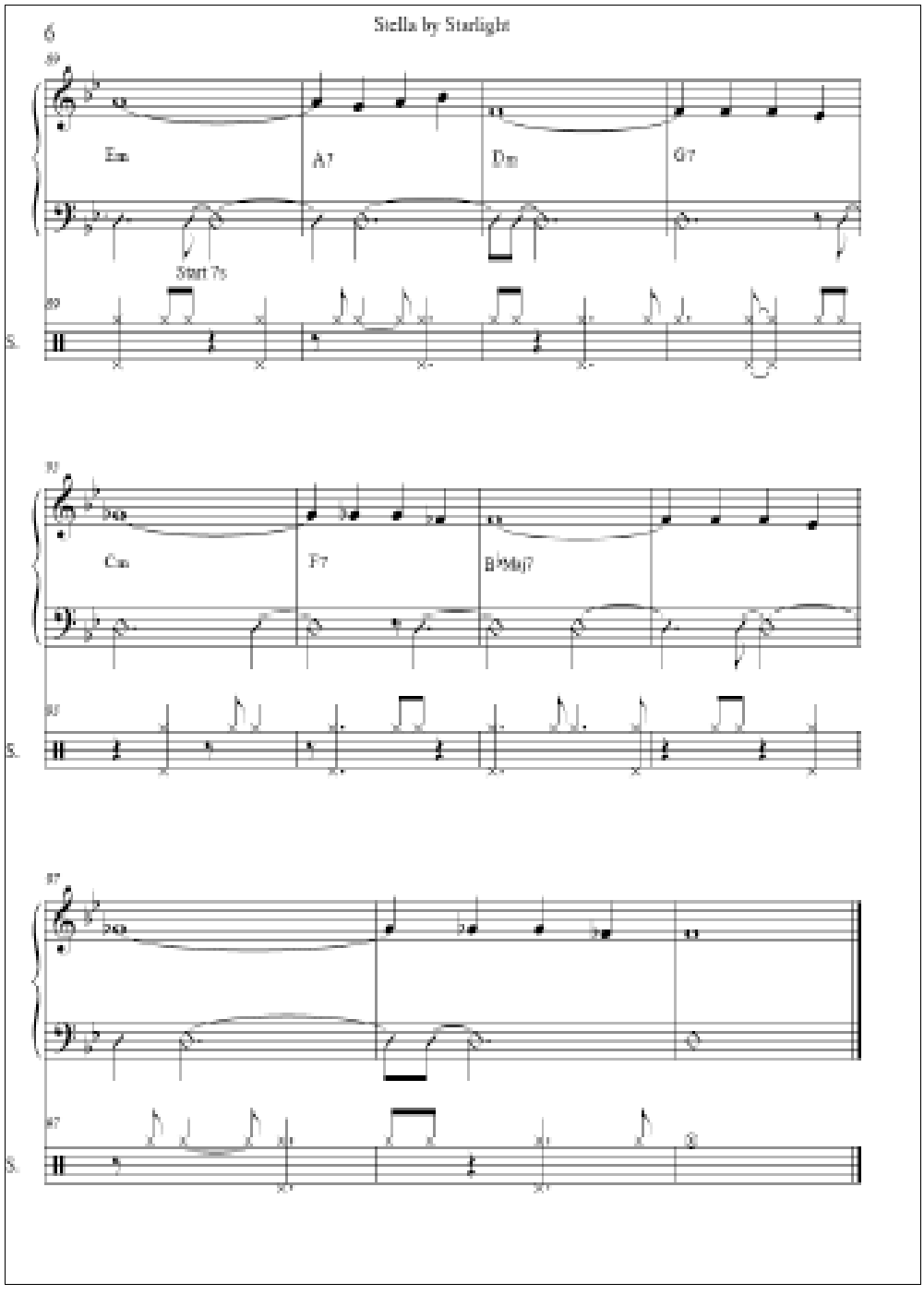
Appendix C: Possible beat cycles in N cycles 4–16

N-cycle Cardinality	Number of Beat Cycles	Number of NI Rotations
4	1	0
5	1	2
6	2	0
7	1	3
8	4	5
9	2	4
10	4	5
11	3	15
12	7	9
13	4	18
14	6	18
15	6	19
16	11 (12)	39
Totals	52 (53)	137

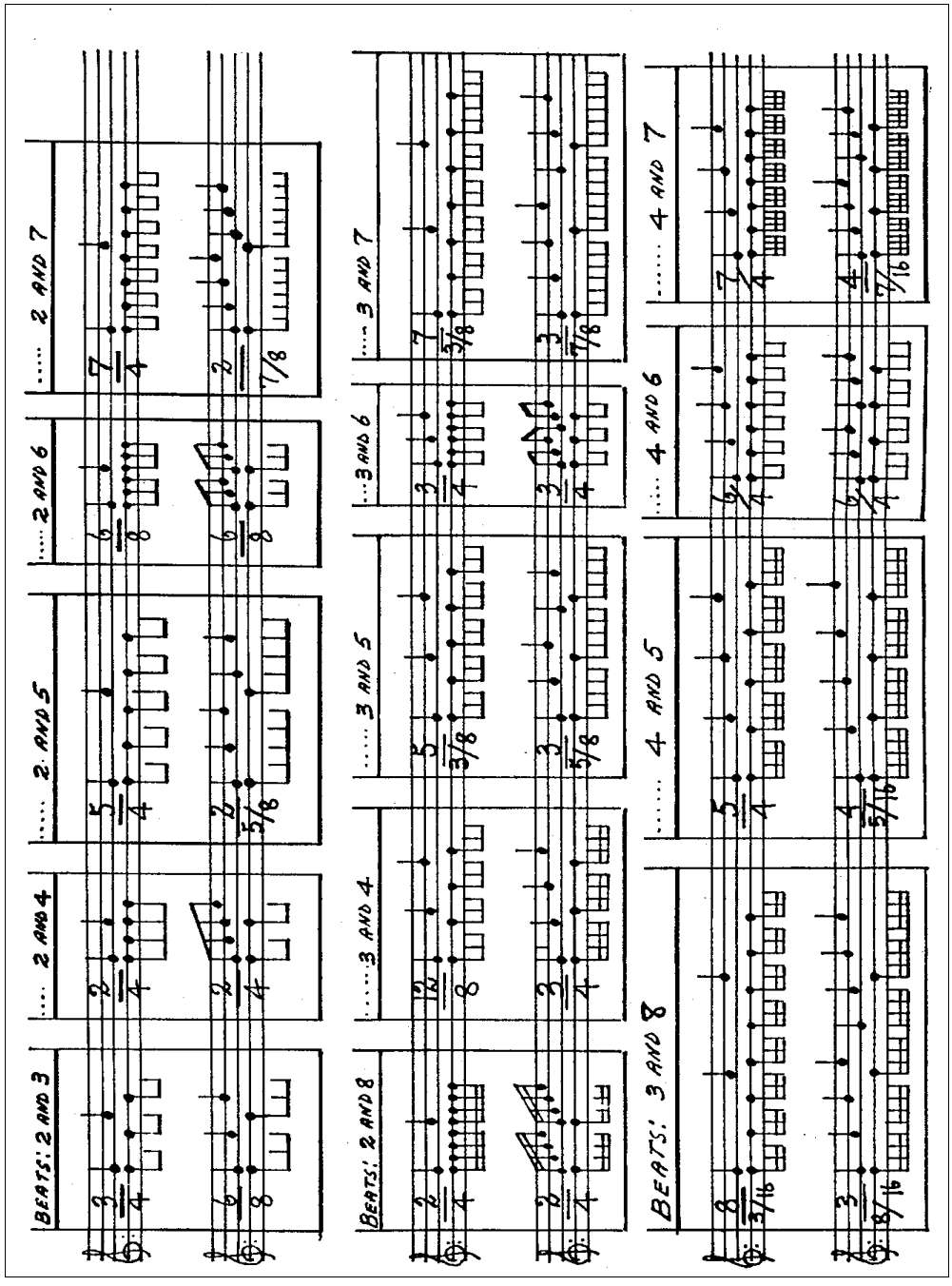
Appendix D: Hoenig's arrangement of Stella by Starlight – Head Out




Stella by Starlight
5
Start 6s


Stella by Starlight
6
89
Em
A7
Dm
G7
Start 7s
S.
91
Cm
F7
B♭Maj7
93
S.
97
97
S.

Appendix E: Billotti's polyrhythms



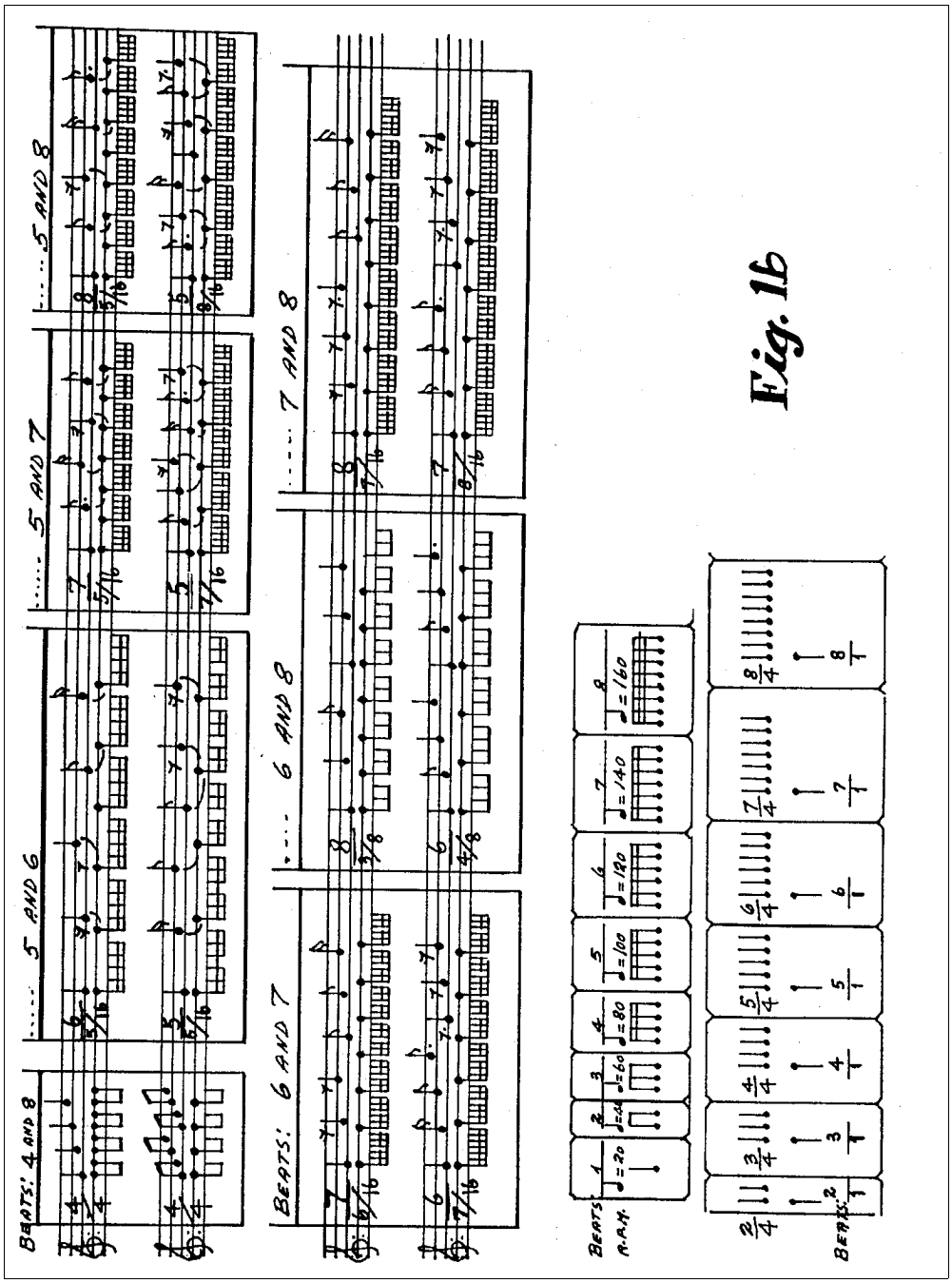

BEATS: 4 AND 8
..... 5 AND 6
..... 5 AND 7
..... 5 AND 8
BEATS: 6 AND 7
..... 6 AND 8
..... 7 AND 8
BEATS
M.M.H.
BEATS:

Fig. 16

Appendix F: Notated Metric Variations

Figure 4.1 “Some Other Time” – Measures 1-8

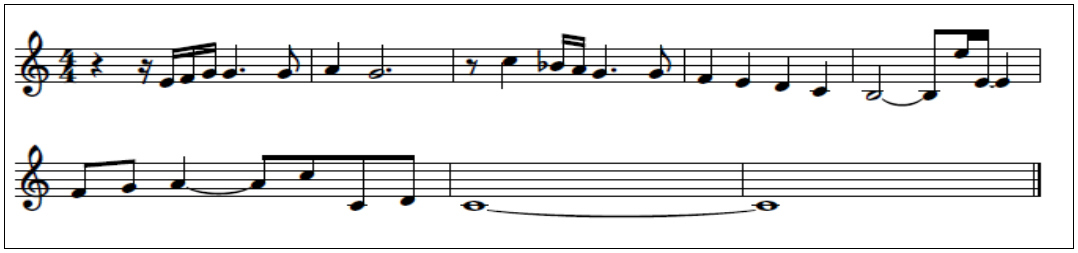


Figure 4.2 Isomorphic rhythms

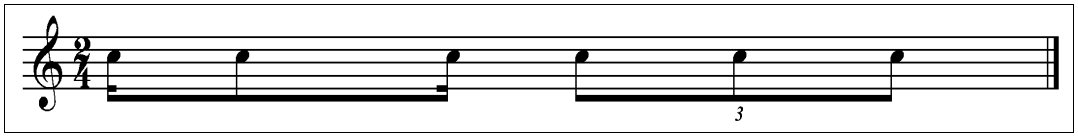


Figure 4.3 A quintolet to a quintuplet

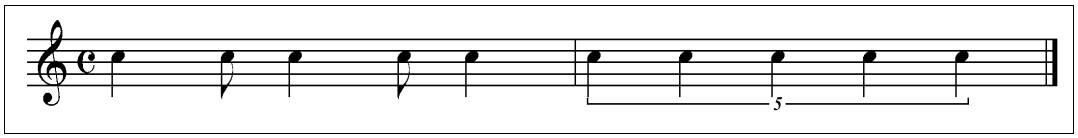


Figure 4.4 Shifts to isomorphic rhythms at the beat level

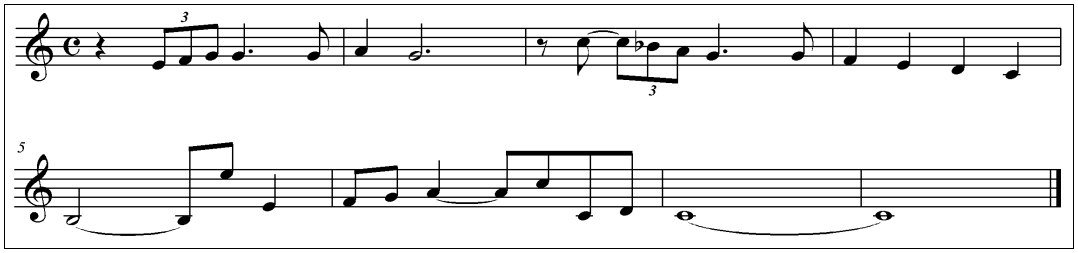


Figure 4.5 With the addition of anticipations

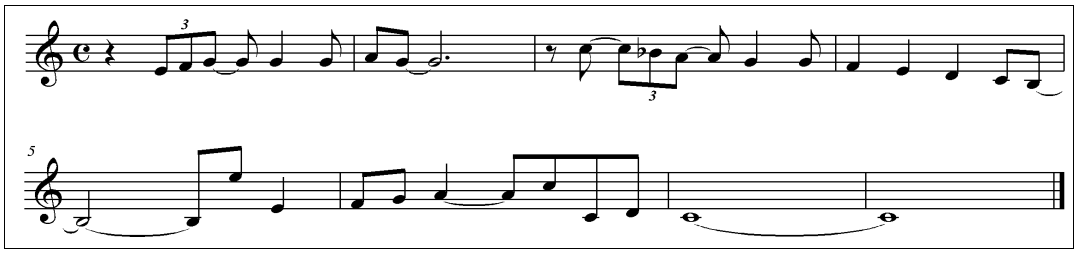


Figure 4.6 Jones' proportional changes at each beat level

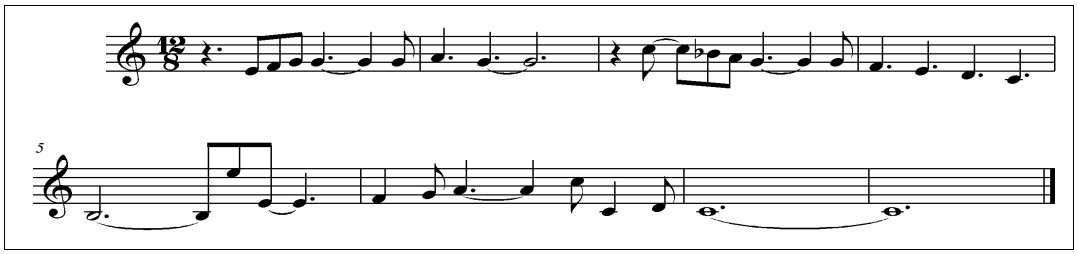


Figure 4.7 Reduction of 4/4 at both half-measures

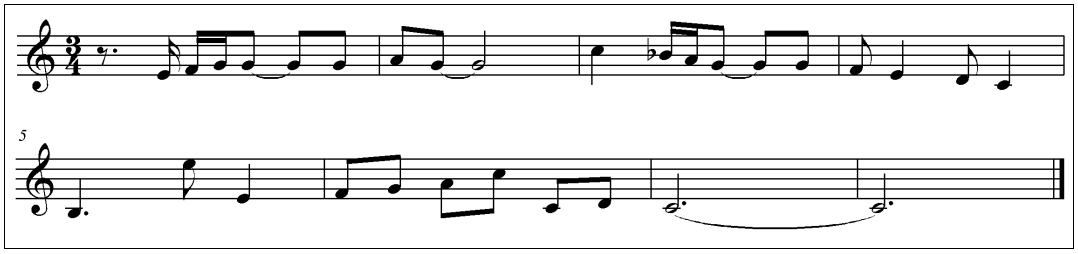


Figure 4.8 “Some Other Time” in 6/8

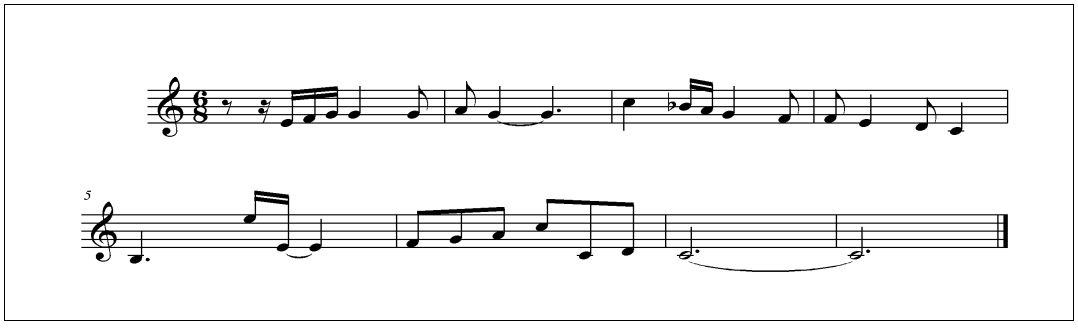


Figure 4.9 Expansion of the third eighth note in both half measures

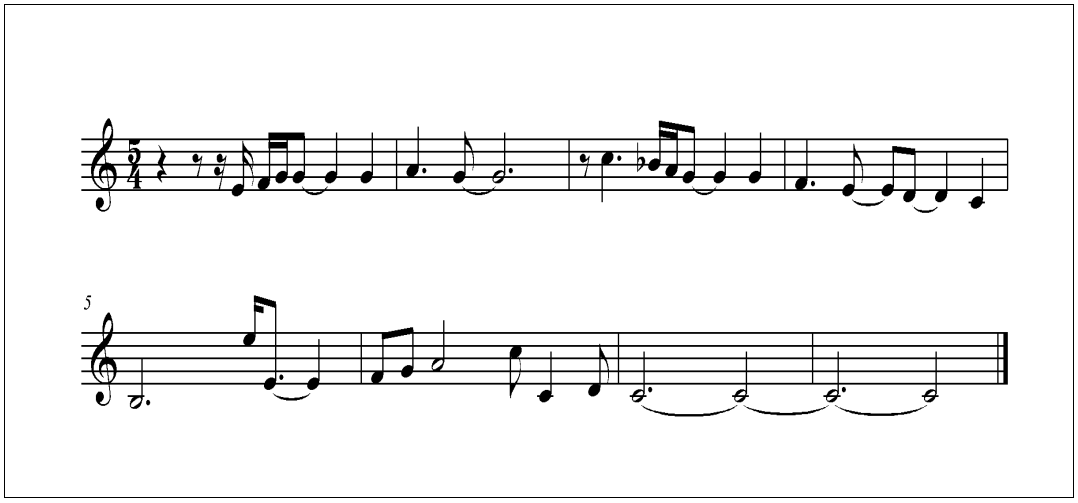


Figure 4.10 Reductions at the half-measure

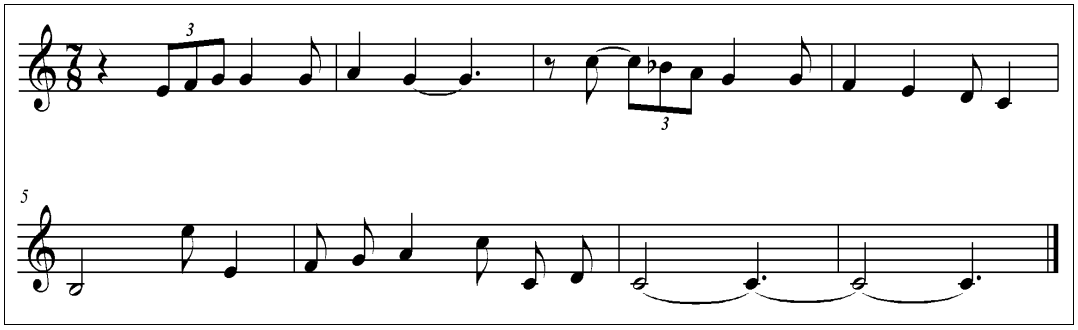


Figure 4.11 Expansions of a single measure

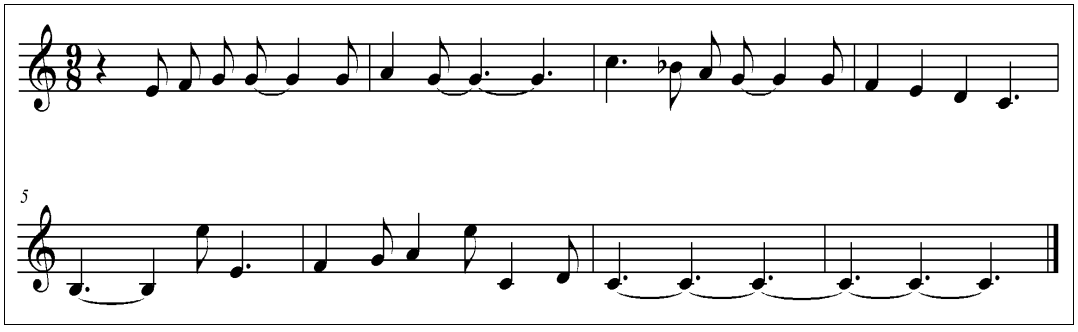


Figure 4.12 Expansions of 12/8 at the half-measure

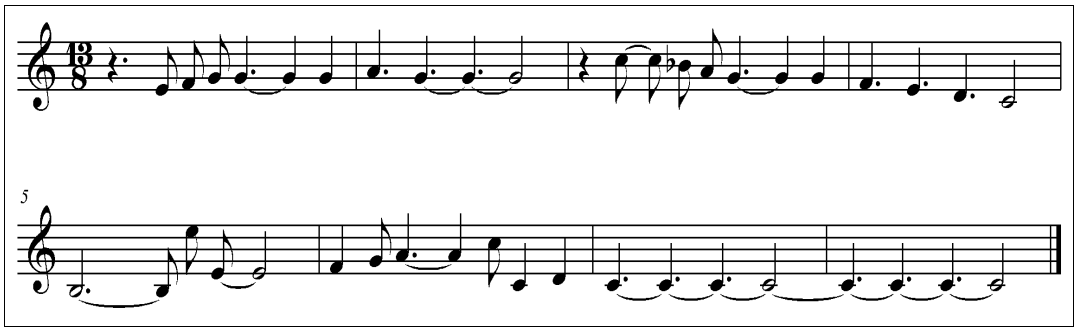


Figure 4.13 Reductions of 12/8 at the half-measure

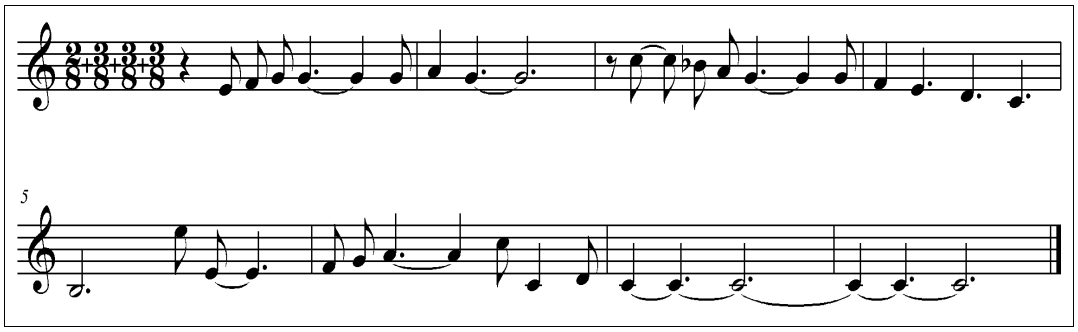


Figure 4.14 10/8

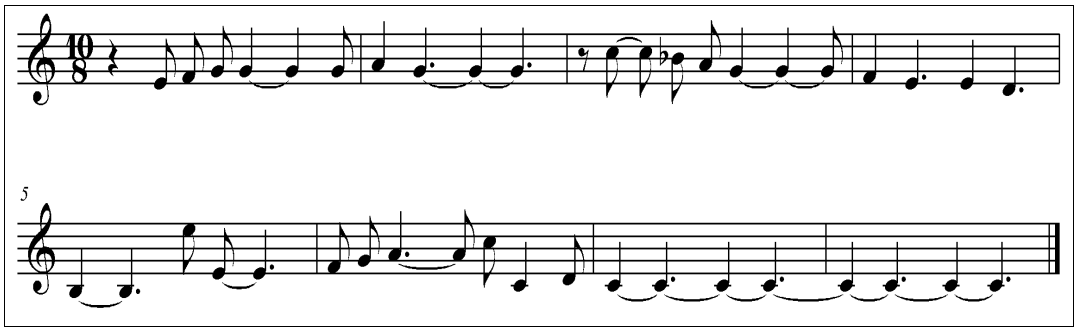


Figure 4.15 14/8

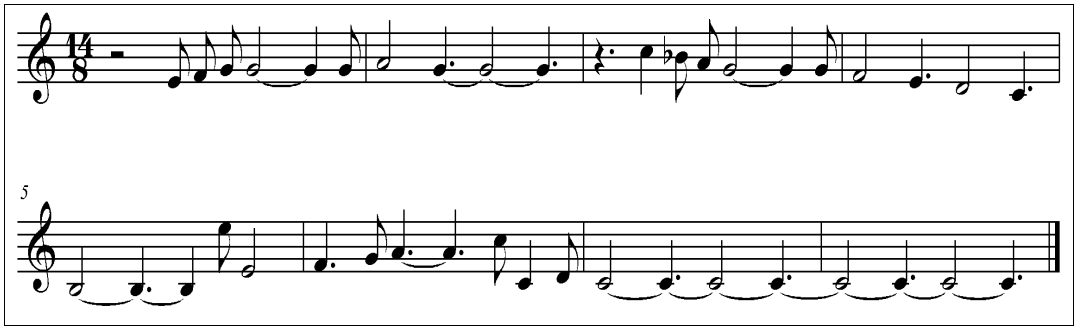


Figure 4.16 Original source melody – “All the Things You Are”

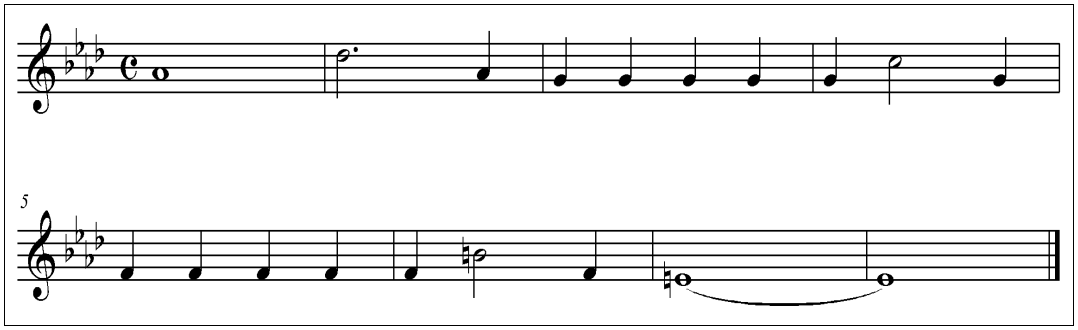


Figure 4.17 “All the Things You Are:” Mixed meter form

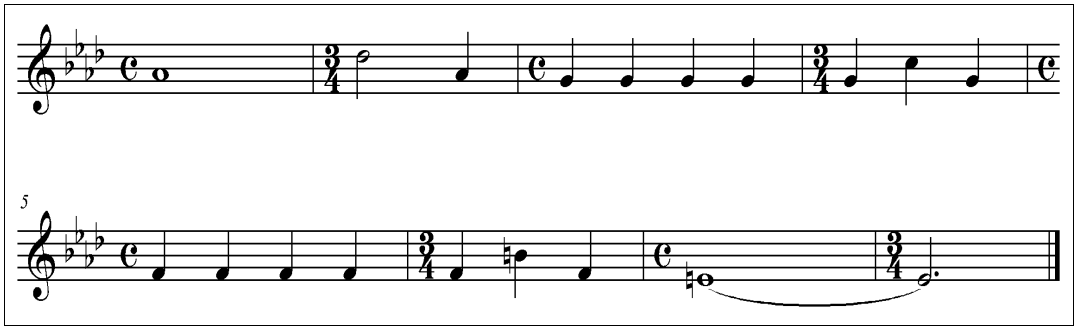


Figure 4.18 “All the Things You Are:” 11/8

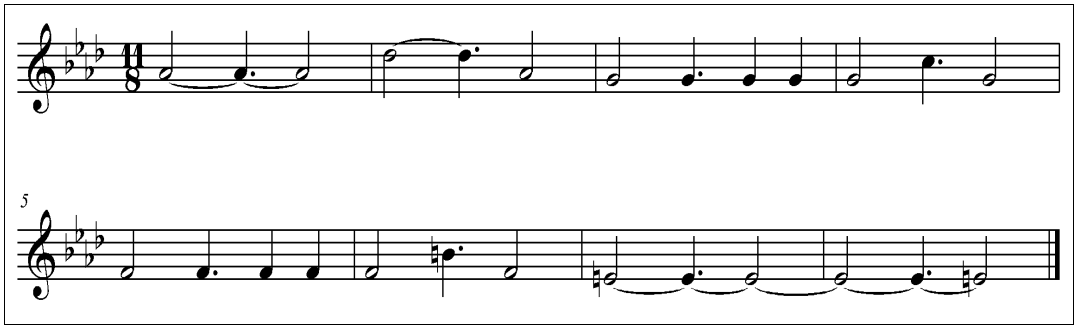


Figure 4.19 Unsyncopated source melody

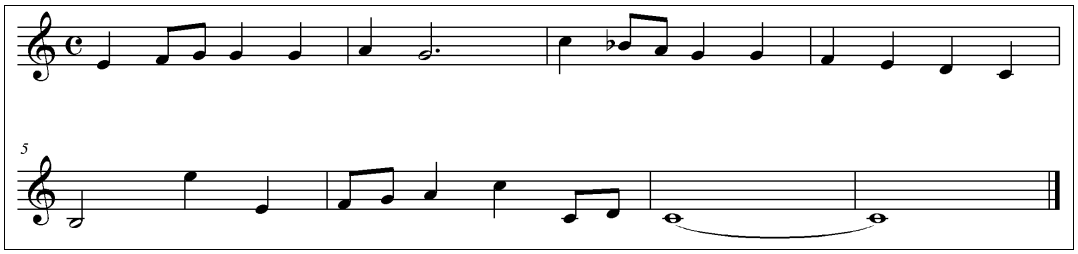


Figure 4.20 Maximally even half-measures

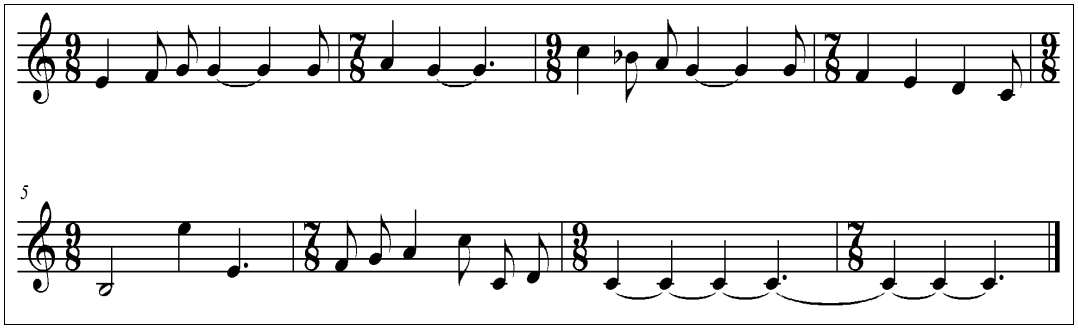


Figure 4.21 A 19-tone ETS meter

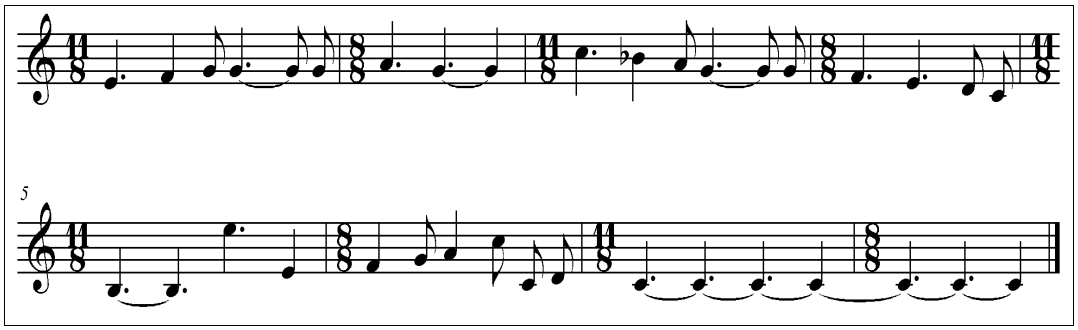


Figure 4.22 Metric superimposition