Crossing The Lines: A Portfolio of Compositions Exploring Rhythmic Dissonance and Polyrhythmic Textures

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Abstract

Rhythmic dissonance, the non-congruence of rhythmic layers, offers a rich area of exploration for composers. This doctoral research, titled *Crossing The Lines: A Portfolio of Compositions Exploring Rhythmic Dissonance and Polyrhythmic Textures,* aims to highlight the effectiveness of using rhythmic techniques to produce compelling musical textures. The thesis is in two parts: the portfolio of compositions (equating to *c.* ninety minutes of music) and a twenty-thousand-word commentary that critically assesses the compositional work and factors that have affected this research, supported by academic literature. The portfolio of compositions comprises nine pieces ranging in ensemble size from chamber to orchestral, enabling a broad exploration of rhythmic devices within the context of my compositional style.

The commentary comprises four chapters. During the discovery of these compositional techniques, there arose a desire to categorise these techniques to fully understand the temporal impact each technique can have on a musical texture. Moreover, the juxtaposition of manipulating rhythmic techniques within a Western Classical notation system presented its own challenges and the need to produce a robust notational practice that can withstand both compositional intentions and notational clarity. Most importantly, the final chapter is an in-depth exploration of compositional development, focusing on *Odyssey*, and considers the overall effectiveness of rhythmic techniques and their ability to produce development over an extended timespan.

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List of Compositions (Chronological Order)

The title of each piece and its instrumentation are provided below. Programme notes can be found in the first volume in the preface for each composition.

Midnight Rhythm – for alto saxophone and piano

Originally written for the *Illuminate Duo* as part of postgraduate workshops at Cardiff University during 2021.

Crossing The Lines – for string quartet

Originally written as a string duo but revised for string quartet (*Solem Quartet)*. The duo version was written in 2022 and revised for the quartet in 2023.

Refractions – for clarinet in B♭, viola, cello and piano

Written with the aim of exploring a more adventurous harmonic plan and contrasting timbral forces.

***Dechrau* –** for solo piano

Designed as a theme and variation, this composition focuses on a monorhythmic motif that is then placed in different rhythmic textures. This piece has two biographical references: firstly, the opening music is taken from my late-grandfather's sketches. Secondly, my undergraduate composition portfolio features a theme and variations piece titled *The Thief*.

Enchantment – for trio (flute, viola, harp)

The initial movement was written for the *Vesta Trio* during Cardiff compositions workshops in November 2022. Subsequent movements were written alongside other compositions (such as *Place of Pain).*

Place Of Pain – for SATB choir

Inspired by my late-grandfather's libretto, *Place of Pain* is based on text from his drafted musical theatre work titled *Remember!* The live recording of this piece is missing a small extract (bb. 142 – 162) of the music due to revisions. A MIDI file of the full version has been included for this piece.

The Rhythm – for snare drum

Aimed to be used as an étude that can be applied to any untuned percussion that can produce different timbral qualities. This piece is also a focus on exploring rhythmic and timbral developments without the influence of pitch.

Odyssey – for solo piano and orchestra

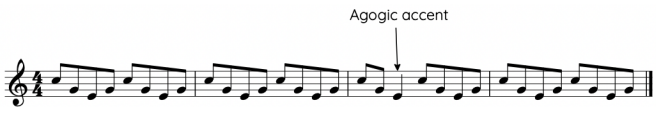
The most ambitious piece in the portfolio aimed at exploring long-term development using rhythmic techniques and is the main focal point for Chapter Four. My first piano concerto, *Storm,* was written in 2019 for my final composition portfolio: I wanted to write a concerto that improved on *Storm's* shortcomings.

Irrationality – for cello and piano

This was the final piece written for the portfolio. This was written to trial the concept of irrational metres.

Glossary

Agogic Accent – A durational accent that emphasises a rhythmic change within a repeated passage.[1]



Ex. 0.1 Example of an agogic accent.

Antimetrical layer – An interpretive layer that conflicts with at least one metrical layer.

Augmentation – the progression from a relatively low-level to a higher-level version of a particular dissonance.

Beat – The fundamental recurring mechanical pulse that occurs within the background of a musical work. Often presented as the beats per minute (BPM) of a piece of music that uses a mensural rhythmic structure and is, in most cases, the tempo of a work. The pulse does not need to be explicitly audible; however, it may appear within a work's rhythmic texture.

Cross-accents – The attack of a note arriving fractionally earlier than its on-beat arrival within a pattern.[2]

Cross-rhythm/Grouping Dissonance/Polyrhythm – The group of two non-congruent rhythmic layers superimposed. An example in its simplest form is the rhythmic hemiola.

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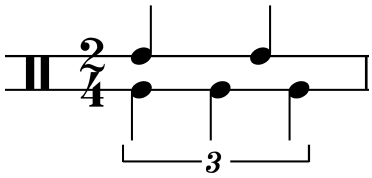
[1] No Attribution, 'Syncopation', *Grove Music Online* (2001) <https://www-oxfordmusiconline-com.cardiff.idm.oclc.org/grovemusic/view/10.1093/gmo/9781561592630.001.0001/omo-9781561592630-e-0000027263> [accessed 13 September 2025]

[2] No Attribution, 'Cross-accent', *Grove Music Online*, www.oxfordmusiconline.com [accessed 25th February 2022]

Cross-rhythmic textures can vary in complexity and density depending on the number of subdivisions used.



Ex. 0.2 Example of a 3:2 cross-rhythm.

Direct Dissonance – The superimposition of two non-congruent rhythmic layers such as a cross-rhythm.[3]

Displacement – The perceived shifting (or displacing) of a sound/musical structure produced by different techniques. Commonly, displacing involves manipulating the perceived downbeat to a later, or earlier, location than the listener is expecting.

Displacement Dissonance – A dissonance caused by the delay, or prematurity of a rhythmic layer not occurring at the start of a metric structure.[4]

Groove – A rhythmic pattern that produces interest through the use of regular and irregular attacks. Commonly repeated, a groove can provide rhythmic excitement that propels music forward by the dragging or pushing of rhythmic attacks within the pattern.

Harmonic rhythm – The speed at which a harmonic progression moves from one chord/vertical harmony to another.

Indirect Dissonance – A metric dissonance produced by the juxtaposition of two opposing rhythmic layers.[5]

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[3] Harald Krebs, *Fantasy Pieces: Metrical Dissonance in the Music of Robert Schumann* (New York: Oxford University Press, 1999), pp.45–6.

[4] Ibid., pp.31–46.

[5] Ibid., p.45.

Isometric – Derived from Medieval music, it means having the same rhythm in every part.[6]

Isorhythm – Term coined in 1904 by F.Ludwig to describe the principle form in medieval music c.1300 — 1450, whereby the same rhythmic pattern recurs in successive repetitions of the melody. It was usually applied to the tenor part of a motet, which would consist of a short repeated rhythmic pattern; the melody in the tenor part was also often repeated but not in synchronisation with the rhythmic repetition. Rhythmic repetition was known as talea, melodic as color.

Measure/bar – Governed by the metre, a measure/bar is the grouping of beats into a structure that allows musicians to organise and process musical material into regular phrasing.

Metre/time signature – A metre is two numbers at the start of a bar that group rhythmic beats into a structure.

Metric Accent – It is common, especially in tonal and rhythmically regular music, for the performer to emphasise the beats of a metric framework. Each metre has an intrinsic metrical accentuation (e.g. 4/4 is strong → weak → strong → weak).[7] In irregular metres, the groupings are inherently irregular,

and so metric accents can appear unevenly. For example, 5/8 produces 3+2 or 2+3.

Metric Accentuation – The emphasis of a given beat within a given metre is normally dictated by the natural accentuation that originates from the underlying pulse of a given

[6] Margaret Bent, 'Isorhythm', *Grove Music Online,* www.oxfordmusiconline.com [accessed 28th March 2022]

[7] Mark Gotham, 'Towards a Cognitively Based Quantification of Metrical Dissonance' *The Oxford Handbook of Time in Music* (8 December 2021).

metre. For example, the natural metrical accentuation within a common time bar (4/4) is on beat one and four.[8]

Metric alternation – The alternation between two metres within a music passage.

Metric conflict – Coined by Cooper and Meyer referring to musical passages that are metrically ambiguous to the extent that they could be re-barred to fit a different metre.[9]

Metric Dissonance – Conceived by Harald Krebs, derived from rhythmic dissonance.[10] Krebs uses 'metric' to emphasise that a piece's metric structure is the layer being manipulated when using rhythmic techniques.

Metric Modulation – The modulation of a musical passage into a different metre. This can also refer to the superimposition of two different metres temporarily, producing poly-metre. Believed to be originated from Elliot Carter, metric modulation appears in his percussion piece *Canaries* as the first appearance of the technique. *Canaries* uses the left-hand maintaining a steady beat throughout, whilst the right-hand is subjected to a right-hand metric change, moving through 6/6, 12/8, 2/2, 4/4, 6/4 and 3/4.[11]

Nested Rhythms – A complex rhythmic technique explored within 20th-Century composition, particularly in works associated with the New Complexity movement, where a tuplet rhythm is placed within (or 'nested' inside) another tuplet.

Pan-isorhythm – Uses isorhythm in all the voices simultaneously–not just the tenor.

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[8] Gotham, pp.293–95.

[9] Grosvenor Cooper and Leonard Meyer, *The Rhythmic Structure of Music* (Chicago: The University of Chicago Press, 1960), p.106.

p.106.

[10] Krebs, p.30.

[11] No Attribution, 'Metric Modulation', *Grove Music Online,* www.oxfordmusiconline.com [accessed 28th March 2022]

Polymetre – The appearance of two or more time-signatures within a musical passage at the same time (superimposition).

Polyrhythm – An umbrella term for the superimposition of different rhythms and metres.[12] Originating from the fourteenth century in medieval polyphony, polyrhythm became a more common technique within twentieth-century composition.[13]

Polytempo – The appearance of two tempi at the same time within a musical passage (superimposition).

Pulse dilution/ambiguity/dissolution/displacement – A synonymic set of terms used to describe the sensation of a musical passage losing or shifting its feeling of a pulse. The choice between dilution, ambiguity, dissolution and displacement is dependent on a scholar's own preference. Pulses need not be phenomenally present in music, though they typically are. Rather, the sense of pulse arises through the listener's cognitive and kinaesthetic response to the rhythmic organization of the musical surface.[14]

Rhythmic modes – The modern name for a medieval concept of rhythm in which the value and relative duration of each note is determined by its position within a larger rhythmic series, or mode, consisting of a patterned succession of long and short values. In notation, the value of the individual note is communicated not by the form of the note but by its portion

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[12] No Attribution, 'Polyrhythm', *Grove Music Online*, www.oxfordmusiconline.com [accessed 16th March 2022]

[13] Ibid.

[14] Ibid.

within a larger figure of notation (called a ligature, a group of pitches 'bound' together) and by the position of that figure among other figures.[15]

Rhythmic/metric consonance/dissonance – Borrowed from harmonic language, rhythmic consonance and dissonance refers to the alignment of rhythmic layers within a musical passage. When consonant, rhythmic layers are congruent; alternatively, in a rhythmically dissonant passage, the rhythmic subdivisions are non-congruent.

Syncopation – The shifting of the attacks to the off-beats within a musical passage. The Grove Music Online states, 'Syncopation usually occurs in lines in which the strong beat receives no articulation'.[16] Syncopation is commonly used synonymously with other terms such as agogic accents, cross-accents and cross-rhythms due to these techniques sharing similar effects.

[15] No Attribution, 'Rhythmic Modes', *Grove Music Online,* www.oxfordmusiconline.com [accessed 28th March 2022].

[16] No Attribution, 'Syncopation', *Grove Music Online,* www.oxfordmusiconline.com [accessed 16th March 2022].

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In submitting this portfolio, I am indebted to a number of role models who have supported both my personal and academic journey. I owe the deepest gratitude to my supervisors, Dr Pedro Faria Gomes and Dr Nicholas Jones. Dr Faria's supportive mentorship as my first supervisor has helped to hone a critical compositional approach and has been outstanding in guiding me in the right direction as a composer and as a teacher. Dr Jones' academic rigour helped gently guide this commentary and asked critical questions that provoked new concepts to explore. Their unwavering support and encouragement have made this work possible and have left a lasting impact on my journey.

I would like to thank the musicians who have workshopped my music: Clare Hammond, Vesta Trio, Illuminate Duo, Solem Quartet, Harriet Riley; and those who have recorded it: Charlie Pittaway, Caitlin Hockley, Jen Ord, Imogen Price, James Oakley, Chris Davis, Dan Davis, Ethan James and Lloyd Cottrell. I am also grateful to Callum Salisbury for his support and aesthetic advice regarding the layout of scores.

I am forever grateful to my parents, Elizabeth and Jason Rogers, for their unwavering support in helping me pursue my passion. I would like to thank my uncle, Peter Davies, for his positive influence and support as a musical role model throughout my musical upbringing. I would like to thank my partner, Laura, for her support during this period.

This portfolio of work is dedicated to my grandmother and late grandfather, Anne and Leonard Davies. Their unwavering support and encouragement to reach the highest academic achievements have driven me to this moment. My grandfather's influence stretches further than just a dedication. Before his passing, he shared a number of musical sketches and libretti with me from his unfinished stage musical. To honour him, *Dechrau* and *Place of Pain* are inspired by sketches of his compositional ideas.

Joshua Rogers

Introduction

Initial Definition

Rhythmic/metric dissonance is defined as a disruption of the prevailing metre within a musical passage through the existence of non-congruent rhythmic layers.[1] In having non-aligned rhythmic layers, the attack points of two or more independent rhythmic layers can create a conflict that disrupts the overall metric structure, thus producing a rhythmic 'dissonance'. Because the term is derived from musical harmony, one can also begin to contextualise ideas associated with harmony into this framework e.g. rhythmic/metric consonance.

Context

During the mid-to-late nineteenth century, scholarly literature began retrospectively assessing the existence of rhythmic dissonance within the work of past composers;[2] however, there has been limited conscious output from composers defining their music as rhythmically dissonant. This portfolio of compositions aims to consciously engage with rhythmic dissonance and explore its existence within my compositional style.

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[1] By non-congruent, I am referring to two rhythmic layers where their pulsations do not align.

[2] Maury Yeston's *Stratification of Musical Rhythm* (London: Yale University Press, 1976), Harald Krebs' *Fantasy Pieces: Metrical Dissonance in the Music of Robert Schumann* (New York: Oxford University Press, 1999) and Floyd Grave's *Metrical Dissonance in Haydn The Journal of Musicology,* 13/2 (Spring 1995), pp.168 – 202 are all texts that explore the presence of rhythmic dissonance within a composer's work.

This PhD research stems from subconscious idiosyncrasies that appeared in my music as a developing musician. I became fascinated with rhythmic and metric cells and realised that I often conceived rhythmic ideas before melody/pitch material during my compositional process. From exploring a range of music in my younger years, I became drawn towards music that had a 'groove' or interesting rhythmic quality.[3] At the University of Bristol, I studied a Master's in Composition for Film and TV, which exposed me to a broader range of musical styles and challenged me to construct music with a degree of temporal fluidity based on the visual media. In doing so, I became more comfortable handling music with temporal irregularity in order to produce effective moments of synchronisation between the music and the visual media. Furthermore, I became more familiar with the traits of media composition, such as metric irregularity, when scoring action scenes.[4] Irregular time signatures are commonplace in chase/action music to give an aural sense of drive and energy to propel the kinetic movement onscreen. Due to these frequent uses of irregularity, these techniques became absorbed into my contemporary-classical language and an intrinsic part of my compositional style. As a result, I wanted to understand these intuitions further and challenge myself to produce a portfolio of compositions that engaged academically with the subject.

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[3] During my time as an undergraduate, I often played a combination of late-romantic and twentieth-century repertoire for recitals. I had an interest in exploring cross-rhythmic music such as Sergei Rachmaninoff (notably *Prelude* Op.24 No.4) and Karol Szymanowski (*Étude* Op.4 No.1 *Allego Moderato* in E♭ Major): both have a heavy emphasis on cross-rhythmic textures.

[4] Notable inspirations for irregular scoring and driving rhythmic cells is 'Stairs and Rooftops' from Lorne Balfe's score for *Mission Impossible: Fallout.*

In preparing my research plan, I struggled to find comprehensive definitions for rhythmic ideas that I believed had appeared throughout twentieth-century compositions. I discovered that in early literature (from the late-seventeenth century to the nineteenth), terms were somewhat malleable; often they are used interchangeably (such as cross-rhythm, grouping dissonance and polyrhythm all having similar meaning), causing confusion and unnecessary diversion. In some cases, scholars introduced a term, sometimes without definition, before moving on without critical discussion.[5] This lack of definition and in-depth analysis may be due to scholars' expectation that readers will infer an understanding from harmonic terminology.[6] Because of these challenges, I sought to produce a commentary that engages with this topic and collates the literature with definitive definitions. Moreover, the commentary is approached from a practical and composition-based perspective rather than from a musicological one.

Compositional Voice within Historical Context

There have been previous examples where composers have explicitly produced work aimed at exploring polyrhythmic techniques, such as Dusan Bogdanovic's *Polyrhythmic and Polymetric Studies* (1990) and Richard Blackford's 2019 composition-based PhD *In and Out of Time*. My work takes a similar venture but aims to produce compositional textures that are unique to my aesthetic. There will also be the exploration of superimposing two rhythmic techniques in order to produce new hybrid textural possibilities. Consequently, I argue that, stylistically, my material differs considerably from other composers due to the harmonic,

[5] See Chapter Two, regarding Melville Herskovits and Curt Sachs (pp.15 – 17).

[6] See Chapter Two, pp.19 – 20. Maury Yeston disregards the theories of Grosvenor Cooper and Leonard Meyer and instead derives a Schenkerian framework for exploring rhythmic dissonances. Similarly, Harald Krebs acknowledge and adopts a similar framework from Yeston but adjust terminology to suit his system.

rhythmic and stylistic language with which I engage. My rhythmic developments focus primarily on localised cross-rhythmic/metric conflicts instead of large-scale, more subliminal manipulations. For example, the rhythmic complexities of Harrison Birtwistle's *Silbury Air* or Elliot Carter's long-range polyrhythms produce rhythmic processes that span an entire piece's duration.[7] Due to my emphasis on localised sub-metric layers, my material could be deemed more explicit, creating a more noticeable aural experience for the audience.

It is important to highlight that whilst this thesis explores a Contemporary-Classical style, there are also musical influences that stretch beyond this genre and inevitably bleed into my music. As an electric guitarist, I became influenced by a range of genres, notably Metal, Heavy Rock, Funk and Pop during my early education. As a first-study pianist, I primarily explored Classical, Romantic and Twentieth-Century repertoire.[8] This breadth of influences has resulted in my inspirations often being borrowed from other musical styles, with most being subconscious occurrences within my Contemporary-Classical voice.

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[7] This does not detract from their ingenuity, but instead appeals to a different aural expectation and compositional practice. It appears, from the score, that Birtwistle intended that performers are aware of his complex pulse labyrinth in its entirety, but only alludes to it in his liner notes. Similarly, Carter's long-range polyrhythms seen in string quartets are not explicitly highlighted to the listener. It appears these are both complex rhythmic events that an audience should *experience* rather than acknowledge consciously and understand.

[8] I often view musical own musical connections within a Classical *vs.* non-Classical styles despite them blending within my own style. As a classical musician, I enjoyed playing music by Ludwig Van Beethoven, Felix Mendelssohn, Sergei Rachmaninoff, Maurice Ravel, Claude Debussy, Enrique Granados and Bela Bartók. From non-Classical genres, I became influenced by Eddie Van Halen, John Petrucci, Earth, Wind and Fire, Charlie Puth, Jacob Collier, My Chemical Romance and Avenged Sevenfold.

Regarding harmony and style, I engage with a broad range of idioms, and this is evident in the scope of harmony used within the portfolio. Throughout, there is evidence of traditional harmony, modality and heavy chromaticism aimed at pushing the rhythmic processes within different harmonic styles. In pursuing a broad harmonic language, I believe that my compositional style can be found within the rhythmic processes and their developments, producing a rhythmic idiosyncrasy across the different soundworlds that this portfolio explores.

Research Aims and Commentary Structure

I have focused on three questions to organise my research. These questions arose through the early stages of the project:

1. What techniques and devices are there that produce rhythmic dissonance? Do these exist within my compositional style?
2. What practices are challenged by the use of rhythmic dissonance (notational/performance practice)? How does a composer negate these problems?
3. To what extent are rhythmic techniques an effective method of compositional development over short- and long-form works?

Question one arose from a sense of frustration, struggling to find a source that explicitly categorised rhythmic techniques. Whilst some literature explored the effect of a proposed technique within a case study, there lacked a comprehensive overview of all methods that can create rhythmic dissonance. Question two derived from music workshops in the early stages of the PhD, where my original notational practice caused unnecessary confusion. It became apparent that I needed to consciously devise a notational strategy to ensure the cleanest form of notation to both illustrate my musical ideas and enable performers to effectively interpret them. The final question challenges the effectiveness of using these techniques within an extended compositional context – my piano concerto, *Odyssey* – focusing in particular on long-term development of rhythmic techniques.

Chapter One is a literature review focusing on the scholarly texts discussing rhythmic dissonance. Chronologically organised, the chapter aims to draw connections to what I consider to be a vague conception of rhythmic dissonance and the growing attention the area receives towards the twentieth century.

Chapter Two highlights' techniques and devices associated with rhythmic dissonance and devises an approach to categorise these, building on past scholarly literature.

Case studies featuring my compositions will be used to highlight where these techniques appear in my work.

Chapter Three explores my notational practices as a result of the workshopping and performance of my compositions. This aims to highlight the issues that have arisen and my approach to mitigating them whilst maintaining my compositional intentions. This chapter also draws upon notational practices from other composers in order to explore the most rational notational practices for polyrhythmic music.

Chapter Four explores the durability of polyrhythmic techniques over short- and long-term development. Using *Odyssey* as a case study, the chapter will assess the extent to which rhythmic techniques are sufficient at producing compositional development over a sustained duration.

Chapter 1 Elusive Terminology and Late Discovery

Overview

This chapter will explore the scholarly literature surrounding rhythmic dissonance within the Classical, Romantic and twentieth-century sphere. It is important to note that there are scholars who are conducting research on rhythm outside of these areas and whose contributions are significant. For instance, Milton Mermikides' research into 'time-feel' discusses the rhythmic techniques of swing and the micro-timings that create development in Jazz improvisation.[1] Similarly, Oliver Woods' PhD research explores *Metric Modulation in Contemporary Drum Practice* with case studies exploring post-fusion music.[2] Steven Walker's DMA thesis researching *The Cyclical, Reciprocal Relationship Between Funk Drumming and the Hip-Hop Technologist* also offers interesting insights into rhythmic variations/developments between the two genres.[3] However, due to the constraints of the current research, their work cannot be explored in detail here.

This chapter primarily focuses on the musicological origins of the terminology, rather than the practical output from composers.[4] The academic literature has been used to aid my own compositional awareness of the techniques and devices available to me as a composer. It

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[1] Merton Mermikides, *Changes Over Time: Theory and Practice* (PhD thesis, University of Surrey, 2010).

[2] Oliver Peter Duffett Woods, *Rhythmic Modulation in Contemporary Drum Practice* (PhD thesis, University of Surrey, 2025).

[3] Steven Walker, *The Cyclical, Reciprocal Relationship Between Funk Drumming and the Hip-Hop Technologist* (DMA thesis, University of Salford, 2021).

[4] Key composers such as Igor Stravinsky, Harrison Birtwistle, Charles Ives, Elliott Carter, Dusan Bogdanovic and Béla Bartók will appear in subsequent chapters.

has also allowed me to understand the academic context of my work, and the broader scope of rhythmic dissonance as a topic. Before engaging with the literature, it is important to acknowledge that scholars themselves have struggled to define 'rhythm' in concrete terms.

Rhythm is a fundamental element of music, yet it is notoriously difficult to define. Justin London's article 'Rhythm' from *Grove Music Online*, for instance, suggests that 'In etymological discussions of the term [rhythm] there is a tension between rhythm as continuously "flowing" and rhythm as periodically punctuated movement. In musical contexts the term [rhythm] is even harder to pin down.'[5] This state of uncertainty has led to numerous scholars attempting to define the term in broad terms. As Justin London states: 'This ambiguity has not only resulted in rhythm being loosely defined in general, but also terms that stem from rhythmic concepts.'[6] William E. Caplin concurs with this viewpoint: 'Everyone agrees: it is difficult to talk about rhythm in music, for that matter, the temporal experience in general.'[7] As a result, 'the language of time and rhythm is complex, contentious, and highly metaphorical.'[8] Moreover, as Curt Sachs states: 'What is rhythm? The answer, I am afraid, is, so far just – a word: a word without a generally accepted meaning. […] The confusion is terrifying indeed.'[9]

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[5]Justin London, 'Rhythm', *Grove Music Online* <www.oxfordmusiconline.com> [accessed 20th February 2023].

[6] Ibid.

[7] William E.Caplin, 'Theories of musical rhythm in the eighteenth and nineteenth centuries', *The Cambridge History of Wester Music Theory* (Cambridge: Cambridge University Press, 2008) pp. 657 – 694.

[8] Ibid. p.657.

[9] Curt Sachs, *Rhythm and Tempo: A Study in Music History* (New York: Vail-Ballour Press, 1953) p.12.

If the concept of rhythm remains elusive even among scholars, how can we explore an aspect of rhythm that delves even deeper into this acknowledged ambiguity? It is vitally important, therefore, to produce a working definition of rhythm. So, to be precise: by rhythm, I am referring to the collation of audible attacks across a temporal plane.[10] Within this temporality, oscillations/attacks are placed to form a series of attacks. These sounds can occur regularly or irregularly, equidistant or non-equidistant, with varying durations. If the oscillations occur with a degree of recognisable repetition/frequency, the series of attacks can be defined as a pattern. To provide greater clarity, a Glossary appears within the front matter to support terminology appearing in this and subsequent chapters.

Rhythmic Dissonance

To clarify the concept as it will be used in this discussion, it is helpful to define what is meant by rhythmic dissonance. By rhythmic dissonance, I am referring to a non-congruency of rhythmic layers within a musical passage. Congruency, defined as 'the quality of being similar to or in agreement with something', appears in music through the vertical alignment of rhythmic attacks within a metre.[11] Dissonance is produced by introducing rhythmic layers that weaken the established metric alignment through anti-metric attacks. The anti-metric attacks destabilise the inherent structure that a musical metre imposes and can result in a degree of metric ambiguity or lack of metric strength within a musical passage.

Rhythmic dissonance does not appear as an independent term in *Grove Music Online* but has been used by a range of scholars in twentieth century and contemporary academia. The earliest reference to the term in academic literature is Melville J. Herskovits' 1928

[10] In the context of music, our temporal plane is traditionally the duration of a given work.

[11] See Ex. 1.4 (page 17).

publication *Patterns of Negro Music*.[12] Herskovits briefly highlights the stylistic challenges of performing African music, from a western-trained musician's perspective, citing the difficulty of performing 4/4 in one hand against 9/4 in the other 'with a rhythmic consonance every 36 beats[.]' Herskovits does not elaborate on the use of this term, nor does he cite any reference. One can infer that Herskovits is borrowing the harmonic terminology to imply the concept that the convergence of two independent pulse trains aligning is 'consonant'.[13] This also requires the reader to infer their own understanding of dissonance within rhythm.

The most common attribution cited in the literature is Joseph Schillinger's *System of Musical Composition* (1950).[14] Schillinger's volume of books is dedicated to composition processes such as rhythm, harmony, pitch-scales and counterpoint with an emphasis on mathematical and graphical presentations. Schillinger states the superimposition of two non-congruent periodicities, such as a 2:3 relationship, as dissonant within his *Encyclopedia of Rhythms*: a companion volume to the main text.[15] Like Herskovits, Schillinger does not

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[12] Melville Herskovits, 'Patterns of Negro Music', *Illinois Academy of Science Transaction* (1928), cited by Curt Sachs. We must be aware of the context of this scholar's research and the racial stigma that existed in this historic period. This research does not aim to support or promote Herskovits' racial comments but instead aims to take information of importance to this research and acknowledge it.

[13] Evan O.Adams, 'What is Rhythmic Dissonance?', *The Eagle Feather*, 14/1 (2017), pp.1–22 <http://dx.doi.org/10.12794/tef.2017.360>. Evan O.Adams uses the terms convergence and divergence in association with cross-rhythmic alignment.

[14] Harald Krebs, 'Some Extensions of the Concepts of Metrical Consonance and Dissonance', *Journal of Music Theory*, 31/1 (Spring, 1987), p. 99. Krebs cites Schillinger as the first academic to use the term.

[15]Joseph Schillinger, 'Theory of Rhythm', *The Schillinger System of Musical Composition* (New York: Carl Fischer, 1946). The *Encyclopaedia of Rhythms*, the volume that contains the 'dissonant' reference is not footnoted due to its posthumous release twenty-years after Schillinger's passing.

elaborate on this statement within his main rhythm volume; instead, he dedicates a subchapter to cross-rhythmic textures titled the 'Interference Of Periodicities'.[16] The chapter avoids the use of the term rhythmic dissonance; however, 'interference' has negative connotations, suggesting that the superimposition of non-congruent pulses (or 'periodicities') produces a disruptive – and therefore dissonant – sound. From a musician's perspective, Schillinger's text can be challenging to comprehend. The introduction highlights Schillinger's system as a synthesis of modern physics, psychology and mathematics in addition to musical theory,[17] forcing a musician to grapple with challenging and potentially alienating formulae and graphical presentations.

The terminology reappears in Curt Sachs' *Rhythm and Tempo: A Study in Music History* (1953) but quotes Herskovits near-*verbatim* without elaboration.[18] Later in the book, Sachs draws a connection to harmony's close connection to rhythm and suggests that harmony's consonance and dissonance are closely linked 'to the concept of "good" and "bad" beats' but again does not reinforce the term rhythmic dissonance.[19] Another moment is missed when Sachs raises metrical alterations and the hemiola: this is a technique that produces rhythmic dissonance but is not acknowledged by Sachs.[20] Understandably, the holistic nature of Sachs' book aims to cover a large span of musical history and therefore inevitably lacks depth regarding more niche topics.

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[16] Schillinger, p. 41.

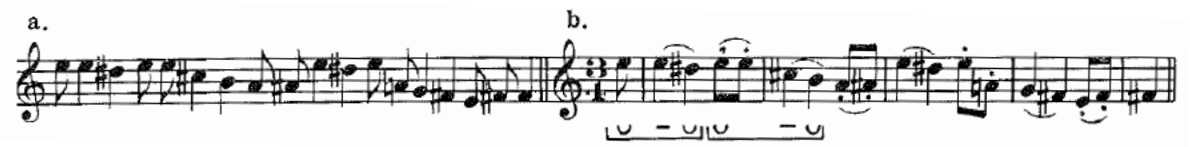
[17] Ibid., p. xi. Introduction by Arnold Shaw and Lyle Dowling.

[18] Sachs, p. 41.

[19] Ibid. p. 268.

[20] Ibid. pp. 190, 304.

Scholars Grosvenor Cooper and Leonard Meyer in *The Rhythmic Structure of Music* (1960) reference Sachs' use of the term and include it in their case studies, but frustratingly do not provide their own interpretation.[21] They also introduce a new term, 'metric crossing', used for musical passages that are metrically ambiguous to the extent that they could be re-barred.[22] They present a simplified piano reduction of Bartók's Piano Concerto No. 3 as their case study. Cooper and Meyer organise Ex. 1.1 into an alternative metric grouping of 3/4 with an anacrusis (their Example 120b), as well as placing the quaver on the first beat, resulting in a syncopation.[23] Bartók's original notation notates the RH in 3/8 as the main metre with an implication of 2/4 in the LH.



Ex. 1.1 Cooper and Meyer, *The Rhythmic Structure of Music*, Example 120.[24]

They also discuss metric alternation using Guillaume Dufay's 'Kyrie' from *Missa Sancti Jacobi* as a case study. Ex. 1.2 (a reproduction of their Example 123) showcases their analysis, but arguably, some groupings could be perceived differently.[25] More strikingly,

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[21] Grosvenor Cooper and Leonard Meyer, *The Rhythmic Structure of Music* (Chicago: The University of Chicago Press, 1960), p. 108.

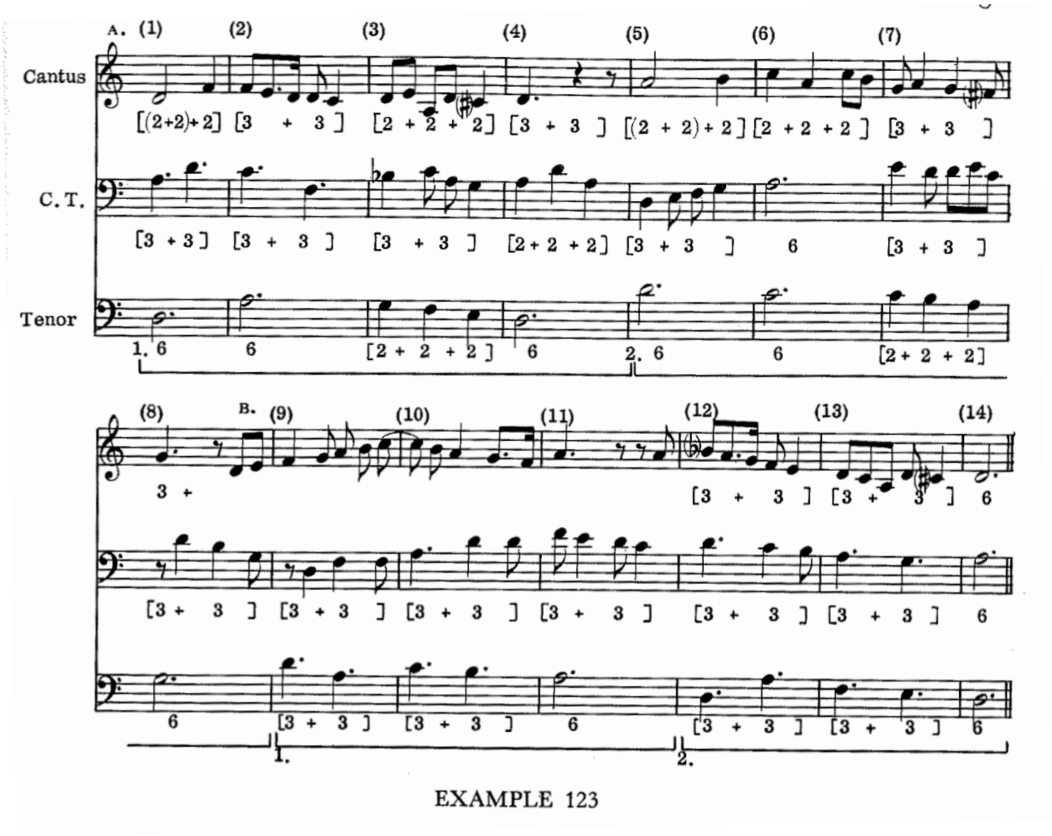
[22] Ibid. p.106. One could also use the term interchangeably with metric ambiguity, the ability for a passage to be metrically ambiguous and therefore can fit into different metres.

[23] Ibid.

[24] Ibid. pp. 106–108.

[25] For example, bars 3 – 5 within the countertenor line could be perceived retrospectively as grouped in 3/4 due to bar 4 being 2+2+2. Interestingly, Cooper and Meyer chose to contextualise bar 3 within the compound metre of 6/8 instead of the 3/4 that is established within the cantus and tenor lines.

Cooper and Meyer's example suggests that metrical conflicts have existed since the Renaissance period, highlighting the delayed response in academia to explore this area of compositional technique.



Ex. 1.2 Guillaume Dufay's "Kyrie" from Missa Sancti Jacobi; Cooper and Meyer, Example 123. [26]

Understandably, this is due to the compound feeling being established in the countertenor in bars 1– 2. This example highlights an important factor of rhythmic dissonance: context. Within the context of a musical passage, a listener's entrainment is forged by past and future rhythmic events. The listener in this case study is immediately faced with a metrical conflict. Bar 1 has a sense of 3/4 (cantus) against 6/8 (countertenor and tenor) that resolves in bar 2. With regards to subjectivity, our feeling a single rhythmic layer can change due to its surroundings (such as the bar 3 in the cantus being interpreted as 3+3).

[26] Ibid. p. 109.

Frameworks for Measuring Dissonances

A significant turning point occurs with Maury Yeston's book *The Stratification of Musical Rhythm*. Yeston assesses the historical context and, damningly, critiques Cooper and Meyer's approach of using poetic metre due to issues of inconsistency and their 'arbitrarily applied' methodology.[27] Yeston provides a framework for exploring rhythmic stratification by defining three rhythmic strata: the foreground, middleground and background.[28] The foreground is 'at the absolute surface of a composition'.[29] The middleground material is seen as slower-moving rhythmic material that provides the interpretation of the foreground grouping through accentuation. The background is the slowest-moving layer of rhythmic events. Yeston also emphasises pitch content as influential to our perception of rhythm and the approach to identifying middleground layers.[30] In his conclusion, Yeston states: 'Procedurally, the relationship between pitch and rhythm can only be understood non-circularly either by valuing some of the attacks within a rhythmic pattern they coincide with important pitches, or by valuing certain pitches because they coincide with recurrences of important rhythmic patterns.'[31]

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[27] Maury Yeston, *The Stratification of Musical Rhythm* (London: Yale University Press, 1976), p. 29.

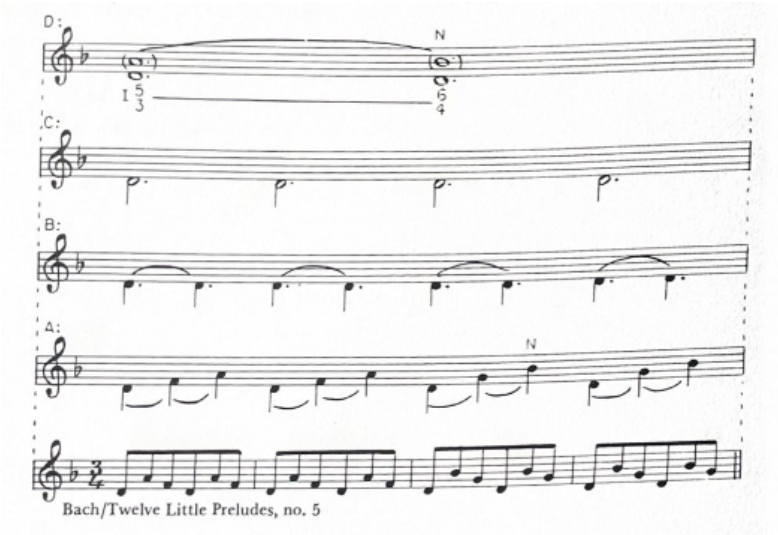
[28] Yeston derives this framework from Schenkerian analysis, but not to the extent that one music be proficient in analysing using Schenker's framework.

[29] Ibid.

[30] Ibid. p. 84. 'All rhythmic patterns of middleground levels are determined exclusively by pitch criteria. Significant pitches are chosen on the basis of principles of tonal structure, and then the rhythmic patterns formed by these pitches may be posited.'

[31] Ibid. p. 151.

There can be multiple middleground layers. In Ex. 1.3, Yeston presents A, B and C as separate middleground layers. Yeston highlights the importance of pitch and phrasing in differentiating the multiple layers. Layer A highlights the arpeggiation of D minor with a crotchet pulse that is present within the foreground implying a 3/4 metre. Layer B presents the repetition of the tonic within Bach's arpeggiated passage creating a suggestion of 6/8, resulting in two middleground layers that conflict one another. Yeston argues that this could be notated in 6/8 given the Layer B interpretation but is dependent on compositional intention. If the pedal D note needed emphasis, 6/8 would be appropriate; alternatively, if Bach intended a 'sweep from root to third to fifth', then 3/4 is the correct metre.[32] Yeston concludes this section by emphasising the importance of the pitch strata governing the time signature 'and not *vice versa*'.[33]



Ex. 1.3 Different layers of motion; Yeston, *The Stratification of Musical Rhyt*hm, Example 3.8 [34]

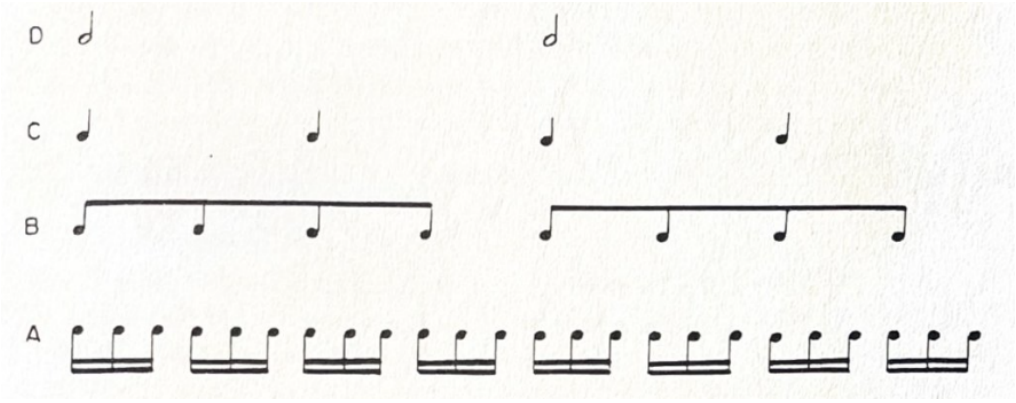
[32] Ibid. p. 70.

[33] Ibid. p. 71.

[34] Ibid. p. 68.

Yeston's comments are significant when deciding, as a composer, the overall metric structure chosen for a musical texture. Firstly, the composer needs to establish the important layers of the texture (melody, ostinato patterns, harmonic rhythm and musical gesture) whilst devising the metric structure for a composition. Secondly, Yeston's emphasis on pitch strata governing the time signature infers that the relationship between pitch and metric structures is closer than one could assume: these factors are explored in Chapter Four.

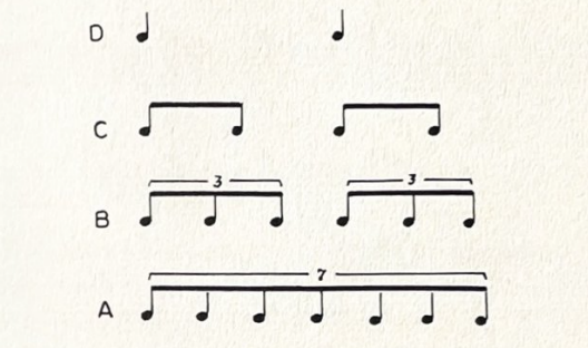
Yeston's text applies the terms consonance-dissonance within a rhythmic context, with well-overdue elaboration. Yeston states that rhythmic consonance is produced through the alignment of rhythmic layers and is demonstrated by the rhythmic layers presented in Ex. 1.4.[35] In contrast, rhythmic dissonance is created through the non-alignment of different rhythmic layers and is shown in Ex. 1.5.



Ex. 1.4 from Yeston's *The Stratification of Musical Rhythm* showing 'a schematization' of rhythmic consonance. [36]

[35] Ibid. pp. 78 – 79.

[36] Ibid. p. 78.



Ex. 1.5 from Yeston's *The Stratification of Musical Rhythm* showing rhythmic dissonance. [37]

A key scholar who builds on Yeston's theory is Harald Krebs, particularly through his article 'Some Extensions of the Concepts of Metrical Consonance and Dissonance' and his subsequent book *Fantasy Pieces*: *Metrical Dissonance in the Music of Robert Schumann*. Krebs' article uses Yeston as a springboard, but with some minor changes. First, Krebs uses metric, as opposed to rhythmic, due to the concept that 'Yeston defines metre in as the outgrowth of the interaction of a number of strata'.[38] In having these interferences within a metric structure, the new strata inevitably produce an opposing metric effect. This is made clearer in *Fantasy Pieces* where Krebs discusses the interaction of different pulses (strata) becoming metrical beats, or beats 'above the level of the bar line (hypermetrical beats, or hyperbeats)'.[39]

[37] Ibid. p. 79.

[38] Ibid. p. 106. One could also use the term interchangeably with metric ambiguity, the ability for a passage to be metrically ambiguous and therefore can fit into different metres.

[39] Ibid. p. 30. One could argue that a change in terminology causes confusion, in the same context that many use cross-rhythm and polyrhythm interchangeably. For the remainder of this paper, I treat metric/rhythmic dissonance as interchangeable terms and will abide by the terminology that the author uses.

Krebs adopts a geometric approach, stating that Yeston and Charles Seeger's approach is arithmetic and therefore somewhat limiting due to the method relying on horizontal misalignment through the combination of unequal integers (2/3, 3/4).[40] A geometric view allows there to be vertical misalignment, using the same integer (e.g. two non-congruent quaver pulse trains) in addition to horizontal (primarily seen in arithmetic methodology). Krebs argues that adopting a geometric approach allows a second type of dissonance to occur where 'the nonaligned association of equivalent (congruent) layers' produces dissonance and cites Cooper and Meyer's concept of metric crossing as an example of this.[41]

Krebs identifies metre as the combination or 'unification of all layers of motion' and establishes three layers: the pulse layer, micropulses and interpretive layers, linking to Yeston's concepts of foreground, middleground and background.[42] His framework is complex; to avoid confusion, a direct quotation is given here:

> The pulse layer is the most quickly moving pervasive series of pulses, generally arising from a more or less constant series of attack on the musical surface. (The omission of a few pulses here and there does not seriously disrupt the pulse layer once it is clearly established.) More quickly moving layers, or 'micropulses,' may intermittently be woven into the metrical tapestry of a work as coloristic embellishments. Of greater significance are the series of regular recurring pulses that move more slowly than the pulse layer. These allow the listener to 'interpret'

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[40] Harald Krebs, *Fantasy Pieces: Metrical Dissonance in the Music of Robert Schumann* (Oxford: Oxford University Press, 1999), pp. 17 – 18. This also appears in Krebs, 'Some Extensions of the Concepts of Metrical Consonance and Dissonance', pp.101 – 102.

[41] Ibid. pp. 17 – 18.

[42] Ibid. p. 23. Krebs' terms are also derived from Schenkerian analysis.

> the raw data of the pulse layer by organizing its pulses into larger units. The pulses of each 'interpretive layer' subsume a constant number of pulse-layer attacks; an interpretive layer can therefore be characterized by an integer denoting this constant quantity. I refer to this integer n as the 'cardinality' of the layer, and to an interpretive layer of cardinality n as an 'n-layer.'[43]

Krebs identifies two forms of dissonance: grouping dissonances and displacement dissonances.[44] Grouping dissonances occur when some alignment of two non-congruent layers exists, such as a cross-rhythm.[45] Within a cross-rhythm, the two conflicting pulse trains start together before diverging. According to Krebs:

> If in a grouping dissonance Gx/y, x and y have a common factor z, alignment will occur more frequently, namely after a number of pulses determined by the equation (xy)/z. Thus in the dissonance G9/6, alignment occurs at every 18th pulse (9 times 6, divided by 3, the common factor of 9 and 6), and in the dissonance G12/8, at every 24th pulse (12 times 8, divided by the common factor 4).[46]

In the quotations above, Krebs has established a formula to calculate the moment of convergence within a grouping dissonance.[47] This is the first approach to quantifying rhythmic dissonances and has helped me to contextualise my compositional approach to

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[43] Ibid.

[44] Ibid. p. 33. These terms are borrowed from Peter Kaminsky.

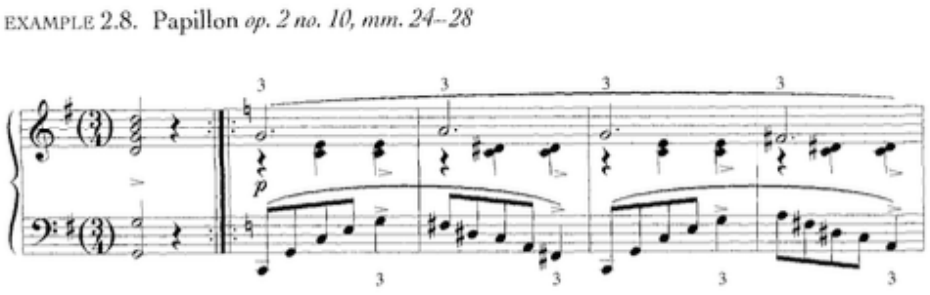
[45] Ibid. pp. 31 – 35.

[46] Ibid. pp. 31 – 32.

[47] 'G' is shorthand for grouping.

developing cross-rhythmic material. For example, one approach could be to calculate moments of convergence within my own work throughout a piece to see if these convergences increase or decrease in distance when exploring grouping dissonances.

Displacement dissonances are two simultaneous pulse streams of equal cardinality that are offset from one another. These dissonances require an established metrical layer and one antimetrical layer.[48] Unlike a grouping dissonance, a displacement dissonance's attacks do not converge in the same cycle.[49]



Ex. 1.6 example taken from Schumann's *Papillon* op. 2 in *Fantasy Pieces*.[50]

Ex. 1.6 is an example of displacement dissonance between the right-hand dotted minim and the accentuated crotchet in the left-hand. Krebs argues that we can hear this displacement dissonance due to two reasons. Firstly, b.24's pause allows us to hear the start of the new passage (b.25) as context for the upcoming displacement. Our first metrical layer is the RH dotted minim. Secondly, the accented LH crotchet on beat 3 establishes a new metrical layer through its consistency and repetition. In the example above, Krebs is

[48] *Clapping Music* (1972) by Steve Reich is an example of a rhythmic pattern becoming displaced by a quaver beat in each cycle.

[49] Ibid. p. 33.

[50] Ibid. p. 35.

referencing both pitch strata, agogic accentuation, and the established metric layer to highlight a displacement dissonance, reinforcing the concept that there is a more complex relationship between metric and anti-metric texture occurring.

The labelling system is different for displacement dissonances. Krebs uses 'Dx+a': 'D' for displacement, 'x' for the shared cardinality of the interpretive layers, '+' to indicate forward progression, and 'a' for the displacement index. This formula may seem complex, but below (Ex. 1.7) is a simplified example of displacement dissonances using coffee beans, as illustrated in Schumann's *Fantasy Pieces*.

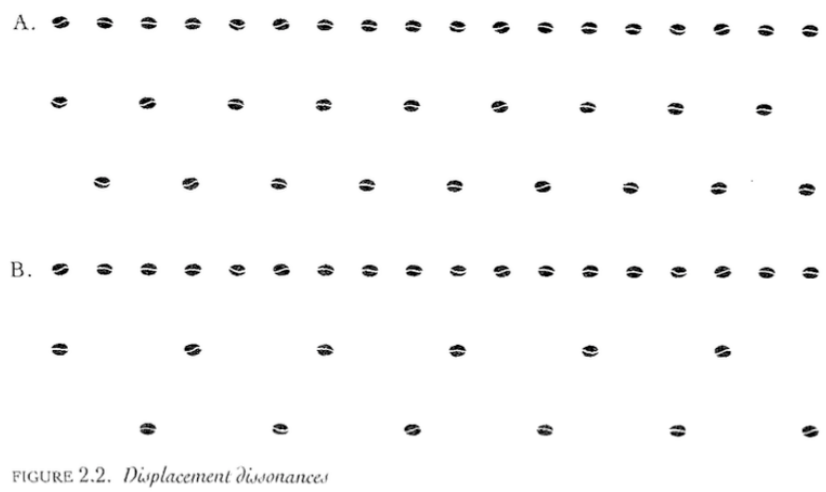


FIGURE 2.2. *Displacement dissonances*

Ex. 1.7. Coffee bean presentation from *Fantasy Pieces* illustrating displacement dissonance. [51]

This example presents two displacement dissonances. The pulse layer running along the top of both examples is the lowest common pulsation shared by the two different cardinalities. Using Krebs' formulae, A is a D2+1 dissonance and B is D3+2.[52]

[51] Ibid. p. 34.

[52] Ibid.

Krebs discovers that Schumann uses metric dissonance in conjunction with harmony to produce even greater moments of musical tension. Schumann's vocal works also follow a similar trajectory. Krebs draws attention to sections where Schumann's musical text expresses thematic tension and is accompanied by a rhythmically dissonant texture. Krebs highlights *Es Leuchtet meine Liebe* as a work reflecting Schumann's connection between text and metrical states, using moments of metrical dissonance at the appearance of a character (the giant). Krebs deduces that Schumann's fragile mental state could be a source of metrical conflict, as if his music personifies his battle through metrically consonant and dissonant passages, but raises the need to be cautious regarding this theory due to a lack of concrete evidence.[53]

Krebs' work primarily focuses on Schumann's music, but also applies brief case studies to Haydn, Beethoven, Berlioz, Chopin, Ives and Schoenberg as examples of metric dissonance from the past and present, arguing that this framework can be applied to other works. Avior Byron, in his review of *Fantasy Pieces*, raises some concerns regarding Krebs' inclusion of Schoenberg's Valse De Chopin from *Pierrot Lunaire*, citing that Schoenberg's ideologies go against Krebs' theories.[54] Byron states that Krebs believes in subtle metrical stresses within the performance of a work, and for the performer to have an awareness of where metrical conflicts begin and end within the music in order to best communicate them.[55] Byron quotes Schoenberg's comments on over-accentuating as being 'poor musicianship' and that the central concept of the motive was the important element to the listener, resulting in the start and end

[53] Ibid. p. 184.

[54] Avior Byron, 'Reviewed Work(s): Fantasy Pieces: Metrical Dissonance in the Music of Robert Schumann by Harald Krebs', *The World of Music*, 46/3 (2004), pp. 159 – 164.

[55] Ibid. p. 161.

of a motif being of less importance.[56] Byron questions grouping Schoenberg's work amongst composers such as Haydn, Beethoven and Berlioz due to the implication that Schoenberg's work is inherently metrically consonant.[57] Moreover, Byron suggests that Krebs tries to quantify moments within Schoenberg that are too complex to use a binary consonance-dissonance model. Byron states 'Krebs' attempt to force them into a pure metrical consonant or dissonant definition is superficial.'[58]

Byron raises a number of key concepts and challenges regarding metric dissonance. Firstly, there is the fundamental challenge of communicating these metric dissonances through accentuation, phrasing, pitch selection and dynamics in an appropriate manner. Furthermore, it can be counter-intuitive to superimpose a system (i.e. Krebs' system) that quantifies these rhythmic ideas into a composer that juxtaposes that approach. For example, the approach would completely fail when applying the system to work from the New Complexity movement, where metrical consonance has little to no occurrence.[59] Byron defining consonance and dissonance as binary is, in my opinion, problematic. I would argue that Krebs' use of numerical ratios, and his section discussing low-level, mid-level and high-

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[56] Ibid., quoting from Arnold Schoenberg, *Style and Idea,* ed. and trans. Leonard Stein (Faber & Faber London 1975), p. 330.

[57] Byron, p. 162.

[58] Ibid.

[59] Richard Taruskin, *Music in the Late Twentieth Century*, rev. edn, *The Oxford History of Western Music*, V (Oxford: Oxford University Press, 2010), pp.509–11. Whilst Taruskin does not explicitly discuss the concepts of metrical consonance, he does discuss Ferneyhough's use of highly complex nested rhythms and the movement's aim to push beyond 'cognitive constraints'.

level dissonances illustrates that metric dissonance is more than just a binary framework and instead offers a greater spectrum of quantification.[60]

Krebs' exploration of this field was a significant advancement in rhythmic/metric dissonance by presenting a relatively robust framework for exploring rhythmic conflict. This framework for analysis requires pre-requisite conditions to function effectively: namely, the music must be constructed with metrical consonance as the starting point.

Recent Literature

In recent literature, rhythmic studies have become more developed. Justin London's book *Hearing in Time: Psychological Aspects of Musical Meter* addresses challenges with metre. London titles a chapter 'Metric Malleability and Metric Ambiguity' in which he employs these terms.[61] London re-emphasises that metrically ambiguous musical passages can be re-interpreted to fit different metres based on their accentuation – similar to Cooper and Meyer's earlier Bartók example.

London's chapter on metric dissonance references the term 'shadow metre' from William Rothstein and Frank Samarotto. 'A shadow meter is a secondary meter formed by a series of regularly recurring accents, when those accents do not coincide with the accents of the prevailing meter (or hypermeter).'[62] London summarises the chapter with the following:

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[60] Krebs, pp. 53 – 57.

[61] Justin London, 'Meter as a Kind of Attentional Behavior', *Hearing in Time: Psychological Aspects of Musical Meter*, 1st edn (New York: Oxford University Press, 2004; online edn, Oxford Academic, 1 September 2007).

[62] William Nathan Rothstein, *Phrase Rhythm in Tonal Music* (New York: Schirmer Books; London: Collier Macmillan Publishers, 1989), p. 167.

> Unambiguous metric contexts involve pitch/durational patterns that strongly tend to project a single meter and are readily maintained by the listener, even in a deadpan performance.
>
> Latently ambiguous metric contexts involve metrically malleable pitch/durational patterns that have the potential for ambiguity, but these are usually disambiguated by the use of expressive variations in performance.
>
> Truly ambiguous metric contexts involve pitch/durational patterns that may give rise to different metric construals on different listening occasions. This includes polyrhythms in certain tempo ranges, complex textures in which voices/layers project diverse metric organizations, as well as metrically malleable passages in a deadpan performance. […]
>
> Vague metric contexts involve the absence of one or more normative levels of metrical structure. […] In a metrically vague context no determinate pattern ever emerges.[63]

London's collation of ideas regarding metre is a useful source for a contemporary perspective on metric perception. In the context of my work, London's concepts can be applied to my music to assess the extent of metric ambiguity within a musical passage.

Mark Delaere's article of 2009, *Unfolding Time: Studies in Temporality in Twentieth-Century Music*, highlights the lack of research surrounding the study of rhythm, and states that it has only been since the nineteenth century, 'isolated theoretical studies of musical time

[63] London, Hearing in Time.

[have] seen the light'.[64] Notably, Delaere provides a brief glossary of crucial rhythmic terminology such as rhythm, beat, metre, tempo, pulse, anti-metric figure and polyrhythm.[65] These definitions proved influential for the compilation of my own Glossary.

Delaere argues that the categories of musical time are not fixed at any level; 'beat or tempo, for instance, can operate on the surface, the intermediary or the background level, depending on context.'[66] If musical temporality is not fixed, one could argue that musical notation, the vessel for communicating temporal concepts, is also impacted by this. Because of this concept and the complexity that my music aims to explore, it is important to construct a robust notational practice that allows the exploration of temporal concepts whilst simultaneously being an effective conduit for performers to engage with. Navigating this within a Western Classical notational practice also creates its own challenges due to the rhythmic hierarchy imposed by that system. Navigating intentional disruptions (i.e. rhythmic/metric dissonances) inevitably creates a paradoxical tension between the precision of the Western Classical notational system I use and the rhythmic conflict that I aim to produce in my compositions. These concepts will be explored within my third chapter on notational practice.

Two recent theses explore rhythmic dissonance within a composer's works. Imri Talgam examines the challenges of performing rhythmic dissonance in Ligeti's *Études* and attempts to re-notate Ligeti's scores to aid in the performance of complex rhythms. Talgam defines rhythmic dissonance as 'the simultaneous coexistences of at least two competing

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[64] Mark Delaere, 'Tempo, Metre, Rhythm', *Unfolding Time: Studies in Temporality in Twentieth-Century Music* (Leuven: Leuven University Press, 2009), p. 13.

[65] Ibid. pp. 18 – 19.

[66] Ibid., p. 18.

pulse trains that exhibit some degree of regularity, allowing the listener to entrain to either of the different metres and grouping of accents suggested by each'.[67] Although this definition aligns with past scholars, Talgam has avoided acknowledging the literature surrounding rhythmic dissonance, so the definition appears to be his own conception, and its integrity is brought into question.[68] Talgam highlights the need for listeners to experience some form of metric grounding before a rhythmic dissonance can be contextualized;[69] this becomes more challenging within post-tonal music due to frequent metric changes and irregular rhythm. Talgam, like Krebs, emphasizes the importance of a performer's interpretation. Due to Ligeti's complex groupings, Talgam uses Ligeti's *Étude 3* 'Touches Bloquées' as an example, where the performer has several parameters that can be manipulated more freely to influence the perception of grouping conflict, including accentuation, articulation, dynamics, and the balance between hands. One could argue, then, that rhythmic dissonances are not only governed by the compositional intent behind them but also by the performance practice of them. This requires further extended discussion, and this will take place in Chapter Three to address the most optimal notational approaches to rhythmic dissonances within a performance context.

Walter Ellis Hampton also explores rhythmic consonance and dissonance within the solo percussion work of contemporary composer Eckhard Kopetzki. Hampton initially highlights a number of elements that can create rhythmic dissonance such as contrasting

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[67] Imri Talgam, Performing Rhythmic Dissonance in Ligeti's Études, Book 1: A Perception-Driven Approach and Re-notation (PhD dissertation, City University of York, 2019), p. 13.

[68] This discussion takes place on p. 13. It is only until p. 47 where Talgam references the work of Krebs and Yeston.

[69] Talgam, p. 113.

metre, isolated attack points (syncopation), changes in rhythmic density such as changes in tempo or rubato, and finally silence (hiatus).[70] Hampton discovers that Kopetzki uses rhythmic consonance and dissonance through the manipulation of both rhythmic contrasts, note values, cross-rhythmic and metric pulse patterns.[71] Additionally, Kopetzki uses silence (hiatus) and 'moments of repose' to increase musical tensions.[72] Finally, Hampton highlights Kopetzki's structural approach to rhythmic dissonance, concluding that Kopetzki progresses from metric consonance to dissonance on a 'large scale' through the evolution of simple low-level dissonances into more complex irregular metric layers with overlapping cross-rhythms.[73] With regard to Hampton's observations, I am particularly interested in Kopetzki's employment of silence and his structural use of rhythmic dissonance, and the extent to which these techniques manifest within my own compositional practice.

In a 2017 publication in an undergraduate journal, Evan O. Adams of the University of Texas addresses the question: 'What is Rhythmic Dissonance?'.[74] Adams organises rhythmic dissonance into three categories: metric, temporal and contextual. Metric is categorised by the existence of two or more metres simultaneously for example, cross-rhythmic textures.[75] Adams separates these into divisive and displacement, a clear derivation

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[70] Walter Ellis Hampton, 'Rhythmic Consonance and Dissonance in Eckhard Kopetzkis's Works for Solo Percussion: *Topz-Tanz* and *Canned Heat*' (DMA, University of North Texas, 2014), pp. 11 – 12.

[71] Ibid. p. 47.

[72] Ibid. pp. 12, 47.

[73] Ibid. p. 47.

[74] Evan O. Adams, 'What is Rhythmic Dissonance?', *The Eagle Feather*, 14/1 (2017), pp. 1 – 22 <http://dx.doi.org/10.12794/tef.2017.360>**.** This paper was peer-reviewed, but given the fact that it was written by an undergraduate student, it must be approached with an appropriate level of caution.

[75] Ibid., p. 8.

of Krebs' grouping and displacement theories.[76] Temporal dissonance occurs through the use of polytempo i.e. two tempi occurring simultaneously.[77] Adams presents the concept of convergence and divergence points within a polytemporal work, depending on the temporal ratio of the two (or more) tempi.[78] There also exists moments of convergence and divergence occur when the tempi become synced momentarily.[79] This can occur more frequently when the ratios of two tempi are simpler. For example, a ratio of 2:1 or 3:2 would see more frequent moments of convergence than 5:19.

Adams suggests that we can experience rhythmic dissonances horizontally and he defines these as contextual dissonances.[80] A comparison can be drawn to Krebs' term indirect dissonance, where the listener can internally maintain an established pulse, allowing them to notice a change in metricity. These dissonances rely on an aural tension produced by the disruption of a rhythmic pattern.[81] Finally, Adams identifies that there is a limited collection of composers who consciously, or subconsciously, tackle rhythmic dissonance despite its potential for compositional development.[82]

Mark Gotham's paper 'Towards a Cognitively Based Quantification of Metrical Dissonance' aims to quantify metrical dissonance. Gotham acknowledges that we experience

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[76] Ibid. I would argue that changing the terminology to 'divisive' only further exacerbates the issue of confusing terminology.

[77] Ibid. p. 9.

[78] Ibid. pp. 9 – 10.

[79] This can also occur within polymetre where two different metric accents can converge when they arrive at their lowest common denominator.

[80] Ibid., pp. 11, 20.

[81] Ibid., p. 11.

[82] Ibid., p. 21.

a metrical dissonance within the context of another metre and that we cannot entrain to both simultaneously.[83] Gotham's framework relies upon a metrical weighting system using the Classical concepts of strong and weak beats. In Gotham's terms 'the "strong, weak, medium, weak" of a simple 4/4 becomes 3,1,2,1 and adding an extra pulse level [quavers] expands this to 4,1,2,1,3,1,2,1'.[84] Whilst this concept appears useful, it is not without problems: Gotham is relying upon the performance practice of a given passage for this quantification to be realised. Secondly, this notation system implies that the main rhythmic accentuation follows this metric rigidity with no deviation of its own for the full cycle, with a second layer acting as a disruptor. I would argue that this does not account for displacements that do not occur for the full period where a displaced voice/line might stop short within the texture.

Original	4	1	2	1	3	1	2	1	Sum	Mean
Half-cycle displacement	3	1	2	1	4	1	2	1		
Resulting difference	1	0	0	0	1	0	0	0	2	0.25

Ex. 1.8 highlighting a D4 displacement dissonance.

[83] Mark Gotham, 'Towards a Cognitively Based Quantification of Metrical Dissonance', *The Oxford Handbook of Time in Music* (8 December 2021). This is somewhat disputed by W. Techumeh Fitch and Andrew J. Rosenfeld in their paper 'Perception and Production of Syncopated Rhythms', *Music Perception* (April, 2007), pp. 43 – 58. Similarly, Ève Poudrier and Bruno H. Repp also dispute this argument in 'Can Musicians Track Two Different Beats Simultaneously?', *Music Perception*, 30/4 (April, 2013), pp. 369 – 390.

[84] Ibid. p. 282. My interpretation of this system is that the higher the number, the louder the dynamic accent of the beat (with 4 being the loudest accentuation and 1 being the softest).

Original	4	1	2	1	3	1	2	1	Sum	Mean
Quarter-cycle displacement	2	1	4	1	2	1	3	1		
Resulting difference	2	0	2	0	1	0	1	0	6	0.75

Ex. 1.9 highlighting a D2 displacement dissonance.

Original	4	1	2	1	3	1	2	1	Sum	Mean
Unit displacement	1	4	1	2	1	3	1	2		
Resulting difference	3	3	1	1	2	2	1	1	14	1.75

Ex. 1.10 highlighting a D1 displacement dissonance.

Exx. 1.8 – 10 offer three examples using 4/4 with displacements. Note that Gotham's resulting differences use a subtractive system where the displacement cancels out the strength of the original metre and therefore reduces the metric dominance of the original pulse. Gotham does not present an example with an additional pulse level (e.g., an implication of 3/4 or 5/4) as the system only appears to work with using two pulse trains.[85]

Gotham's 'discrete-weighting model' is useful at quantifying a generalised concept of displaced dissonances, but due to the accentual approach this system is somewhat void within twentieth century and contemporary case studies. As I raised earlier, Byron's comments regarding Schoenberg aesthetics reinforce this scepticism. The metric accentuation that existed within the Classical period no longer stands within the twentieth century making our use of metric accentuation null.

Gotham's exploration of irregular metre, with a focus on 7/8, leads him to believe that mixed metres are not categorizable within his discrete-weighting model; however, when

[85] Ibid., p. 283.

using his calculated salience values, Gotham found that binary metres are more 'adversely affected' than mixed metres.[86] One could argue that due to mixed metres already posing an inherent feeling of instability, because of their hypermetric irregularity, binary metre have a higher level of consonance to deviate from. Gotham's paper highlights a number of interesting concepts despite the criticisms highlighted. Notably, the degree of displacement affects the perceived (or mathematical) rhythmic dissonance created. Secondly, due to the inherent rhythmic instability within irregular metres, Gotham's model does not work as effectively, inferring that metric weightings are weaker within irregular metres.

I believe this approach does offer an interesting insight but, as Gotham suggests, there are assumptions and generalizations used to reach results.[87] It appears that a true quantification of how an individual perceives rhythmic dissonance cannot be truly calculated, even with expertise in psychology and scientific testing. Additionally, it is not within the scope of this research to try and answer this. Instead, my perspective aims to offer a pragmatic approach, relying upon music theory, literature and other scholarly research, primarily focusing on our musical experience of rhythmic dissonance. General assumptions can be made, but these can easily be challenged by social, cultural and educational factors that impact a listener's own aural experience. As a result of this, the main aim of this research is to approach rhythmic dissonance from a pragmatic and musical perspective.

Concluding remarks

The term 'rhythmic dissonance' has been in its infancy since the early twentieth century, with scholars often alluding to the concept with little elaboration and a reliance on the reader to

[86] Ibid., p. 296.

[87] Gotham, pp. 146 – 71.

infer their own understanding. This changed with the work of Yeston and Krebs. Through the construction of a framework, it became possible to analyse rhythmic dissonances and retrospectively prove that these techniques existed within Renaissance, Classical and Romantic eras. With the emancipation of rhythm in the twentieth century,[88] composers such as Ligeti and Kopetzki have explored more complex rhythmic dissonance, leading to a greater opportunity to categorise a growing wealth of rhythmic techniques that produce dissonance. The next chapter categorises various factors that have an impact on rhythmic dissonance and the rhythmic techniques that produce dissonance.

[88] Delaere, p. 21. Delaere uses the term 'emancipation of rhythm' referring to the exploration new rhythmic ideas following isorhythm.

Chapter 2 Categorising Rhythmic Dissonance

Context

To experience a rhythmic dissonance, the phenomenon of rhythmic entrainment needs to be disrupted. Entrainment, a concept displayed in both humans and some animals (such as apes, fireflies, birds and sea lions), describes the ability to synchronise to an external beat. [1] Entrainment is a skill honed by musicians that enables them to quickly align to a given periodicity, allowing an ensemble to synchronize to a single temporal speed.[2] As musical training progresses, musicians will often face more challenging music that requires rhythmic irregularity, such as irregular metres and syncopation.[3] As a result of overcoming these challenges, a musician's ability to entrain and contextualise different rhythmic material strengthens. I argue that entrainment enables the contextualisation of rhythmic dissonances, as

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[1] Patrik N. Juslin, 'Get Into The Groove: Rhythmic Entrainment', *Unlocking the Secrets of Musical Affect* (Oxford: Oxford University Press, 2019). Also see Margaret Wilson and Peter F. Cook, 'Rhythmic entrainment: Why humans want to, fireflies can't help it, pet birds try, and sea lions have to be bribed', *Pyschonomic Bulletin Review* (New York: Springer US, 2016), pp.1647 – 59.

[2] I have personally seen this as a teacher of young musicians. Entrainment in younger musicians is far less secure than in higher-level musicians. It appears to be a intrinsic skill that we have, that requires refinement through musical training and aural exercises. High-level musicians are able to perform complex syncopations and rubatos, requiring a complex understanding of their relationship to the underlying pulse as they shift in- and out-of-phase.

[3] This is evident within the musical examination boards (such as ABRSM, Trinity and Rockschool) where later grades introduce irregular metres, more challenging syncopations and cross-rhythmic textures.

suggested by Krebs' consonance → dissonance model, and is a crucial element in understanding the metric disruptions that occur.[4]

We must also briefly touch upon the pervasive psychological factors at play. A study by Ève Pourdrier and Bruno Repp asked the question: Can Musicians Track Two Different Beats Simultaneously?[5] This experiment took trained musicians (graduate and postgraduate students) and asked them to perform two separate 2/4 and 6/8 rhythmic passages simultaneously. Through three separate experiments, they found that the musicians excelled in the initial experiment where 'selective attention' was required. When having to 'divert attention', that is simultaneously track the different metres, their accuracy declined. Pourdrier and Repp found that musicians demonstrated the ability to track two separate metres, but not perfectly. This gives some insight into how musicians process polymetric material for pulsations 'on' and 'off' the beat. For additional insight, a similar study by W. Tecumseh Fitch and Andrew J. Rosenfeld also cite similar findings with some insight into how individuals contextualise polyrhythmic studies.[6]

Discussion will now focus on the factors that influence rhythmic dissonance, using extracts from my own works to demonstrate the extent to which these have influenced my own practice.

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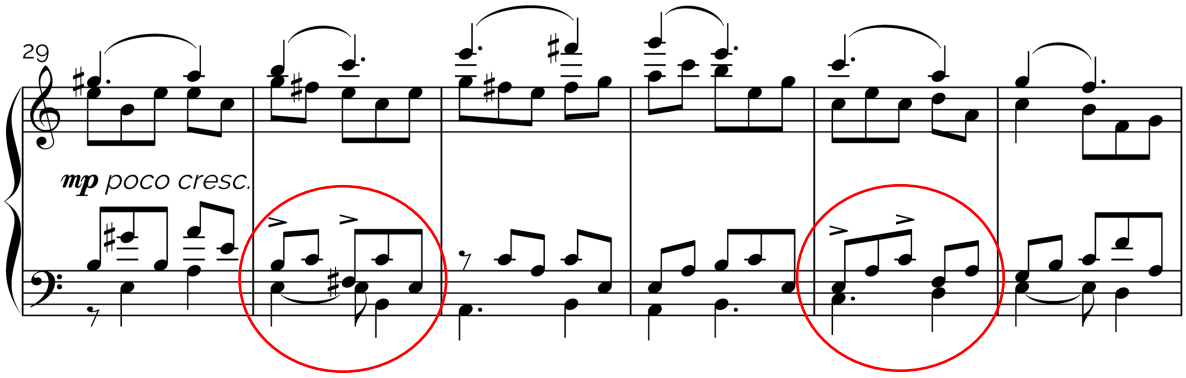
[4] Harald Krebs, *Fantasy Pieces: Metrical Dissonance in the Music of Robert Schumann* (Oxford: Oxford University Press, 1999), pp.22 – 61.

[5] Ève Poudrier and Bruno H. Repp, 'Can Musicians Track Two Different Beats Simultaneously?', *Music Perception*, 30/4 (April 2013), pp. 369 – 390.

[6] W. Tecumseh Fitch, and Andrew J. Rosenfeld, 'Perception and Production of Syncopated Rhythms', *Music Perception*, 25/1 (September 2007), pp. 43 – 58.

Dynamics/Accentuation

The use of dynamics/accentuation can highlight or subdue the presence of rhythmic dissonance. Commonly, the accentuation or raised dynamic pushes the musical idea to the foreground of a texture, causing listeners to shift their aural attention to the dynamically loudest textural idea. In placing a metrical idea that is non-congruent within the foreground of the texture, the foreign metric layer can create a rhythmically dissonant moment to occur. Additionally, if the middleground texture becomes rhythmically dissonant, it can also create the perception that the foreground material is displaced within the passage. Similarly, accentuation that falls against the natural congruence of the metre will result in the perceived weakness of the main grouping.



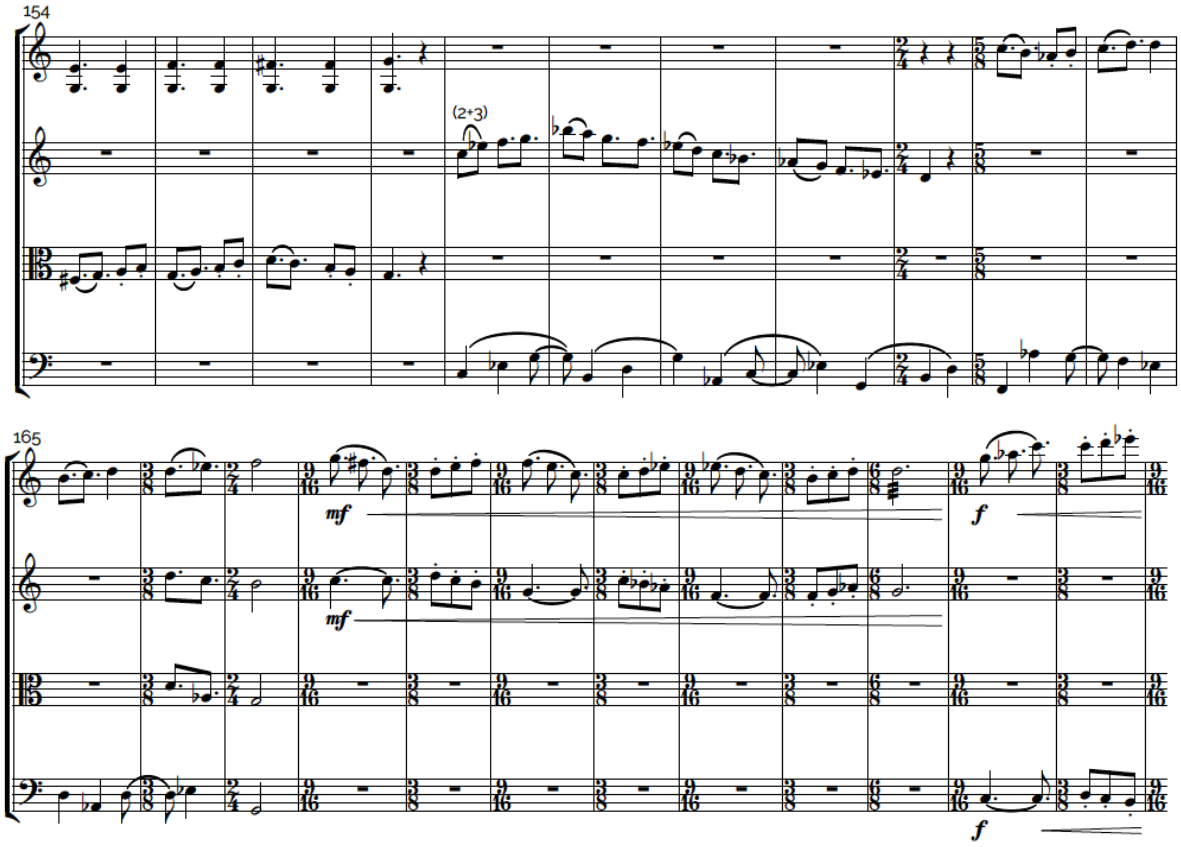
Ex. 2.1 Short passage from *Dechrau*, written for piano, demonstrating sub-metric manipulation.

Ex. 2.1 highlights a passing example of this in *Dechrau*. We initially hear accentuation of the 5/8 marking 2+3 within b.30, aligning with the metric subdivision of the melodic progression. The bassline is in 3+2, producing a subtle rhythmic dissonance that is not accentuated. Bar 34 introduces a dissonance that is more pronounced through the accentuation of the tenor voice 2+3 against the 3+2 appearing in the other voices.[7] This effect is subtle but

[7] An argument could be made to group this as 2+3, separating the tenor voices from the unison grouping in the other voices to highlight this internal textural conflict. This approach to notational practice is discussed

supports the concept that we can use accentuation or dynamics to bring out a rhythmically dissonant element within a passage.

In *Crossing The Lines,* accentual emphasis and note duration are used to shift the metric subdivision.



Ex. 2.2 Extract from *Crossing The Lines* presenting shifting metric subdivision.

Ex. 2.2 highlights a moment where the metric subdivision is manipulated to be perceived differently from the previous passage. This effect shifts the 5/8 metre from 3+2 to a

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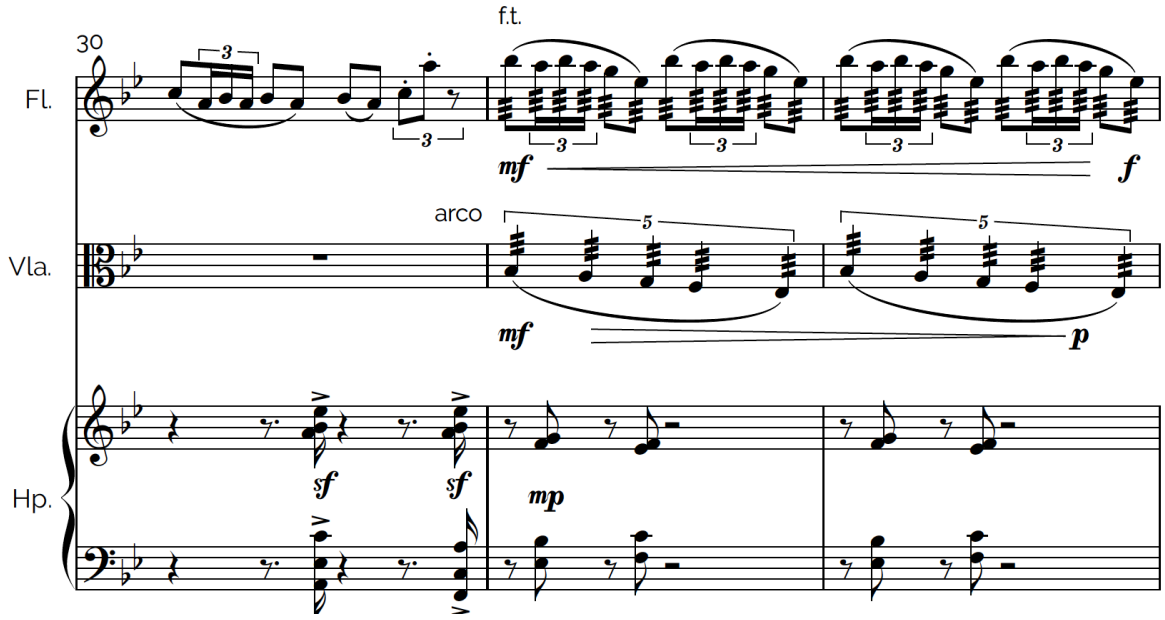
in Chapter Three where I prioritise the overall dominant metre/subdivision as the primary grouping to prevent confusion. Moreover, when implemented in syncopated or more contrapuntal textures, grouping material in the same fashion allows for greater clarity and the use of articulation, in this case, accents highlight the sub-metric subtlety to the performer.

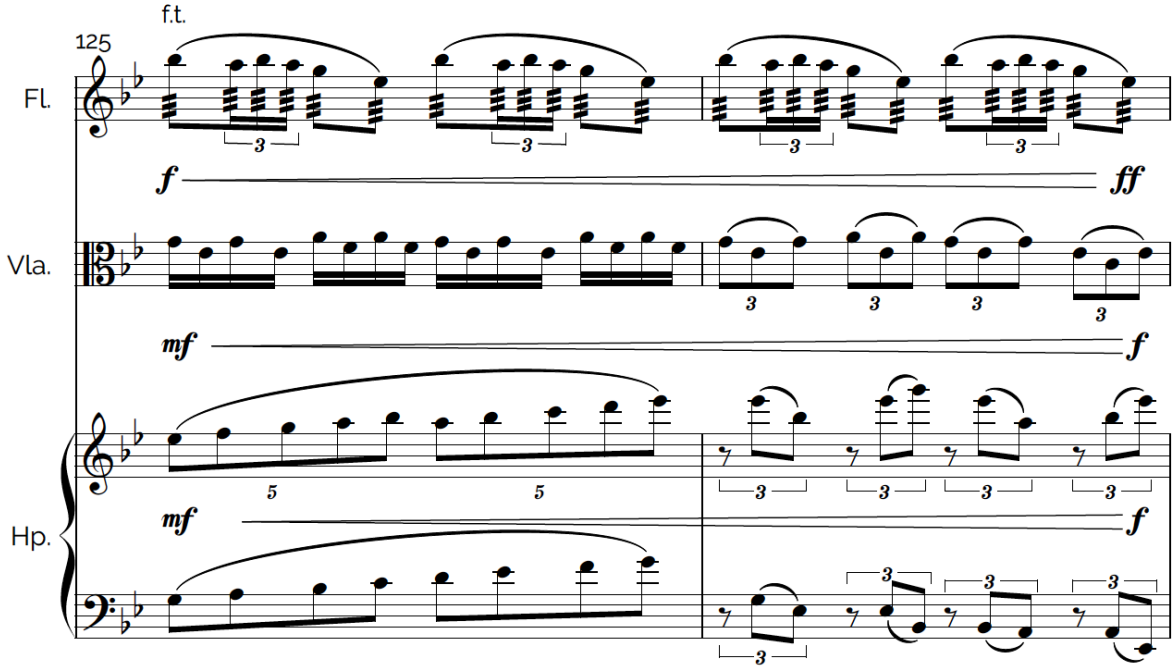
2+3 grouping in bb.153–161, shortening the initial main pulse. In addition to the submetric shift, the cello part produces a displacement dissonance created by an emphasis of 3/4 through the melodic phrasing, bowing pattern and harmonic rhythm. There is a brief feeling of resolution at b.162 with the 2/4 metre. In the following section, the metric subdivision is augmented into 9/16 against 3/8 alternating metre, emphasising a contrast between the semiquaver triplets and the quaver duplets.

Textural/Timbral

The ensemble size and textural choices offer further polyrhythmic possibilities. Due to its sheer mass, a larger orchestral ensemble can produce a higher density of metrical layers by splitting voices beyond a chamber ensemble's ability. Alternatively, smaller ensembles allow for a more intimate experience of rhythmic dissonance where greater clarity can be heard between dissonances. Handling multiple pulse streams simultaneously can be challenging because as complexity is added, clarity over individual periodicities can become lost in the texture.



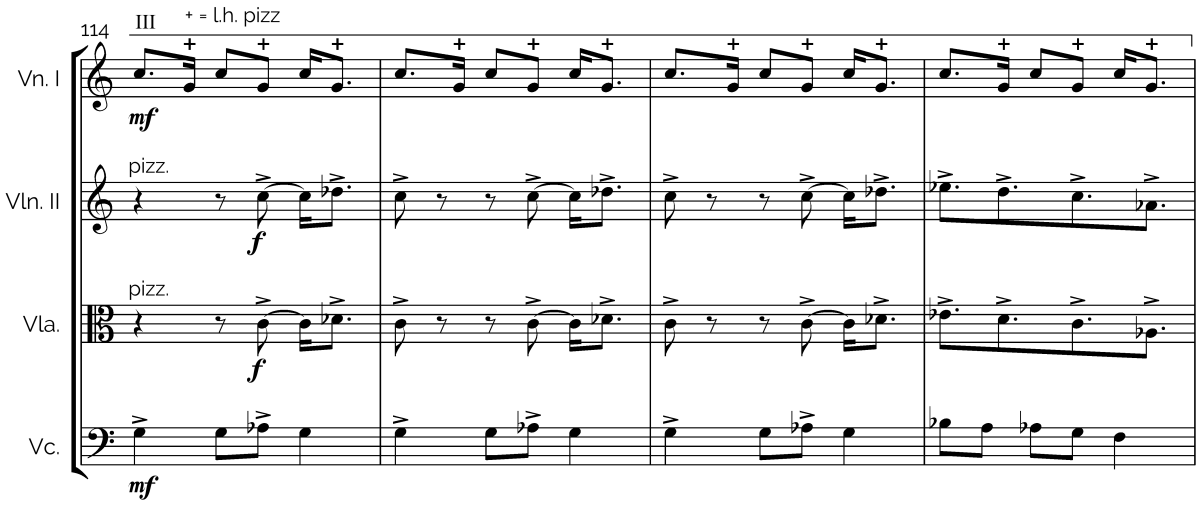
Ex. 2.3 Enchantment 1st movement b. 30–31.



Ex. 2.4 Enchantment 1st movement bb. 125–126.

Ex. 2.3 and Ex. 2.4 showcase material in bb. 31–32 reappearing in bb. 125–126 with textural changes. Whilst the flute line is identical, the texture underneath has developed and now features a more dissonant 5:4 cross-rhythm in the harp with decoration and emphasis of the simple metre in the viola. In b.126, the cross-rhythm is simplified, but a 3:2. There is also syncopation within the harp triplets, weakening the main beats of the 4/4 metre. Moreover, it has the possibility of inferring a 12/8 metre due to the triplet grouping.

In *Crossing The Lines*, timbre plays an important role in developing the cross-rhythmic textures throughout the score.



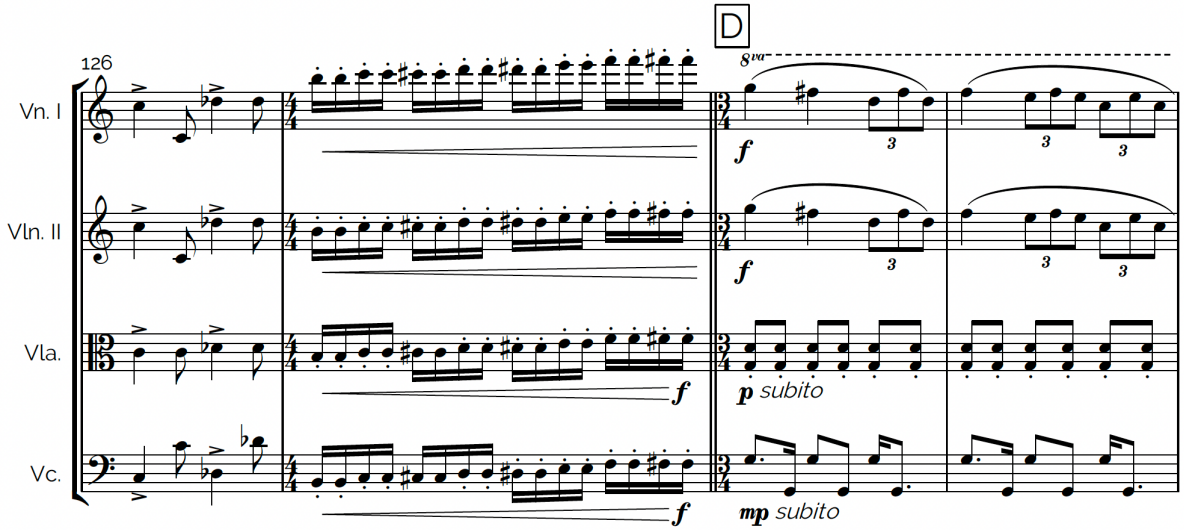
Ex. 2.5 *Crossing The Lines* bb. 114–119.

Ex. 2.5 highlights a moment where the entire ensemble transitions to *pizzicato*. In this texture, numerous rhythmic dissonances occur. In violin I, a 4:3 cross-rhythm (grouping dissonance) is notated as an 'assimilated' monophonic rhythmic texture.[8] A 3+3+2 (submetric manipulation) percussive interjection occurs in the violin II and viola, starting on the offbeat of beat two. Underneath this, the cello is also subtly highlighting a 3:2 cross-rhythm, allowing some congruence between the two parts due to the alignment of the four and two. Notably, there is a moment of congruence between all parts at the start of each bar, highlighting mostly a localised rhythmic disruption, rather than one that focuses on a larger metric dissonance.

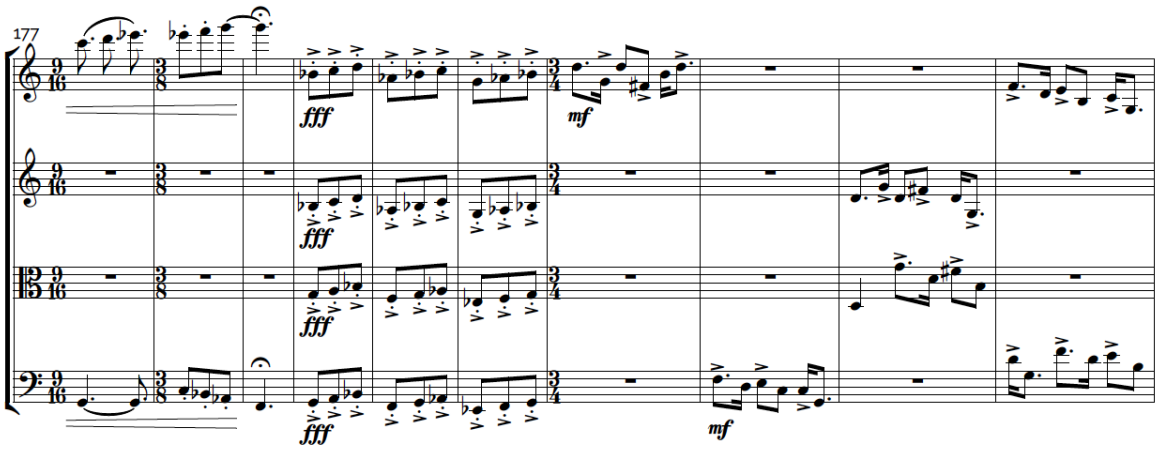
Regarding textural changes, I believe that rhythmically/metrically dissonant textures are juxtaposed by unison sections throughout the work in order to reestablish metric consonance and provide a moment of relief between rhythmically dissonant passages. By using this approach, rhythmic consonance can be used to create structural points of

[8] Discussion regarding assimilated notation appears in Chapter Three. For now, this approach uses polyrhythmic concepts presented in a written monophonic voicing, but uses accentuation, timbral or dynamical contrasts to highlight its polyrhythmic intentions.

significance to help produce an effective balance between consonance and dissonance. The material also acts as a moment for the ensemble to regroup before diverging into the following section.

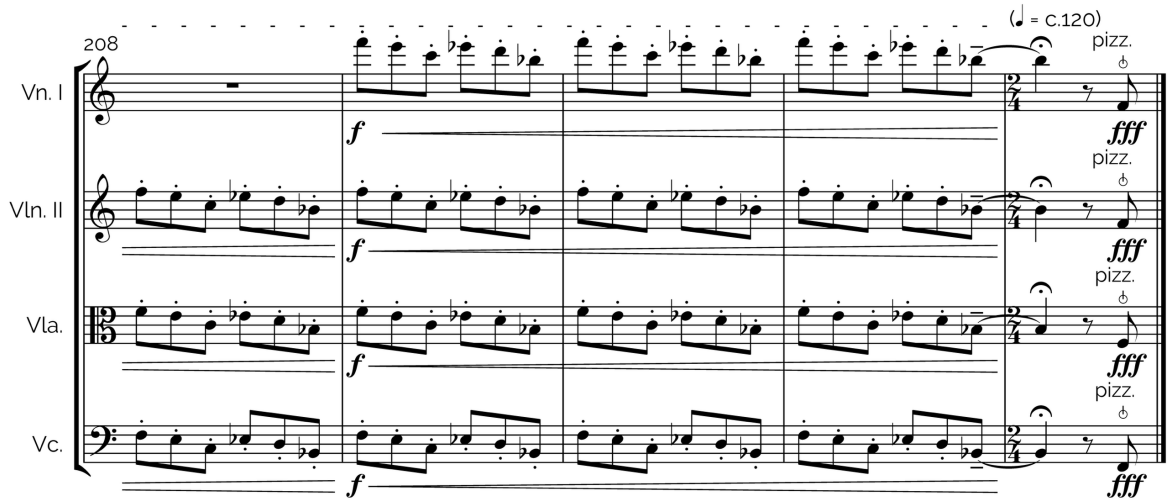


Ex. 2.6 Unison in *Crossing The Lines* between bars 126–129.



Ex. 2.7 Unison interjection at 180–182 in *Crossing The Lines*.

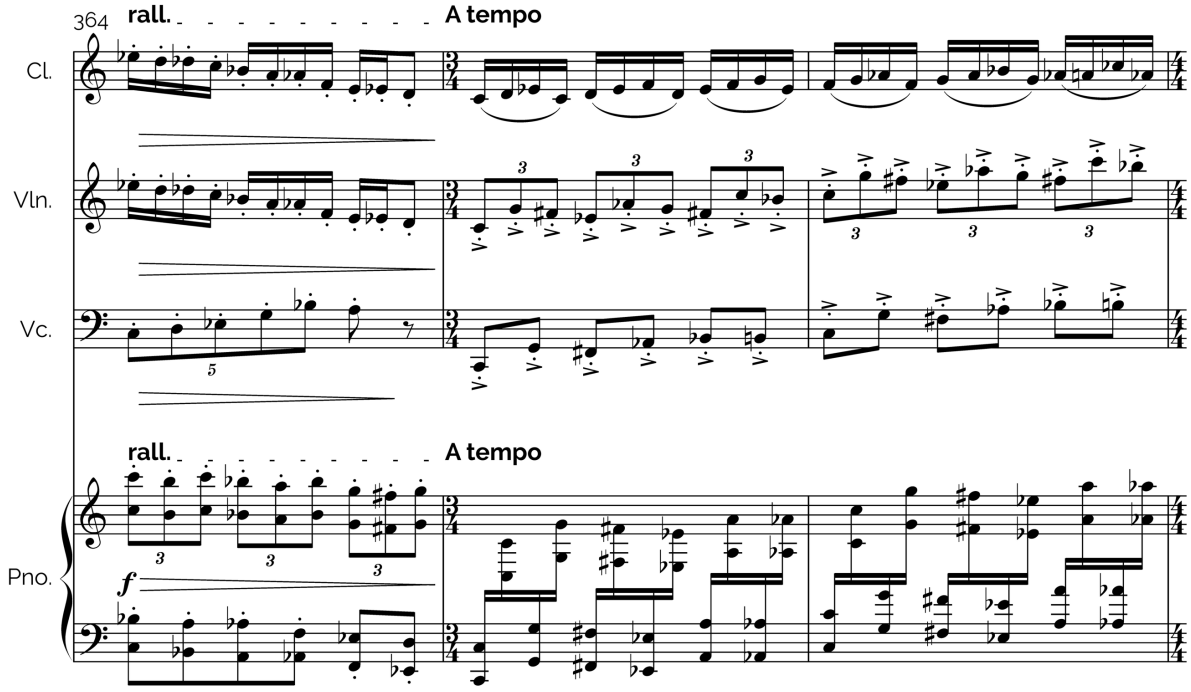
In *Crossing The Lines*, unison is employed as structural identifiers by intentionally changing the texture to highlight a new structural event. Ex. 2.6 showcases a moment where a climax occurs, bringing all acoustic forces together in an aggressive texture before entering a new antiphonal texture. Similarly, Ex. 2.7 highlights a similar approach at the climax of the piece.



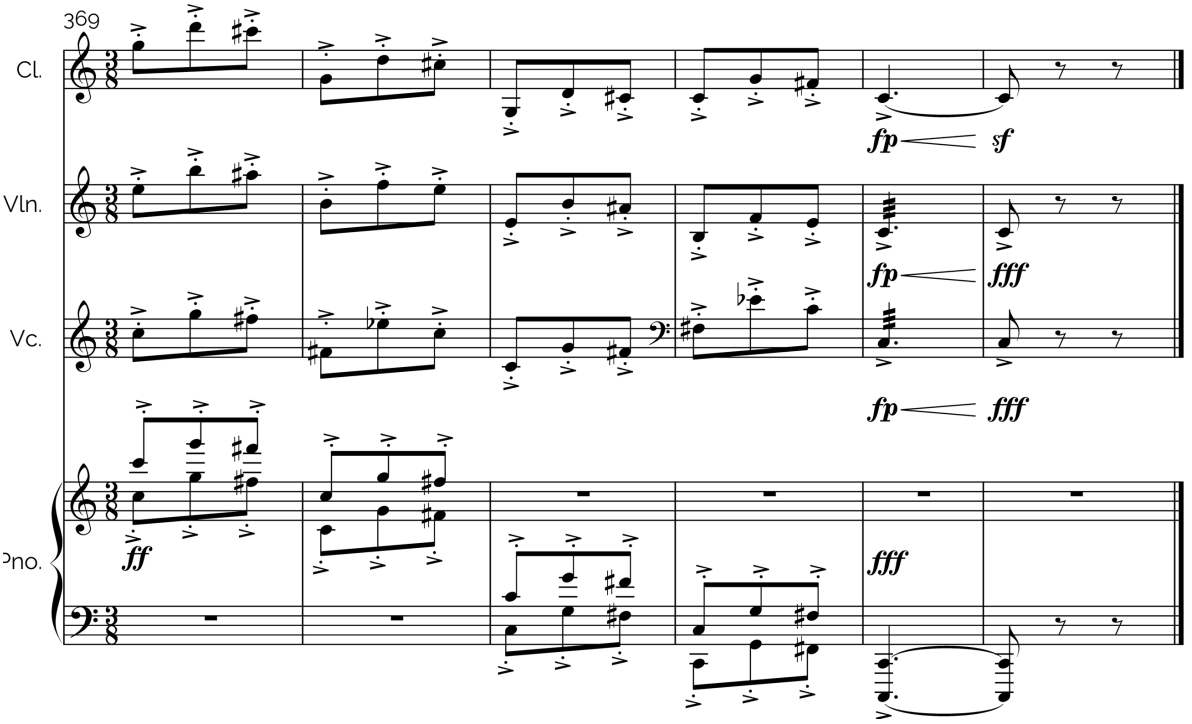
Ex. 2.8 final bars from *Crossing The Lines.*

The finale of the piece (Ex. 2.8) uses staggered entries to build the texture of the material to a moment of full rhythmic unison, reflecting the earlier moments within the piece where rhythmic consonance has been used to finalise a section or transition. Instead of using it to transition, the repetition and extension of the motif reinforces the concept that this material is reaching the end of its trajectory. The temporal *accelerando* provides the feeling of an unstoppable force as the texture begins to feel out of control.

A similar climax occurs in *Refractions,* where the ending finishes with a descending unison passage following a chaotic rhythmic build-up. Prior to the final bars in Ex. 2.10, Ex. 2.9 showcases the buildup using cross-rhythmic textures. This time, pitch is also used to signal the end of the piece through the crashing descent of the motif.



Ex. 2.9 *Refractions* bb. 364–366.



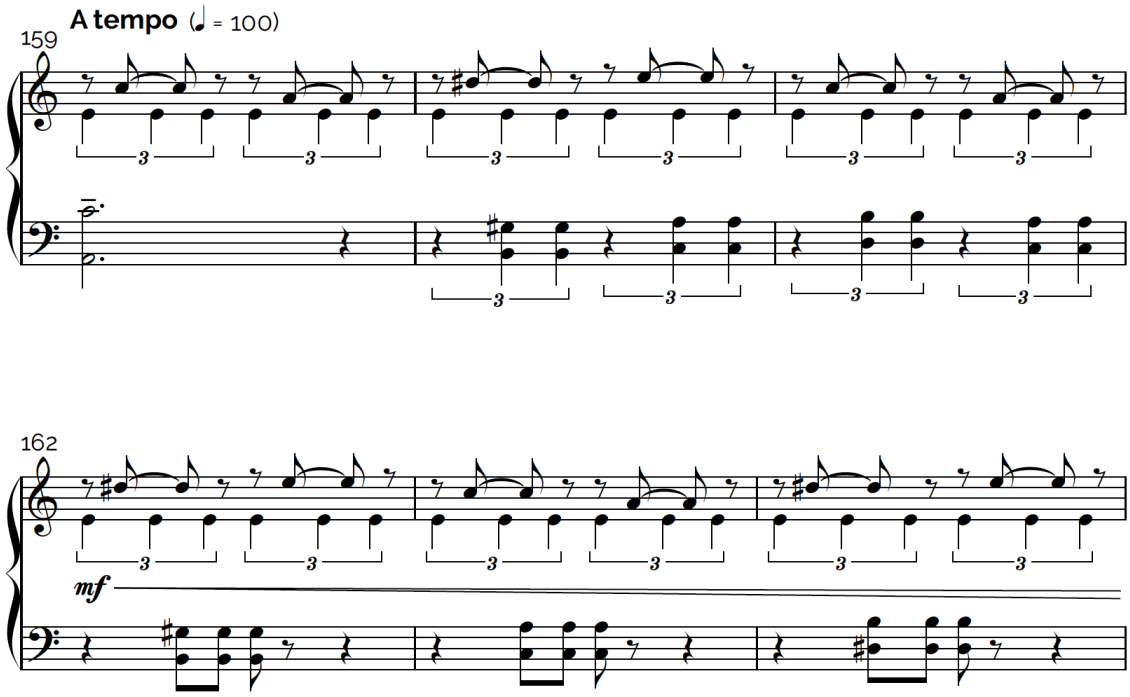
Ex. 2.10 *Refractions*' closing bars.

Pitch/Register

In a recent study, Dirk Moelants and Leon van Noorden explored the influence of pitch intervals on the perception of polyrhythms.[9] Whilst they found that results spanned a continuum, they discovered that their test group had an increased awareness of the slower component of a grouped dissonance (polyrhythm) if the pitch interval was increased.[10] The authors argued that a greater pitch interval weakens their combined relationship; in other words, it is more challenging to perceive them as a single voice and instead act as two separate pulse trains. If a composer aims to subdue the conflict of two non-congruent pulse trains, then the texture would benefit from pitches close together. To exacerbate the difference between two pulse trains, the intervallic gap should widen to emphasise the rhythmic dissonance between two different rhythmic events. In the context of my work, this study made me more aware of the psychological factor at play when designing polyrhythmic textures. In other compositions, it has impacted my compositional approach regarding instrumental registers and the possibilities of blending two independent pulse streams to varying degrees by placing their pitches closer or further apart.

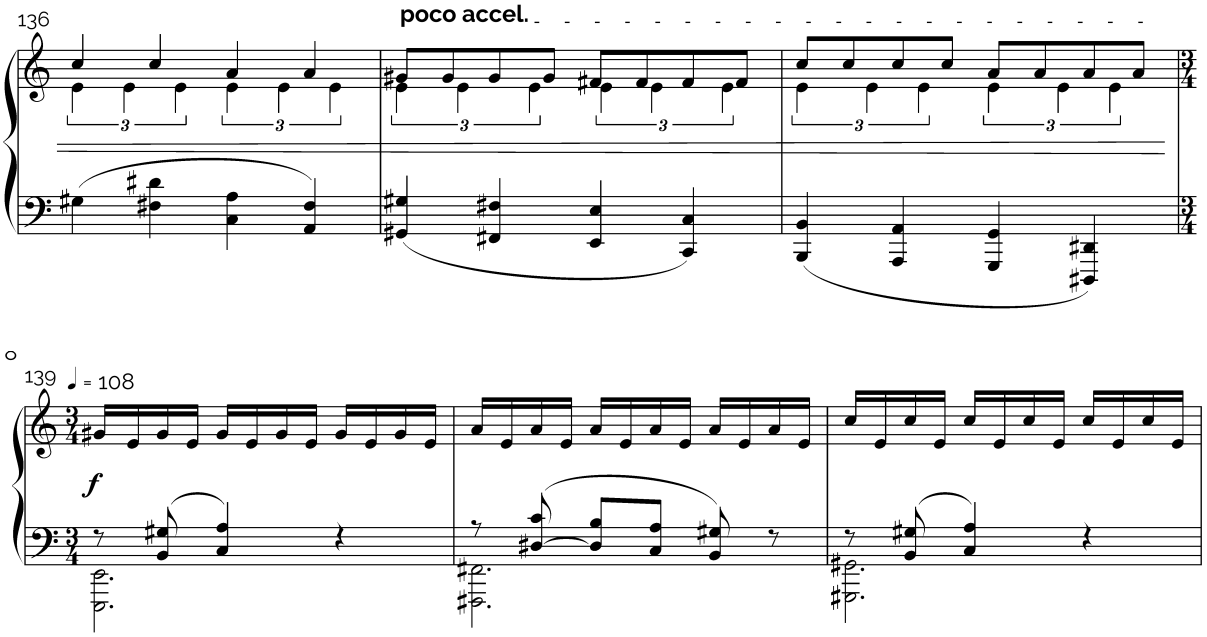
[9] Dirk Moelants and Leon Van Noorden, 'The Influence of Pitch Interval on the Perception of Polyrhythms', *Music Perception*, Vol. 22/3 (Spring, 2005), pp. 425 – 440.

[10] Ibid. p. 439.



Ex. 2.11 *Dechrau*, written for solo piano, bb. 159–164.

For example, in Ex. 2.11, the upper registral syncopation protrudes against the triplet pedal produced by the E. Aurally, the pedal note becomes less consciously disruptive due to its repeated cycle within the texture. Additionally, the pitch remaining within the middle register of the texture produces a less disruptive aural experience due to the interest taking place in the upper and lower register. One could even argue that the triplet pedal creates a metric shift, due to its stable and consistent pulsations, that then emphasises the duplet rhythmic ideas as the rhythmically dissonant elements within the passage. In contrast, Ex. 2.12 highlights the blending of the cross-rhythmic concepts as the pitches' intervallic distance draws closer. With the assistance of an *accelerando*, the cross-rhythmic element breaks down by bar 139 and blends into a section of rhythmic consonance. One could argue that a combination of tools, such as temporal techniques, can be employed to produce interesting transitions between rhythmic consonance and dissonance.



Ex. 2.12 *Dechrau* bars 136–142.

Temporal

Temporal dissonances rely upon the manipulation of temporal elements to produce dissonance. Importantly, I argue these manipulations should occur on a larger scale (affecting most or all instruments), or for a substantially sustained duration, in order to distinguish them as a new temporal event rather than one that could be experienced as a metric modulation. This could be the non-alignment of two independent pulse trains, i.e. polytempo. Temporal dissonances, by nature, produce moments of convergence and divergence where two independent pulse trains align temporarily before diverging again.[11] Dependent on their lowest common denominator, these moments could occur frequently or infrequently.[12] On a

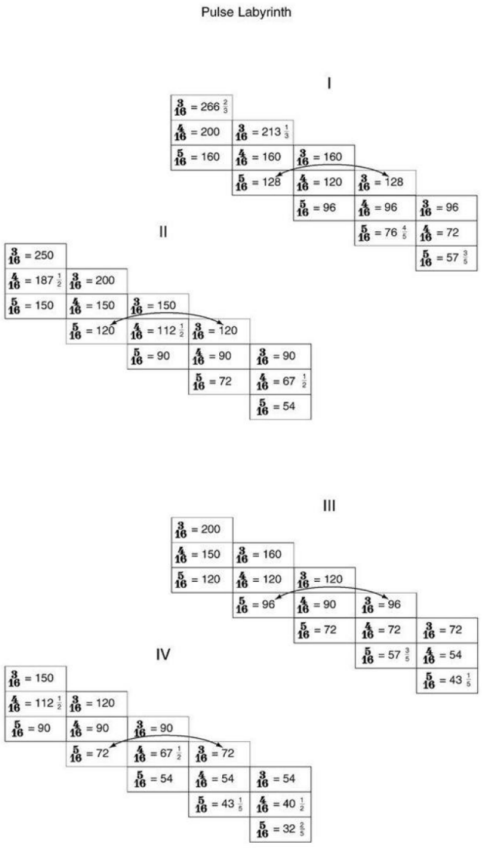
[11] Evan O. Adams, 'What is Rhythmic Dissonance?', *The Eagle Feather*, 14/1 (2017), pp. 1 – 22 <http://dx.doi.org/10.12794/tef.2017.360>.

[12] Ibid.

micro level, this is similar to cross-rhythmic points of convergence/divergence. Convergence occurs on the first beat of the cycle before the two pulse trains diverge for the cycle length.

An example of complex polytempo appears in the 1977 chamber ensemble work *Silbury Air* by Harrison Birtwistle. Birtwistle produced a complex framework named a 'pulse labyrinth' consisting of three superimposed pulse trains (pulses). The framework is presented in the preface of the score (Ex. 2.13), highlighting the complex tempo relationships between the pulsed material as it gradually develops through each movement. The diagram also highlights that each movement begins with three pulse streams that evolve in a sequence, with one pulse maintaining a temporary stasis.[13] Whilst this portfolio does not explore Birtwistle's intricate levels of temporal complexity, essences of my compositional work are inspired by it, reflected by the use of metric modulation and temporal relationships.

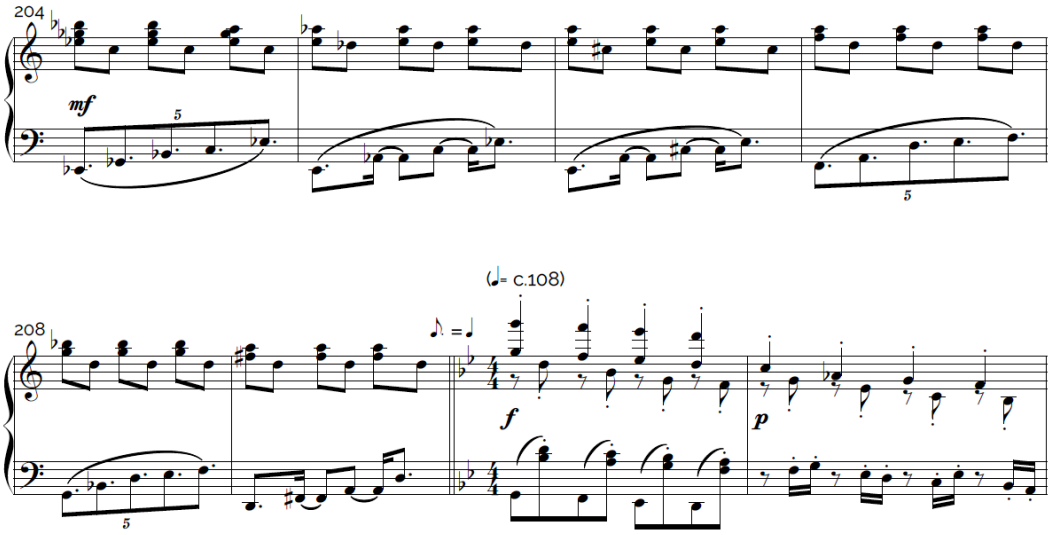
[13] See Ex. 2.13. Birtwistle, in his first movement uses 5/16 = 160 then 4/16 and finally 3/16. This is also present in 5/16 = 96, 4/16 and 3/16. For further exploration, please see the work of Jonathan Cross, *Harrison Birtwistle: Man, Mind, Music* (London: Faber, 2000) and Vera Ivanova, *Cantus and Continuum in 'Silbury Air' by Harrison Birtwistle* (PhD dissertation, University of Rochester, 2007).



Ex. 2.13 Pulse labyrinth from Harrison Birtwistle's *Silbury Air*.[14]

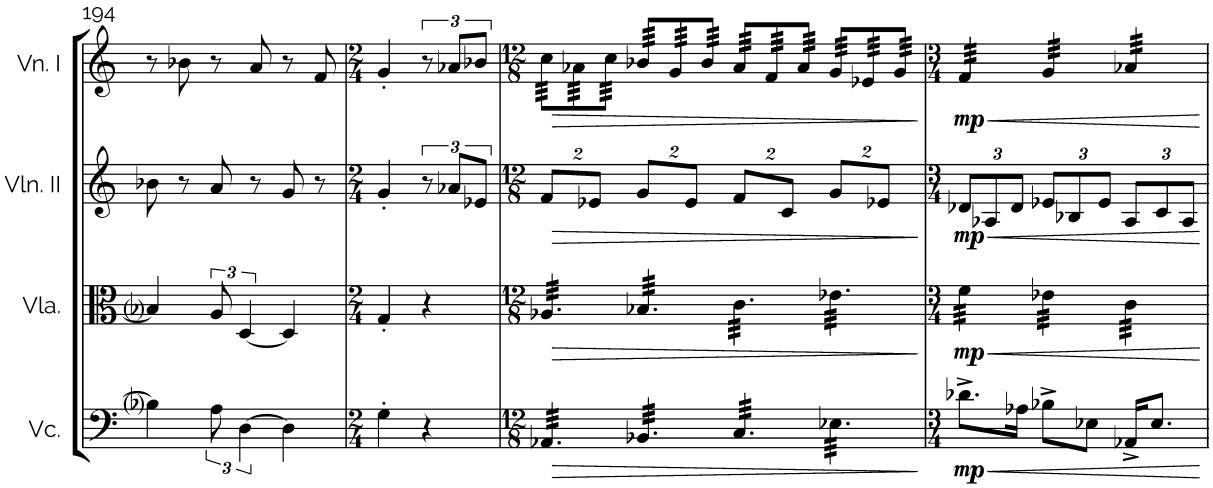
Dechrau attempts a simple metric modulation through the middle variations. Firstly, bar 123 foreshadows the following sections with the tempo marking quaver = 104–108. Bar 175–209 establishes a conflict between a quintuplet feeling in 3/4 alternating with a dotted quaver sequence. The tempo indication for this section (quaver = 80) gives the resulting speed of the dotted quaver sequence being perceived at quaver = 104. The next section then transitions into quaver = c.108 (see Ex. 2.14), giving the performer a tempo marking close to the metric modulation in addition to the metric modulation marking dotted quaver = crotchet.

[14] Harrison Birtwistle, *Silbury Air*, study score, UE 21223, (London: Universal Edition, 2003).



Ex. 2.14 Metric Modulation example in *Dechrau*.

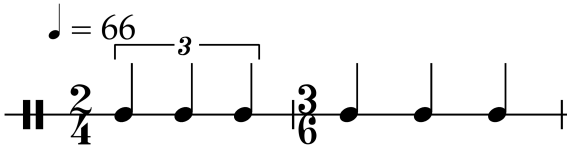
Crossing The Lines also features metric manipulations where opposite time creates an augmentation of the motif (see Ex. 2.15). During the climax of the piece, multiple rhythmic concepts clash within a metric modulation shift from duple time into compound time. The viola part's duplets appear superimposed within the metric modulation, further juxtaposing the ensemble's metric pattern. Bar 198 features an augmented version of the 3:4 cross-rhythm against the 12/8 metre and the duplet violin II part.



Ex. 2.15 Brief showcase of opposite time and metre alternation in *Crossing The Lines*.

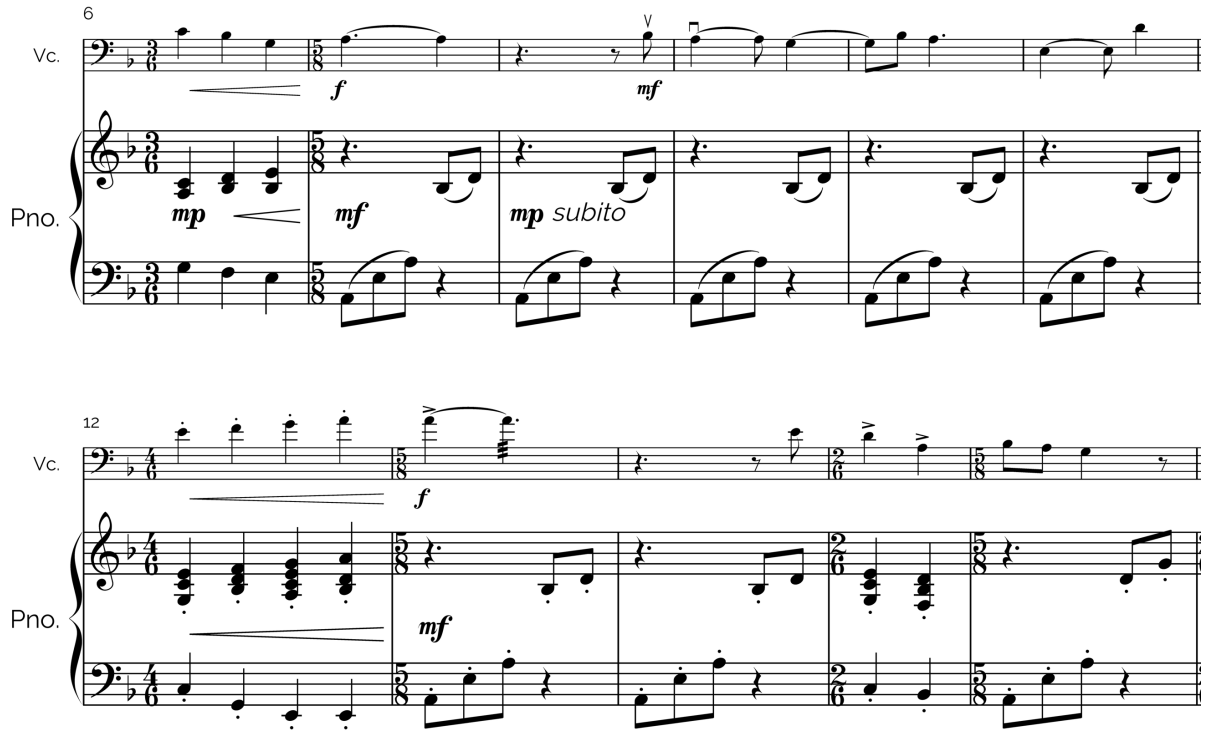
I find these temporal shifts are powerful in producing new aural experiences with the same material due to their pervasive effect on an entire passage or texture using one device. One could argue that because of their pervasive effect, they are more radical than the subtleties of the previous examples discussed.[15] As a result, one could argue that temporal dissonances can be effective in moments where a more explicit idea needs to be communicated.

In relation to temporal concepts, *Irrationality*, written for piano and cello, uses metric modulation as the core premise for development; however, this is articulated through irrational time signatures. For composers, irrational time signatures enable bar durations of irregular length that could not fit within a simple/compound (rational) metre. Irrational metres are often used to visually simplify the notation of a complex rhythmic idea yet maintain the rhythmic intention. The denomination of 6 indicates that the bar is split into 6 equal portions of the whole note, resulting in a triplet crotchet. Changing the numerator allows the possibility of having an irregular number of triplet crotchets within a bar. In Ex. 2.16, the two bars would produce an identical aural experience.



Ex. 2.16 Example of irrational metre.

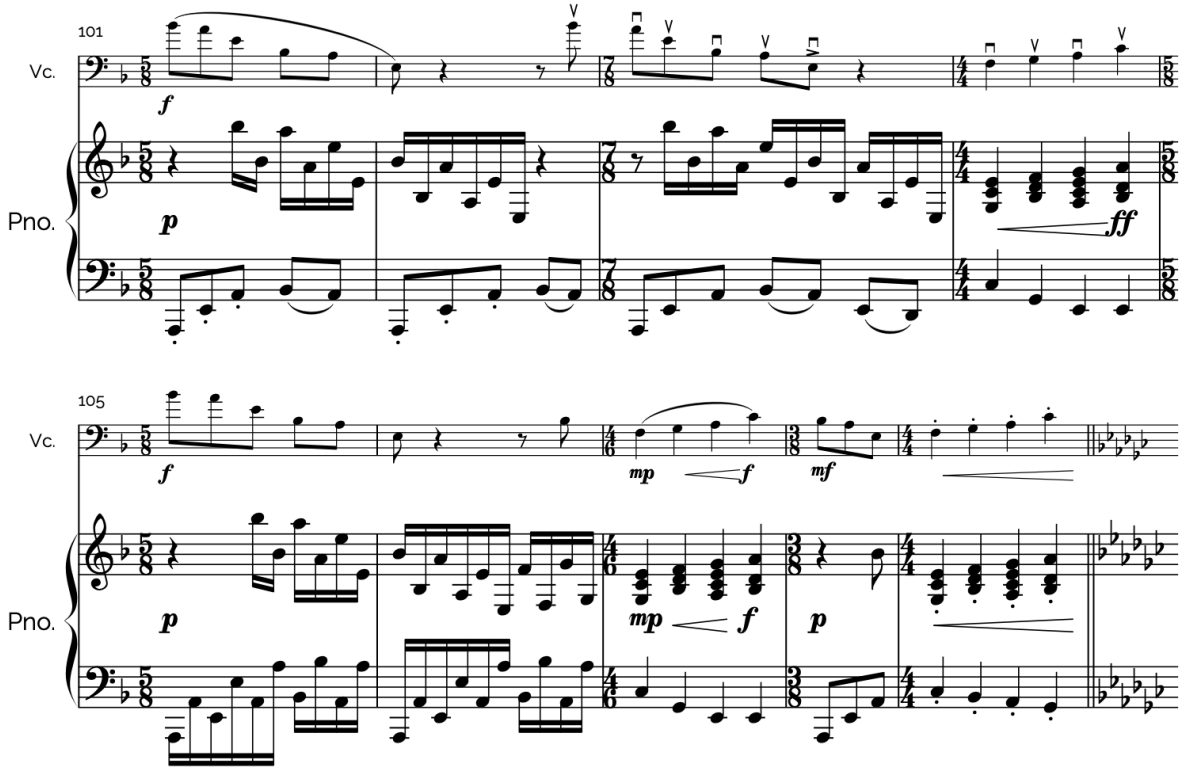
[15] Ex. 2.7, from *Crossing The Lines*, also employs temporal elements by using an *accelerando*. In this example, the *accelerando* is more texturally and semantically significant than being used as a temporally dissonant device.



Ex. 2.17 bb. 6–16 from *Irrationality* showcasing irrational time signatures.

In Ex. 2.17, irrational time signatures act as both metric interjections that disrupt the 5/8 passage, and as augmenting developments, functioning similarly to previous examples where expanding metres creates the opportunity to produce new rhythmic and melodic possibilities. In my opinion, the technique's effects compound when material is repeated within a rational *vs.* irrational context, an aural experience of the music slowing down.

Ex 2.18 presents this example in bb. 104 and 107 with repeated material that is temporally manipulated through using rational and irrational metres. Due to the inherent faster note duration in irrational metres, the 4/4 metre feels laboured in its movement. This can create a concept of rhythmic conflict both metrically and structurally by establishing the two metres as different temporalities that disagree with one another, as if the music is being torn between two different tempi.

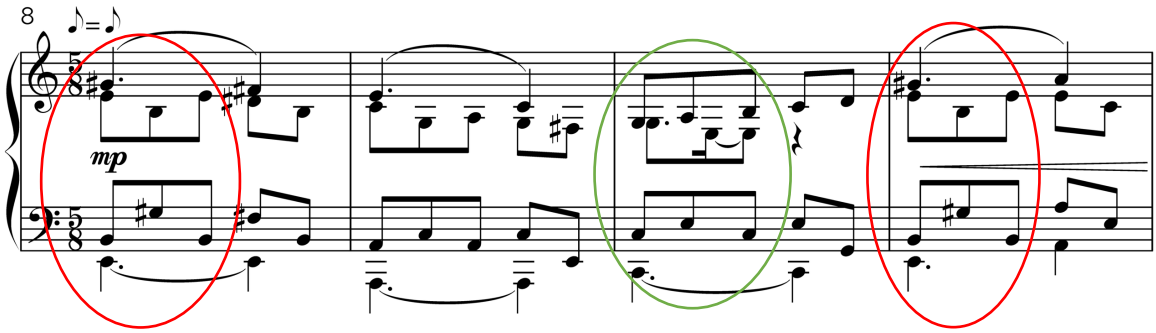


Ex. 2.18 Example of rational *vs.* irrational time signatures.

Contextual Dissonances

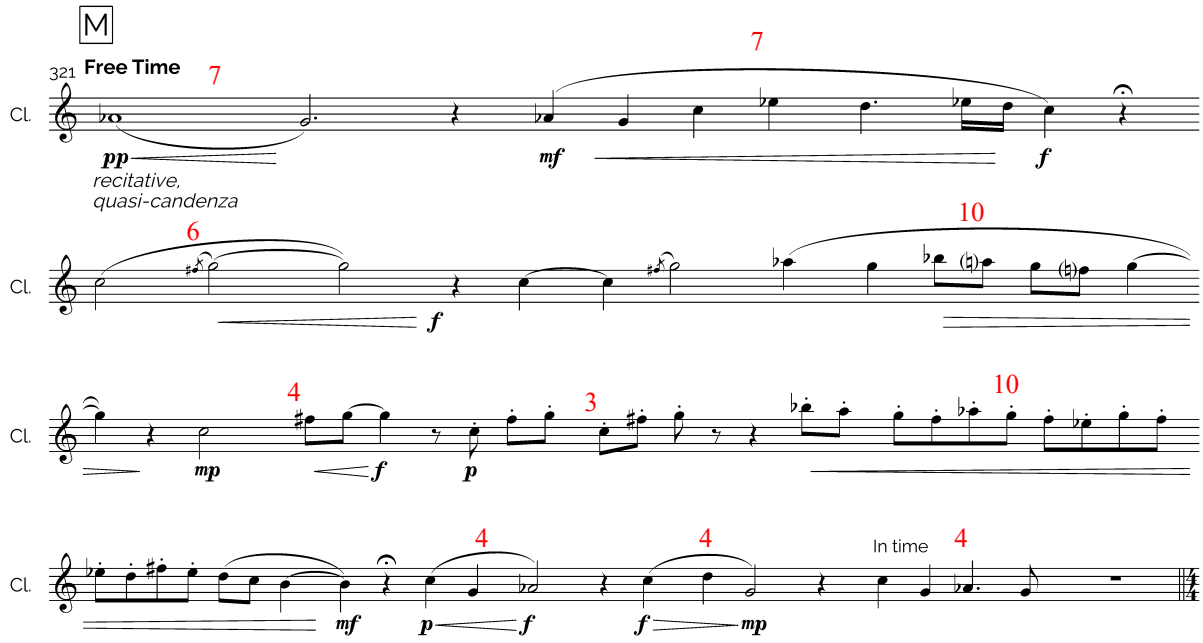
Contextual dissonances require the listener to acknowledge rhythmic information retrospectively by perceiving new events as deviations from previously metric material. In the opening bars of any work, the core concepts (or expectations) are established for what is to follow such as the textural, harmonic and rhythmic ideas. If a metre, or rhythmic pattern, is established, a deviation such as a metric change can create a rhythmic dissonance from a contextual standpoint. Pattern recurrence is a key, yet unquantifiable, component of this process. Patterns can be formed through the repetition of rhythmic, melodic, intervallic and textural ideas that have appeared previously, allowing a listener to recognise a deviation from the pattern. In most cases, motivic, textural and thematic material is repeated in order to establish a contextualisation of the pattern and allow listeners to interpret new melodic and rhythmic information as deviations.

Rhythmically, this can produce ‘contextual dissonance’ (Adams) or indirect subliminal dissonances (Krebs) where our dissonance is experienced retrospectively. The effectiveness of this technique is somewhat reliant upon the listener being cognitively engaged, following the perceived metric framework and motific material, because subtle developments within complex textures can easily be missed.



Ex. 2.19 Extract from *Dechrau*, for piano, highlighting a brief melodic and rhythmic pattern recurrence.

Ex. 2.19 showcases an established context that begins to subtly deviate. Bar 8 establishes the context for the following material, and a rhythmic repetition appears in b. 9 before introducing a slight deviation, a grouping dissonance of 2 over 3, in b. 3. This subtle change is reverted in bar 4 as we re-hear the initial gesture made in b. 1.



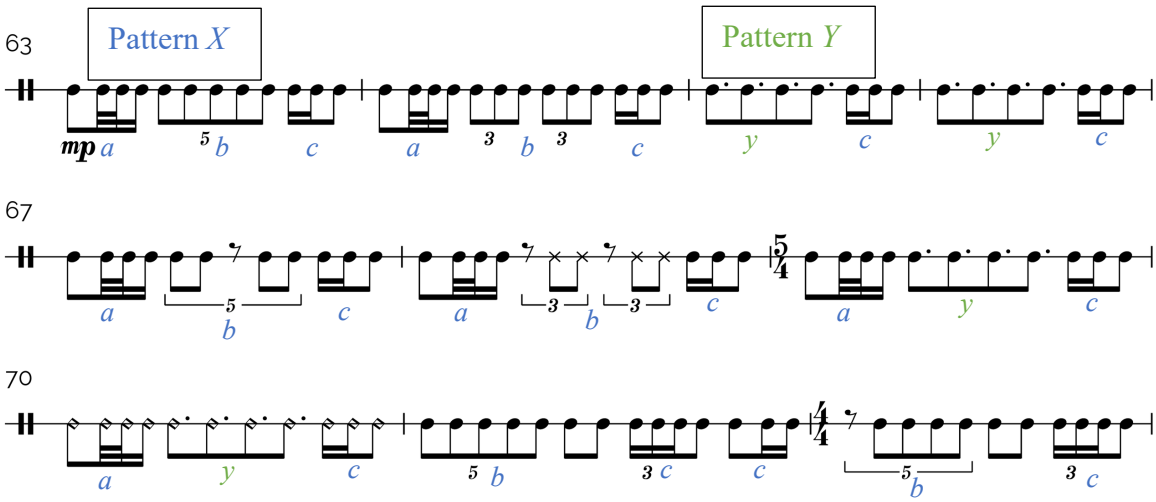
Ex. 2.20 solo clarinet free-time moment during the climax of *Refractions*.

Ex. 2.20 is taken from *Refractions*. For context, the entire score is metred and rhythmically vibrant until an unexpected *quasi*-cadenza passage near the final section of the piece. The temporal shift from a metred passage where the ensemble reaches the climax of a G major^{b9} chord to a solo cadenza is somewhat unexpected. There is an expectation that the G acts as a dominant leading to a resolution in C, but instead the solo clarinet cadenza interrupts the expected outcome. Temporally loose, the cadenza gives the piece a chance to breathe from the tonal and rhythmic torment that has preceded. To some extent, it will allow listeners the opportunity to digest the past material and can offer a drastic contrast shift from the angularity of the previous material where instruments, textures, melodic material and different metres all fought for dominance.

The sequence is intentionally irregular and supported by moments of musical punctuation in the form of crotchet rests, leading to the grouped phrases (in crotchets) 7, 7, 6,

10, 4, 3, 10, 4, 4, 4.[16] This intentional irregularity helps to remove the entrainment produced by the previous metre and also forces the performer to explore this liberally due to organisational structure. Regarding the notational practice, the removal of barlines also affects any pattern recognition and metrical accents that may appear if the music appeared in a section was barred.[17] Note that the final three phrases return to regularity, re-establishing the metric pattern for the following material and help to loosely re-establish a feeling of grouping and regularity.

In *The Rhythm*, for solo snare drum, contextual dissonances occur through subtle changes in the pattern through silence, diminution and metric changes.



Ex. 2.21 bb. 63–72 from *The Rhythm* for snare drum. The primary metre is 4/4.

Ex. 2.21 presents the rhythmic cells used within a short section of *The Rhythm.* A common tendency in my development sections is to merge two independent patterns together in order to produce interesting rhythmic outcomes, especially those that create a rhythmic juxtaposition (e.g. duplet *vs.* triplet groupings). A short pattern occurs at bb. 63–65 (with

[16] The first system has been marked as guidance in Ex. 2.20.

[17] This is a point of interest further elaborated in Chapter Three.

minor development through the diminution of the quintuplet to sextuplet) before a dotted quaver grouping interrupts the sequence at b. 65. These two bars, 65–66, shift the feeling to 12/16 + 2/8, or arguably a 'wonky' triplet feeling in 5/4 (if including the final crotchet beat).[18] By b. 69, the triplet grouping has now augmented and taken the first part of the pattern's rhythmic cell, fitting into a 5/4 bar now gives the sub-metric grouping of 2/8 → 12/16 (irrational metre of 4 quaver triplets) → 2/8.

Text

Text offers an additional dynamic that can affect the rhythmic stability of the music. In addition to handling musical material, effectively handling libretti can result in the text dictating the rhythmic flow due to its syllabic nature. For example, a dense or highly syllabic text could offer the opportunity to explore more natural cross-rhythmic textures. Additionally, text carries semantic meanings, and rhythmic concepts can be employed to help word-paint; on the other hand, care should be taken when handling sensitive topics where rhythmic liveliness could come across as insensitive.

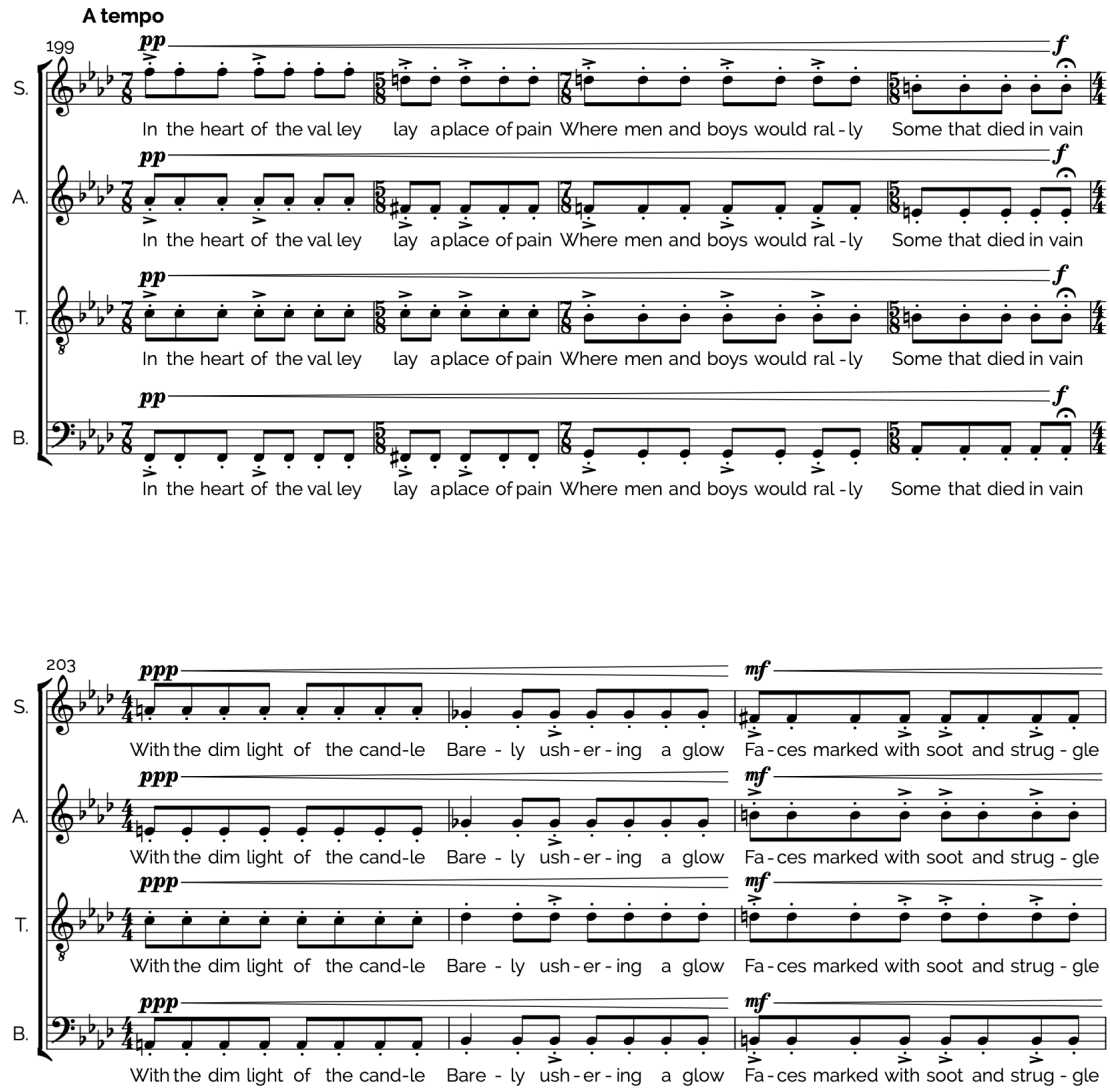
Text has proven to be one of the hardest factors when trying to navigate rhythmic dissonances because of a number of factors: firstly, in stress-based languages, text can carry an inherent iambic flow that speakers naturally develop through cultural, historical and social influences. This can easily be connected to the rhyming patterns within poetry and the emphasis placed on syllabic count, providing continuity and flow. From my experience, there is a particular emphasis on this in compositional training when handling text (particularly in my Western Classical training). This is important due to the nature of rhythmic dissonances

[18] The metre remains in a steady 4/4 in order to maintain a *status quo* of the metric structure and saves the performer needing to shift entrainment to an alternating metre.

intentionally going against the 'natural' iambic flow within each sentence; it can therefore become inherently awkward for singers when faced with rhythmically dissonant passages, as their training/intuition can go against the piece's intentions.

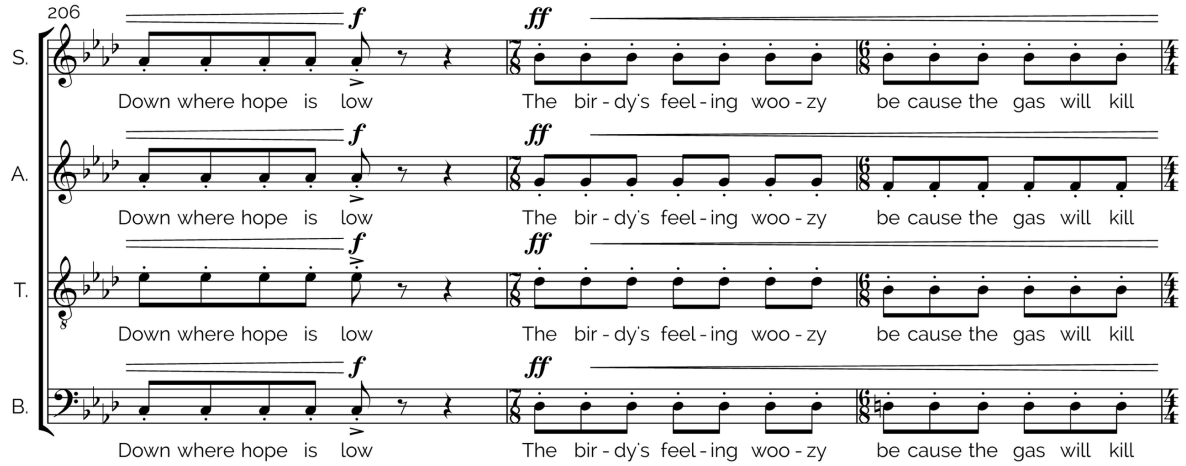
Secondly, the factor of diction makes staggered text challenging to interpret from an audience perspective. In a similar vein, the superimposition of different pulse trains (cross-rhythms) only exacerbates the problem due to the overlapping of text. This problem requires stylistic flair when handling rhythmic dissonance to produce effective textures that do not detract from the compositional intentions.[19]

[19] This research does not account for post-production editing when vocal works are recorded, opening up interesting production possibilities for recording complex textural vocal music.



Ex. 2.22 b. 199–205 from *A Place of Pain.*

In the final section of my SATB choral piece *A Place of Pain*, the text used as verses throughout the score becomes merged into a single section and recited. Due to the metre conforming to the use of syllables, interesting metric alternations occur where the text is irregular. In bar 204, the syllables would instinctively produce a grouping of 7, but an agogic accent is used on ‘bare’ to produce both a rhythmic and metric accentuation. This pause acts both as an emphasis and a subtle hiatus within the text that begins to expand.



Ex. 2.23 bars 206–208 from *A Place of Pain.*

Ex. 2.23 highlights an augmentation of this pause, but now at the end of the phrase. This gap is intended both as a performance break for the singers, due to enduring a long vocal passage beforehand, and as an augmentation of the hiatus concept before the singers enter with louder and irregular text. Note that the alternation has also metrically augmented to 6/8 instead of 5/8 by bar 208.

Challenges with Categorisation

Table 2.1 itemises the rhythmic techniques that I have accumulated during my PhD research. Categorisation has been problematic due to the aural ambiguity of rhythmic techniques. If we categorise using an emphasis on aural perceptions, one could argue that temporal and metrical changes – such as those by Evan O. Adams, outlined in Chapter One – could become interchangeable. For example, the aural experience of hearing a cross-rhythm is similar to a brief instance of polytempo. In a 3:2 relationship, we are experiencing a pulse train 1.5x the speed of the base tempo for a brief duration. Similarly, one could argue that instead of it being a temporal shift, it is a metric change that emphasises a triplet subdivision within the original metre, manipulating a duple metre into a triple (compound) metric feeling. This aurally perceived discrepancy makes it impossible to categorise them convincingly in this manner.

Contextual dissonances rely upon the concept that we can perceive shifts in temporality when only one metric layer occurs in contrary to Krebs' theory. I argue that we can perceive dissonances through context due to our ability to entrain. In the same way a musician does not always perform the basic pulse layer, we can internalise the metre through pattern recognition, allowing us to notice subsequent variations and metric deviations. Accentual techniques rely upon a 'dynamic' change within the rhythmic material. By dynamic, I am referring not only to a change through volume but also a rhythmical duration (for agogic accents). These techniques are commonly impacted by dynamic, timbral and pitch/registral considerations. Temporal changes rely upon the manipulation of large-scale temporal elements within the work, such as the overall tempo or a substantial foreign pulse-train, producing the perceived shifting (or conflict) of time within a passage of music. For example, alternating metre does not affect the overall temporal layer of the score but instead regroups and re-accentuates the material.

Contextual	**Accentual**	**Temporal**
Pattern deviation	Agogic accents	Polytempo
Metric deviation	Alternating metre	Pulse labyrinth (Birtwistle)
Temporal Suspension/Hiatus	Cross accent	Tempi as structural signifiers
	Hypermetre	Tempo changes/shifts
	Polymetre	Metric modulation
	Manipulation of metric subdivisions	Opposite Metre (4/4 *vs.* 12/8)
	Syncopation	
	Irregular phrasing	
	Nested rhythms	
	Cross-rhythms	

Table 2.1 Categorisation of Rhythmic Techniques.

Summary

It is evident that a number of factors, such as pitch, accentuation and temporality, play a role in highlighting polyrhythmic material. To address the second part of the question, it is evident that these techniques appear throughout my portfolio of work in various chamber works. Moreover, the exploration of scholarly literature has helped to reinforce my compositional practice by highlighting important psychological and musical techniques that could be used to enhance my compositions.

Whilst using polyrhythmic techniques, there is a great reliance on the performer effectively communicating the nuances of the music. As mentioned previously, there are rhythmic nuances that can easily be missed by a performer and listener, rendering the music less effective overall. As a composer of contemporary music, the onus is on me to produce a score and notational practice that is effective at communicating my ideas to the performer and subsequently the audience. The next chapter aims to address my notational practices and the challenges I have faced communicating my music to performers.

Chapter 3 Notational Practices for Rhythmic Dissonance

Notational practice and the presentation of material are paramount in expressing the compositional intentions to a performer and their audience. Without a robust practice, performers can easily misinterpret the score, compositional ideas can become lost within complex textures, and presentation can appear messy and overly complex. My notational practice aims to serve the performer with material that is easy to interpret but also allows my compositional intentions to remain true. This chapter aims to analyse my notational practice and the challenges that I have faced in notating my music for performers.

For my music, I believe that understanding the core intentions is key to a successful performance. In handling poly/cross-rhythmic material, the performer's ability to separate these through expressive tools (for instance, dynamics, accentuation, tempo, metre) can help to create a convincing performance. A listener seldom has an opportunity to view the score, especially in contemporary music, placing additional responsibility on the performer to produce the most effective interpretation possible. Moreover, the concert experience is brief, with little opportunity for full digestion of compositional ideas in one sitting. A good interpretation from a performer can help highlight the composition's key moments and can produce a convincing performance. My aim as a composer is to communicate my intentions as clearly as possible so that performers can successfully interpret my work.

In specific cases, I have often chosen to include a performance note for pieces that require additional information regarding the rhythmic concepts within the score.[1] An example

[1] In this portfolio, performance notes can be found in *The Rhythm* and *Irrationality*.

of this is *Irrationality,* a piece that incorporates irrational metres, a rhythmic concept that is not commonly seen in repertoire. For the majority of my scores, performer notes are avoided as much as possible, and a focus is placed on ensuring enough detail on the score to save precious rehearsal time.

There is a second, and more pervasive challenge that has appeared in Chapter One's literature review: the Western Classical notation system. The system's core function is to organise pitch and rhythmic information into a framework that can easily be interpreted by anyone with the ability to read it; however, this framework was founded on the concept of metric stability. Whilst this portfolio is not the first to challenge this notational system, I came to the realisation that, in writing music that is rhythmically/metrically dissonant, I am working against the foundations of its organisational system. To contextualise this challenge, it became crucial that I understood the notation system further.

Context

It may appear that the method of rhythmic organisation (bar lines/metres) has retained its original purpose since the transition from mensural notation to modern stave notation, but the semantics of traditional notation have weakened throughout the musical periods. Cooper and Meyer, for instance, argue that the use of bar lines has changed over the course of different stylistic eras, especially since 1900:

> The use of the bar line by modern composers has not been uniform. Some composers use bar lines in the traditional way, to mark the beginning of metric units. But in much of this music the metric crossing of voices is such as common occurrence that while the bar line will indicate the meter of one voice, it will not do so for another. Indeed, composers have written the meters of different voices with different time signatures […] and used many other notational devices to

> indicate something about the metric structure. Other composers seem currently to be using the bar line to mark off the limits of melodic, harmonic, or rhythmic groups rather than to designate the beginning of metric units. In general, the bar line has become less and less indicative of metric organization. And it must not be conserved conclusive evidence of the metric scheme.[2]

This raises the concept that a gradual development toward complex polyphony has weakened the strength of the traditional approach to metric organisation. Rhythmic material, during the twentieth century, began to diverge from rhythmic homophony into the depths of metric complexity/ambiguity where more than one metre could be perceived. There appears to be an 'emancipation of rhythm' within the twentieth century,[3] where the meaning of these notational terms is destabilised, and flagstones of rhythmic organisation, the metre and bar lines are recontextualised/regrouped to support the radically changing rhythmic complexity of twentieth-century music.

Talgam's thesis, mentioned in Chapter One, challenges the original notation of Ligeti's music and renotates the *Études* 3, 4 and 6.[4] In some passages, Talgam attempts a re-notation of passages in order to best process the complex material.[5] He highlights that 'the notated metre and the pulses of most *Études* serve merely as "virtual" grids for coordinating

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[2] Cooper and Meyer, Cooper and Meyer, *The Rhythmic Structure of Music* (Chicago: The University of Chicago Press, 1960), p. 89.

[3] Mark Delaere, 'Tempo, Metre, Rhythm', *Unfolding Time: Studies in Temporality in Twentieth-Century Music* (Leuven: Leuven University Press, 2009), p. 21.

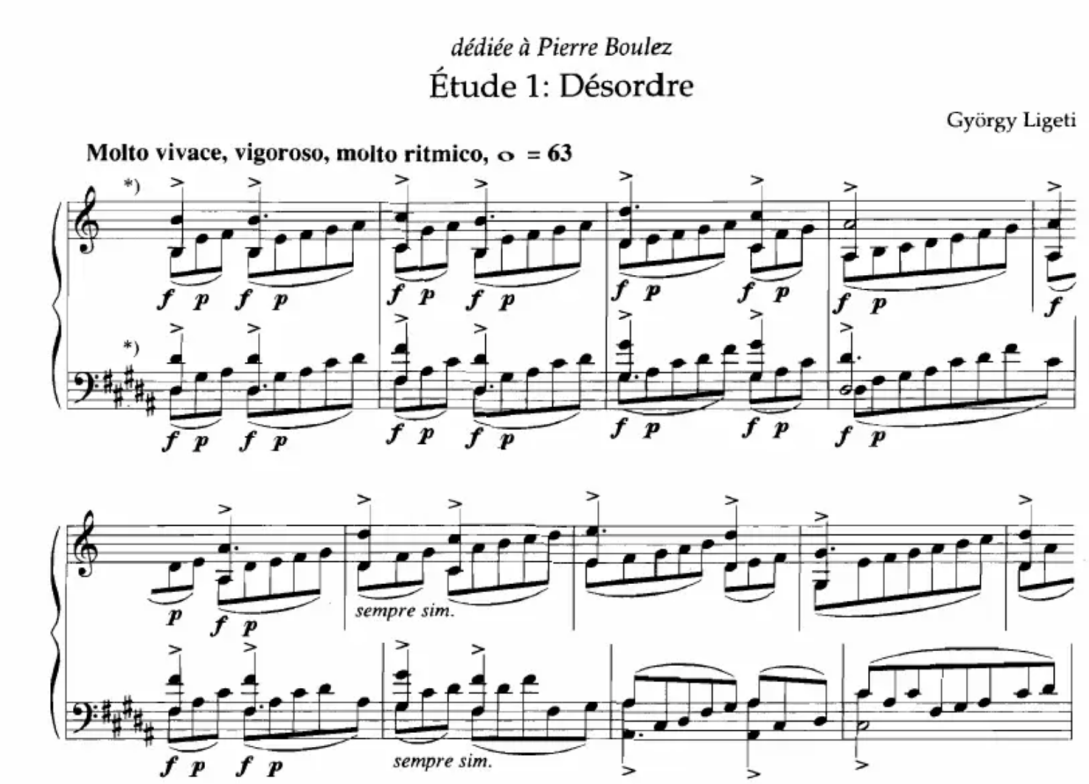
[4] Imri Talgam, Performing Rhythmic Dissonance in Ligeti's Études, Book 1: A Perception-Driven Approach and Re-notation (PhD dissertation, The City University of New York, 2019).

[5] Ibid.

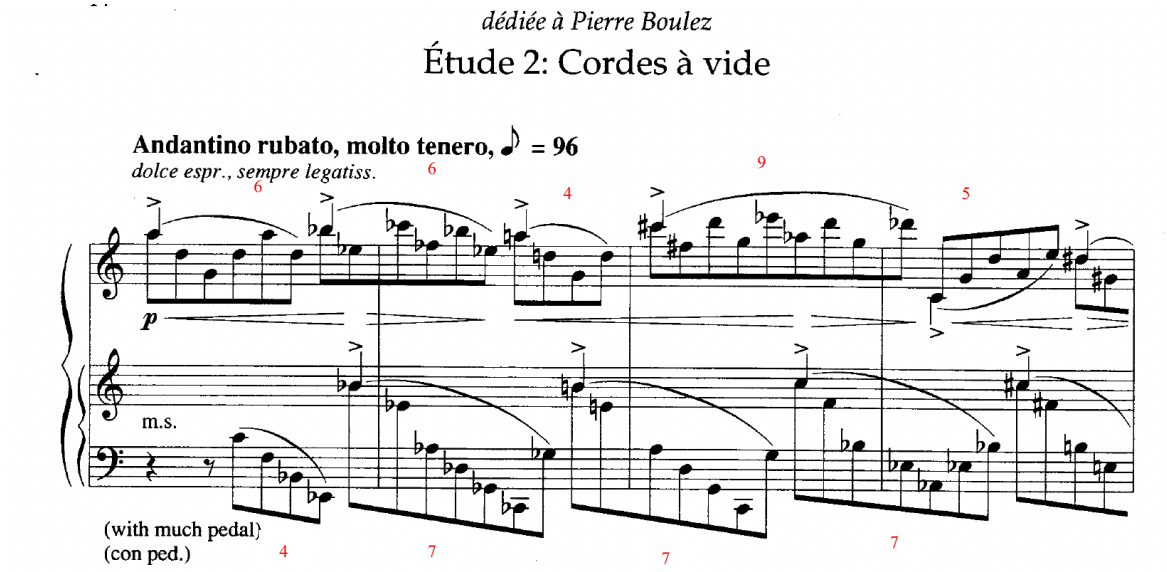
different pulse trains. Often, the *Études* are presented in a traditional meter (such as 4/4, 12/8 etc.), although the meter is never articulated in the music, nor related to its means of organization', reinforcing Cooper and Meyer's belief that musical passages can be notated in different metres due to the metrical ambiguity that may surround a musical passage.[6]

Talgam suggests that the use of a generic metre (4/4, 12/8) provides a neutral landscape for the performer, where conflicting polyrhythms are equal and lack dominance, providing a standard common denominator that can be used as a reference. In essence, the metre acts merely as a structure (or blank slate) in which notes are placed. Conversely, using this method dilutes the role of metre as organising rhythmic accents within the bar, leading to the time signature and its grouping/metric accentual properties to be rendered useless. An example of this can be seen in Ex. 3.1. Barred in common time but not explicitly marked, Ligeti's first étude is notated in a 3+5 quaver grouping and thus can be marked in a 3/8 + 5/8. Note that in bar 4, the bar lines start to separate between the hands, adding further complexity to the étude as the metric accent of each hand begins to shift out of alignment. Initially, the 'neutral grid' of 4/4 does not prove to be useful within this étude, especially since the irregular grouping falls against the natural metric accentuation of 4/4.

[6] Ibid. p. 6.



Ex. 3.1 Ligeti, *Étude 1: Désordre.*[7]



Ex. 3.2 Ligeti, *Étude 2 Cordes à vide.*[8]

[7] György Ligeti, *Études pour piano,* Schott Music (London, 1986).

[8] Ibid.

Ex. 3.2 exemplifies the concept of the neutral grid amongst the complex polymetric texture. Again, the score's time signature is not marked; however, it is clear that it could state 4/4 at the beginning. In this example, Ligeti's secondary voice enters towards the end of the first bar, but again the accent on bar 1^{7} suggests the start of a new phrase.[9] Moreover, the first line is grouped 6 + 6 + 4 + 9 + 5, making it challenging to find a regular metric pattern that would fit the material, especially as the lower voice is grouped differently using a 4 + 7 + 7 + 7 pattern. In addition to this, the second voice enters on bar 1^{8} (quaver) highlighting the start of a displaced line. It is apparent that notating this within an ever-changing metre would never produce a satisfying result due to the need to consider voices, groupings/phrasing and accentuation. The two conflicting voices, lacking accentual alignment, mean that one dominant voice would need to be chosen. Clearly, this is challenging in itself, as the two voices are intentionally equal in these études.

In light of this, I realised the need to be proactive in my notational practice in order to avoid issues that would need to be changed retrospectively, and that compositional intentions had to be communicated effectively and clearly. In the early stages of my research, the importance of notational practice was not at the forefront of my workflow; this changed drastically when some performers questioned my notational practices. The opportunity to workshop early drafts of pieces helped to highlight issues and eliminate them in future compositions.

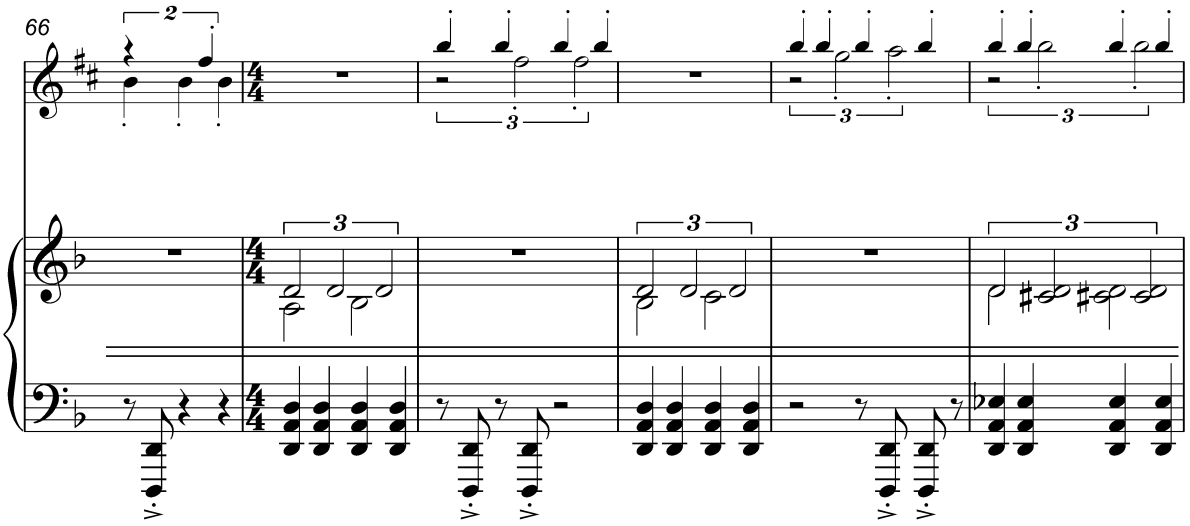
Core Practices

Firstly, the main intention is to value the melodic/foreground material in dictating the metric structure due to the emphasis that it will have on the other rhythmic layers. In some cases,

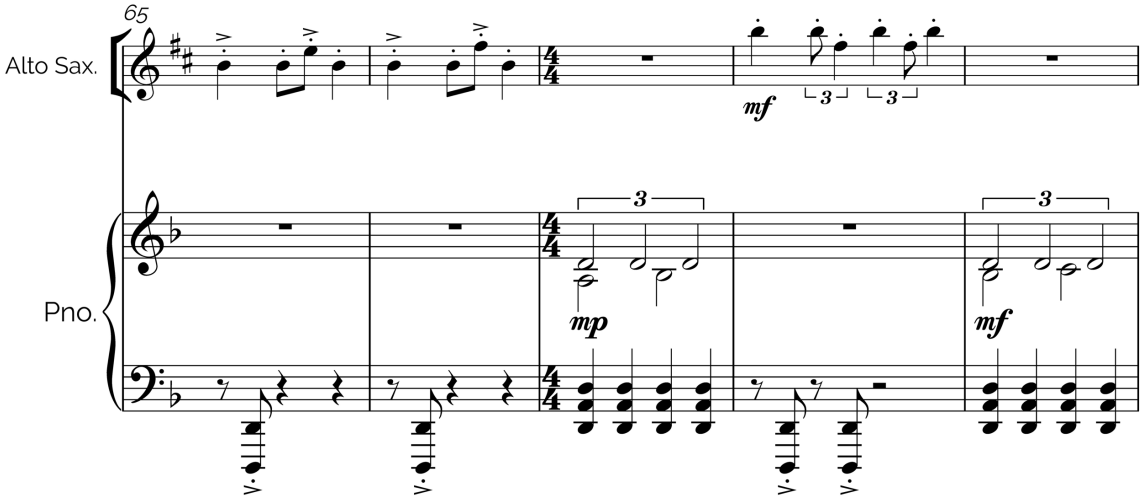
such as the middle section of *Midnight Rhythm*, the rhythmic difficulty of the clarinet part is complex in comparison to the piano part. As a result, the notation is written to favour the most difficult rhythmic patterns. Secondly, Harmonic rhythm, when appropriate, can also dictate the metric structure in passages. This is evident in *Enchantment*'s second movement bb. 54–104, where the metre is primarily dictated by the chordal changes. Thirdly, if sub-metric deviations are within one polyphonic instrument, the deviation is still bound by the overarching metre and sub-metric split (*i.e.* 3+2 or 2+3) indicated by the melodic grouping. For example, this occurs in the first variation of *Dechrau* (Ex. 2.1), where the melody and middleground textures are in different metric groupings; despite this, the texture is grouped in the same grouping as the melodic idea. Fourthly, complex metres that can be neatly split into two are simplified to their easiest form unless an explicit compositional/musical idea is required. This allows the performers to easily process the changing metres in a clear and easily interpretable pattern. Finally, polymetric writing (the visual presence of two metres) within a score is avoided if possible. Instead, expressive markings (accentual markings, phrasing and dynamics) are used to highlight the second metre within the part. Adding additional metres for brief moments of textural complexity creates additional confusion for ensemble performance.

Early Challenges: Cross-rhythmic Notation

In the early drafts of my work, especially my initial piece *Midnight Rhythm*, I encountered problems with using polyphonic voicings with instruments that are single-voiced. This became a seminal moment in the early stages of the PhD that sparked the change in my notational practice.



Ex. 3.3 Early draft from *Midnight Rhythm* bb. 66–71.



Ex. 3.4 Revised version of *Midnight Rhythm* bb. 65–69.

Ex. 3.3 was originally presented to the *Illuminate Duo*, saxophonist Naomi Sullivan and pianist Kumi Matsuo, during the first workshopping of *Midnight Rhythm.* In facing this material, Naomi had not seen cross-rhythmic material written for saxophone in this style and had annotated the material in a rehearsal prior to the workshop to a simplified notation shown in Ex. 3.4. With the use of accents, Naomi could still emphasise the duple metric feeling within the passage and convincingly convey the conceptual 3:2 cross-rhythm originally notated.

Despite a small sample size, this prompted a new perspective in my notational practice. In order to improve the communication of my compositional ideas, I notated assimilated versions of rhythmic patterns.[10] Fitch and Rosenfeld's research suggested that one approach to understanding polyrhythmic material is through 'assimilation', the merging of two independent pulse streams into one, allowing a musician to internalise a rhythm as a single layer.[11] I chose to introduce this to instrumentalists who primarily performed monophonically on their instrument to ensure that their ability to follow the notation was easier. Conversely, it is important to note that this cannot be applied to every performer or to all single-staved instruments. A guitarist, for example, commonly reads two voices within their single-stave notation (a bass and treble voice) and therefore polyrhythmic textures appear more commonly within their repertoire.[12]

Yeston and Krebs both highlighted the importance of accentuation within a passage that can highlight a textural polyrhythmic element. Incorporating this theory into my notational practice (Ex. 3.4), I opted to highlight the duple metric feeling by accentuating the initial downbeat and the second-half of beat 2 (2^2). Accentuating beat 2^2 creates the emphasis of a duplet pulse and weakens the overall three-time feeling that the 3/4 metre should create.[13]

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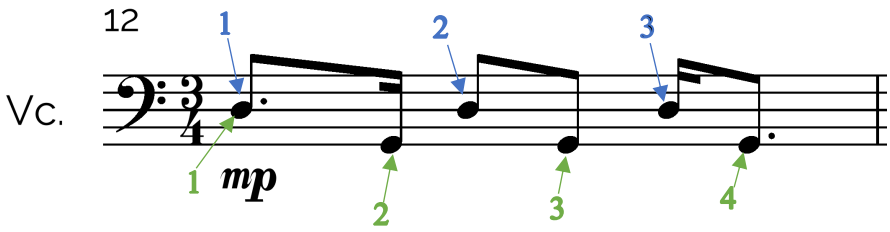
[10] W. Tecumseh Fitch, and Andrew J. Rosenfeld, 'Perception and Production of Syncopated Rhythms', *Music Perception*, 25/1 (September 2007), pp. 43 – 58.

[11] Ibid.

[12] An example of this is Dušan Bogdanović *Polyrhythmic and Polymetric Studies for Guitar* (1990).

[13] Traditionally, 3/4 is characterised by a strong-weak-weak accentuation.

This notational practice was expanded upon in *Crossing The Lines*, initially conceived as a string duo piece but later orchestrated for string quartet. *Crossing The Lines* explicitly uses a 4:3 polyrhythm as part of the underlying ostinato that transforms through temporal shifts (Ex. 3.5). Using the assimilated notational style, the piece was successfully workshopped without any queries raised regarding the cross-rhythmic elements.



Ex. 3.5 Ostinato from *Crossing The Lines*.

In this notational setting, the cross-rhythmic texture can easily go unnoticed. Accents on the initial beat and subsequent G notes to emphasise the four (within the cross-rhythm) could assist in highlighting the cross-rhythmic element to the listener. Within the context of this piece, the 4:3 cross-rhythm is initially treated as the main ostinato. Since this is a middleground texture, accents are left out to avoid the pattern dynamically protruding through the melodic material.

Metre within Polyrhythmic Textures

Before determining the most logical presentation of my material, it is important to be aware of the most dominant metric structure within the musical passage. This is often a convoluted

process, as implied by Cooper and Meyer's metric-crossing[14], but composers must try to produce the most appropriate contextualisation of their rhythmic and melodic material.

I would strongly argue that the melodic structure is the foundation of the rhythmic layers as it is the material at the 'foreground' of the texture. In choosing the most appropriate rhythmic structure for the musical passage, the melodic material should fit neatly into a metre, if possible: even if that produces off-beat rhythmic patterns within the middleground texture. In selecting metre, one must also decide what the overall important metric emphasis is within the musical pattern and secondary metres become subsidiary to that. In textures where melodic focus is absent, but polymetre still exists, I revert to the overwhelming metric emphasis that has been focal to the piece. For example, if the piece has been in 4/4 for the majority of the work (and it is still present in this polymetric texture), then I will maintain this within the passage as much as possible.

If there is the concept of equal conflict, alternating metres can be useful in portraying a sense of equality between two or more metres.[15] Ex. 3.6 is taken from the later stages of *Crossing The Lines* where there are alternating metres, cross-rhythmic textures and then the superimposition of these ideas at bar 139. 7/4 was avoided to highlight the metric emphasis of the melodic material in the first violin. The first violin triplet creates an additional 3:2

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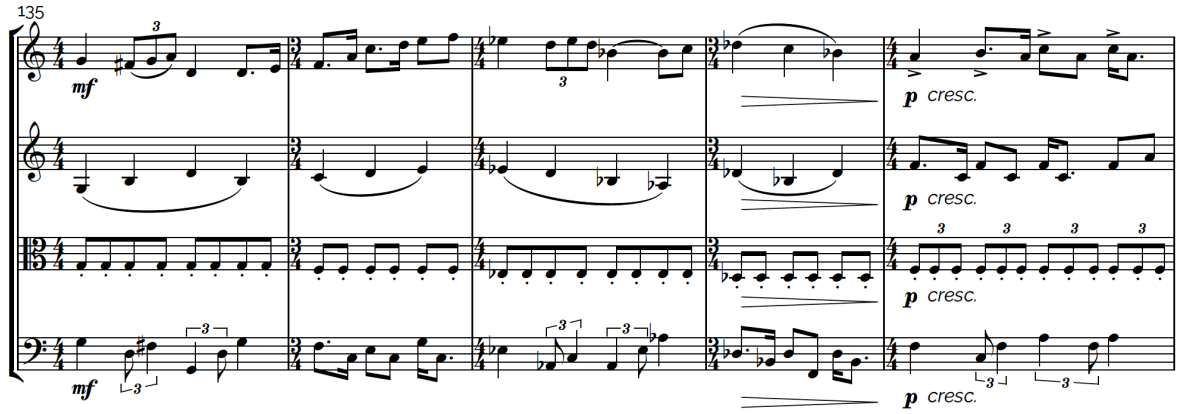
[14] Grosvenor Cooper and Leonard Meyer, *The Rhythmic Structure of Music* (Chicago: The University of Chicago Press, 1960), p. 108.

[15] In using an alternating metric idea, one could argue that there is not a dominant metre but instead a duality (or balance) between the two. If, however, the alternation is unequally weighted (for instance, 2 bars of 4/4 followed by a single 7/8 bar alternating), then the balance is shifted to the more frequently heard metre.

cross-rhythm against the viola in bars 135 and 137. Bar 139 emphasises this triplet versus duplet relationship as a gradual rhythmic *accelerando* begins in the viola part.



Ex. 3.6 *Crossing The Lines* bar 135–139.

Secondly, the use of cross-rhythmic textures in the cello part also dictates the overall metric alternation. Due to the cyclical behaviour of cross-rhythmic patterns, using an appropriate metre can neatly organise a full cross-rhythmic cycle and its alignment with a metric accent (i.e. the first beat). Using an alternating metre allows for a neat alignment of new metric ideas to commence in the following bar, avoiding the combination of different temporal concepts within the same bar/passage.

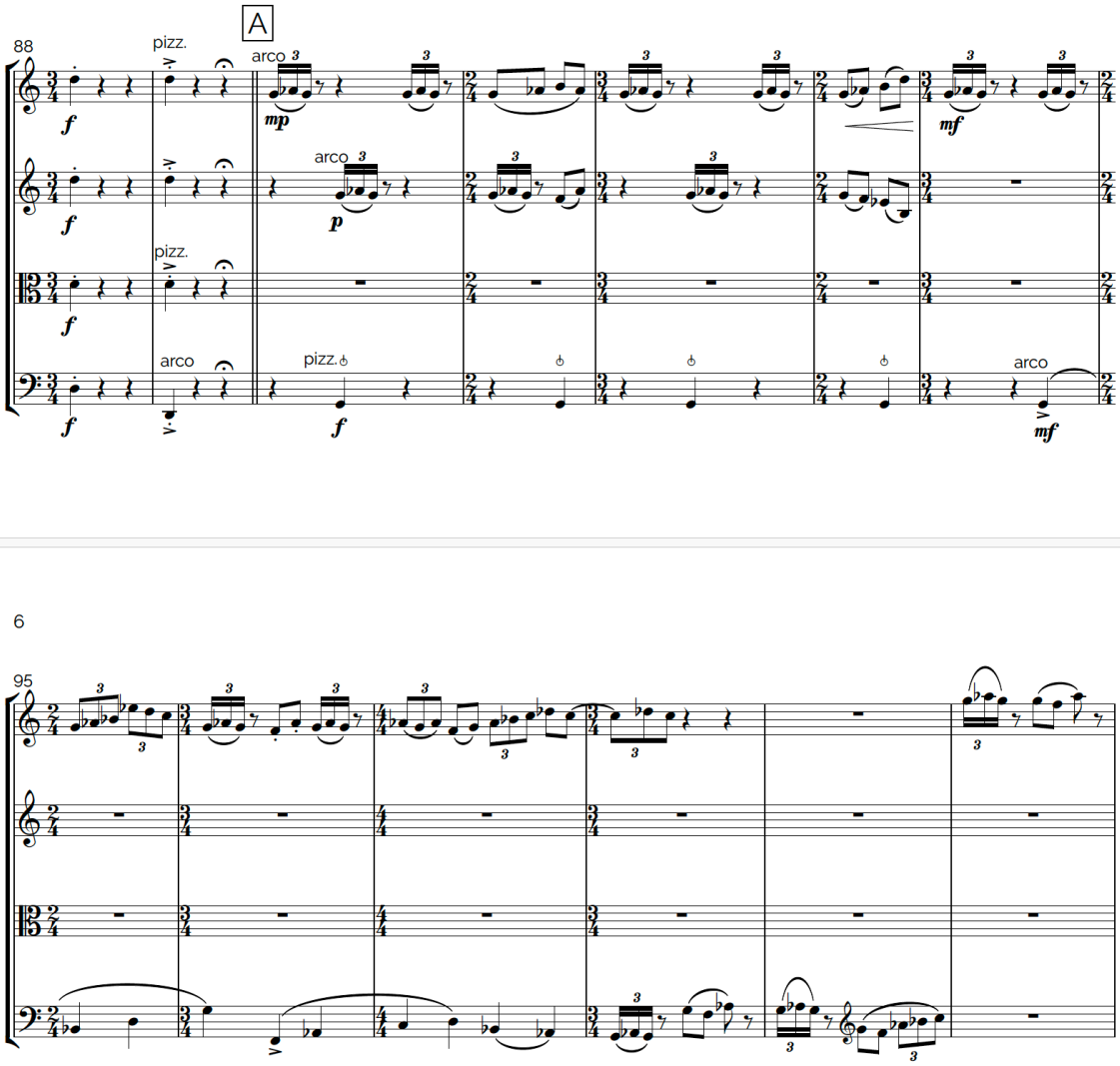
There are opportunities where the harmonic rhythm can also support the rhythmic material. The passage in Ex. 3.6 demonstrates harmony arranged within the metric framework. Using this approach, a new chord for each bar/metre allows the material to appear organised and can help to clearly define the harmonic rhythm for the performer.

One could also use 7/4 here to present less metric information within the passage; however, I would argue that this would give less emphatic accentuation. The start of a new metre can often create a heavier emphasis on the downbeat, a concept that would become subdued in the 7/4 metre. Using the alternating metre also helps express the passage's metric

conflict to the performers, reinforcing the compositional intention and the need for accentuation to highlight the change in material.

In addition to the melodic material emphasising the metric pattern, the violin II part is also notated in a fashion that provokes the concept of alternating metre through groupings of 4+3. The bow pattern enables the performer to attack each first beat within the phrase. There is a possibility to phrase this differently by focusing on the patterns of ascension and descension, but this goes against the harmonic groupings. If the phrasing was changed, the player could be emphasising a 3/4 followed by 4/4 bar rather than a 4/4 + 3/4. At 139, despite the duple versus triple battle that exists between the treble and bass instruments, the music maintains the duple time due to the melodic importance. It also establishes to the performers that the triplet texture is the invasive material battling against the duple material, reinforcing the concept that material should be notated in their dominant metre.

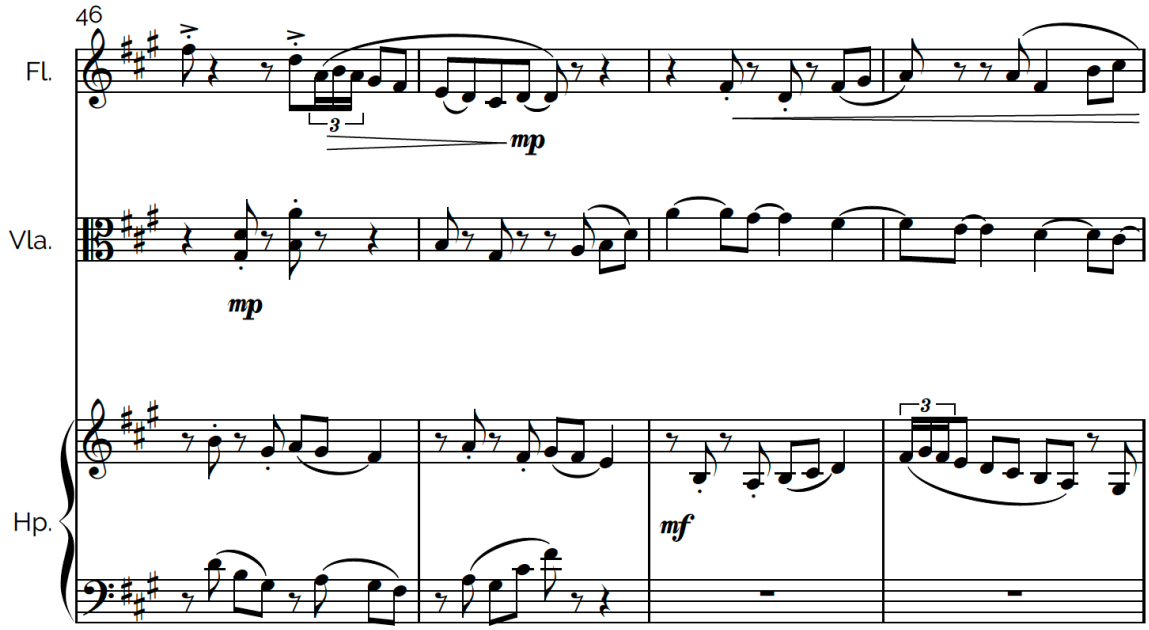
Melodic Importance



Ex. 3.7 *Crossing The Lines* bars 88–100.

Ex. 3.7 showcases an example where the melodic material overrules the cello's implied polymetre. Bar 94 introduces the initial attack of the displaced 4/4 metre in the cello part against the alternating metre. The 4/4 emphasis is repeated in bar 96 with the accentuation on beat 2 and re-bowing/phrasing of the cello part. There is also the use of phrasing and melodic contouring to emphasise the beginning of a new metric grouping. Despite this disruption from the cello, the metre remains focused on the melodic material, the foreground material for the audience. This designates the cello material as a foreign element

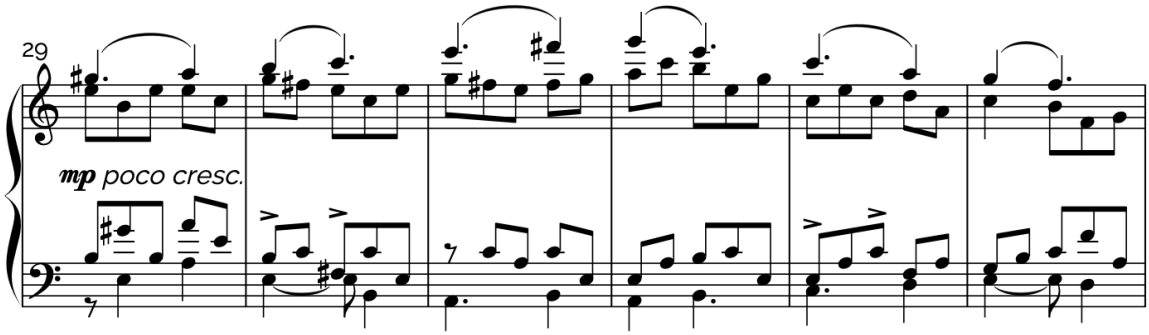
attempting to disrupt the subliminal 5/4 melody. In bar 98, the metre changes: Now, the cello takes over the melody, and the preceding metric structure means that it can arrive on the first beat of the bar.[16]



Ex. 3.8 *Enchantment Mv.3* bars 46–49.

Another example of melodic material overruling displaced dissonances appears in Ex. 3.8 within the viola part, highlighting a texture that could be perceived as polymetric. The viola part consists of 8 dotted crochet pulsations (finishing in bar 50), creating a pulsation of 12/8 for two bars against the underlying 4/4 metre. Contextually, the harp and flute remain in 4/4 but have syncopated material that disrupts the metric strength of the main 4/4 metre. Here the notation is standard, using tied notes to ensure that the main beats of 4/4 are upheld. Using this notational approach also treats the tied notation as disruptive to the 4/4 metre, emphasising the concept that this should be treated as rhythmically dissonant material.

[16] In bar 97, I try to align the two instruments after the cello's displaced metre by using the shorter two crotchet phrase. This allows the material to blend smoothly into the following section.



Ex. 3.9 *Dechrau* sub-metric alternation of 2+3 followed by 3+2.

In *Dechrau*, sub-metric alternation is notated using an alternating beaming pattern to emphasise the groupings of notes. Ex. 3.9 highlights this in the first variation. For much of this texture, all voices within the piano texture follow the same sub-metric group, but this diverges in bar 34 when the bassline uses a 3+2 grouping (notated as a 2+3). I avoided mixing sub-metric groupings within the bar to avoid confusion and to maintain the overwhelming metric grouping within the bar. For ensembles with polymetric material, one could argue that mixing metric groupings in individual parts may not cause an issue; however, problems or unnecessary confusion may arise in rehearsals. In this portfolio, the visual appearance of polymetre has been avoided, and instead, accentuation and phrasing have been used to emphasise a foreign metre within an instrument's material.

Summary

To summarise, my notational practice has developed continually throughout this research. Prompted by workshopping opportunities, I realised the importance of notating polyrhythmic textures in their clearest fashion. It became clear that in navigating a Western Classical notation system, there is no absolute when handling multiple conflicting rhythmic/metric ideas. Instead, the importance should be placed primarily on the main intended metric structure (primarily dictated by melodic material), followed by any compositional ideas that

need to be communicated. In addition to this, the notational practice should use an abundance of notational detail to emphasise crucial rhythmic accentuation to the performer.

The topics addressed in this and previous chapters have inspired me to produce compositional work that engages with a range of concepts. My final chapter explores the combination of both rhythmic techniques and my notational practices in my long-form piano concerto to address the question: to what extent is rhythmic dissonance effective as a compositional tool in long- and short-form works?

Chapter 4 Using Rhythmic Dissonance for Long-Term Compositional Development

This chapter explores the effectiveness of employing rhythmic techniques for compositional development, with a particular focus on sustained engagement with rhythm over an extended timespan. Compositional techniques should enable a composer to produce an abundance of variations that maintain interest throughout the entirety of a composition. In particular, this chapter focuses on a large-scale composition, my piano concerto, *Odyssey,* to critically assess the rhythmic techniques used to develop the compositional material.[1] Before exploring *Odyssey,* it is important to establish my approaches to development within my chamber works due to the context that *Odyssey* was written late in the research period and was inevitably influenced by the decisions taken in the chamber music.[2]

Chamber Works

Midnight Rhythm and *Crossing The Lines*

Early in the portfolio, I used simple structures such as ABA to evaluate the effectiveness of employing different rhythmic characters between sections. In *Midnight Rhythm*, the A theme features a playful theme within a 5/4 metric structure with minor metric shifts; contrasted by

[1] During the composition process, I was made aware of other pieces sharing the name *Odyssey*. It is important to note that this piece is inspired primarily by concept of this academic and educational journey.

[2] Additional exploration of the thematic development regarding *Odyssey* can be found in the Appendix. These sections are excluded from the main body of the text to avoid over-weighting the chapter and distracting from the main dialogue.

the B theme, a more agitated one derived from cross-rhythmic textures. A monotonous pedal tone produced by the piano accompanies the theme and provides little harmonic exploration. *Crossing The Lines* features a similar concept but with different outcomes. The A theme features a lyrical theme surrounded by cross-rhythmic textures and frequent metric shifts of irregular durations. Conversely, the B theme employs metric alternation and a Phrygian modality to produce a different rhythmic voice that contrasts with the A theme. In the returning A section, the metric alternation founded in B influences A between bb. 167–178. This contrasting effect seemed to work well and provided greater variety within a single-movement work; furthermore, the use of different rhythmic devices and textures helped create a distinction between the sections and strengthen the structural identity of a work.

Expanding Structures: *Enchantment*, *Dechrau* and *Refractions*

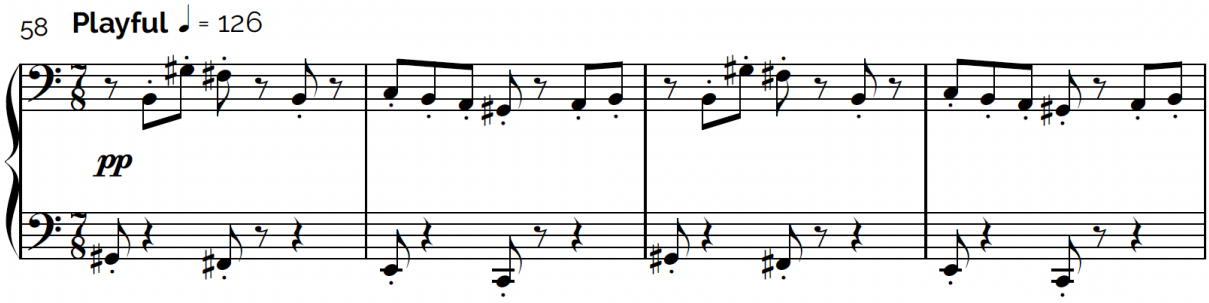
It became evident that the development of rhythmic techniques needed a larger, more complex structure in order to reach their full potential. *Enchantment* is the only multi-movement work of the entire portfolio, written in a traditional fast-slow-fast structure. Below is a table highlighting the entire arc of the thematic material in the piece.

Movement and Structure	Bars	Character and Development
First movement **ABA**	A (bb.1–41)	Rhythmically vibrant and playful theme. • Cross-accents • Cross-rhythmic textures
	B (bb.42–79)	Slower section attempting temporal freedom. • Displaced rhythmic entries • Rhythmic diminution/acceleration.
	A (bb.80–121)	• More complex cross-rhythmic texture. • Greater rhythmic density/complexity. • Rhythmic acceleration (derived from B).
Second movement **ABA**	A (bb.1–53)	Slow tranquil theme. • Displaced entries (displaced dissonances). • Metric consonance (A section in 4/4). • Cross-rhythmic textures.
	B (bb.54–108)	Flowing and metrically-free texture with overlapping entries from all voices. • Metric irregularity–constant changes.
	A (bb.108–137)	• Cross-rhythmic textures • Displaced dissonances • Syncopation
Third movement **Rondo (ABACADABA)**	A (bb.1–28)	• Irregular metre (7/8) with metric interjections.
	B (bb.29–51)	• Displaced entries. • Regular metre (4/4).
	A (bb.52–71)	• Minor variations to previous A section.

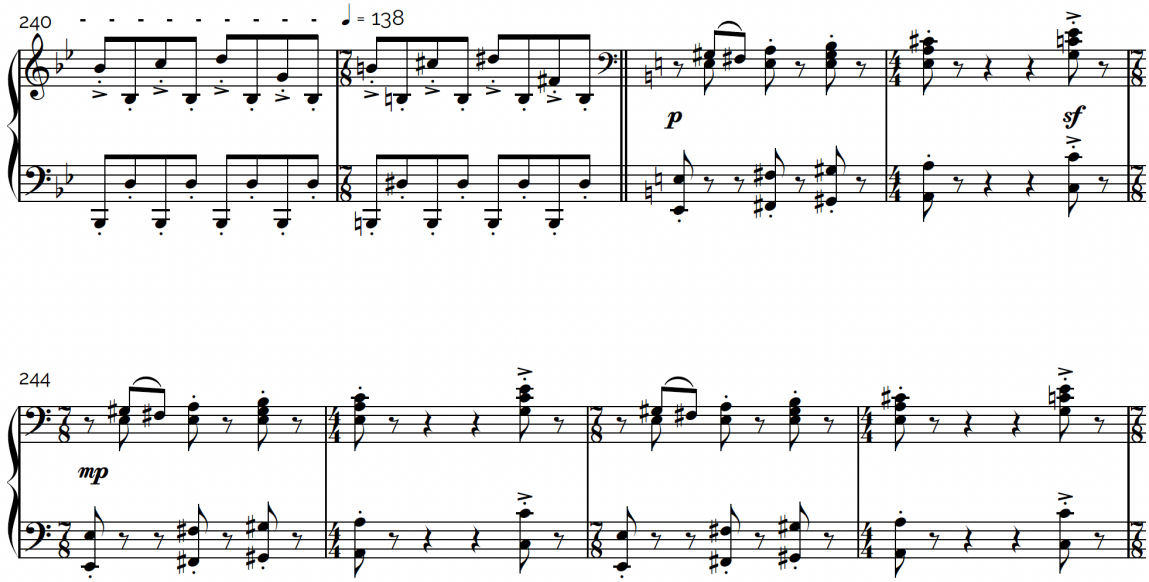
	C (bb.72–88)	• Timbral shift (harp and viola). • Compound time (9/8).
	A (bb.89–106)	• Small metric variations.
	D (bb.107–123)	• Irregular phrasing. • Cross-rhythmic textures. • Timbral variations (pizzicato and hand-stopped harp).
	A (bb.124–141)	• Harmonic shift to minor.
	B (bb.142–164)	• Development of B section with greater interplay between the different instruments.
	A (bb.165–189)	• Coda outro added to from bb.181–189.

Table 4.1 *Enchantment* Structure and Development

Enchantment raises the concept that rhythm can play an important role in organising structural and characteristic elements of a musical work. Notably, the second movement is designed to contrast heavily between the two sections. A, following a simple 4/4 metric framework, followed by the constant metric shifts that occur within the B section. The rondo in the third movement also highlights the use of metric variety to produce different textural outcomes. Some movements remain in simple time, whereas others use compound or irregular metre. The blending of two separate rhythmic/metric ideas from contrasting sections also appeals to me greatly and provides an additional avenue for development and textural exploration. *Dechrau,* I believe, achieves this within a theme and variation structure by reinterpreting textural concepts within different rhythmic/metric settings. For example, variation two (Ex.4.1) uses a simple staccato texture where the theme is in the left-hand.



Ex. 4.1 Bars 58–61 of *Dechrau*



Ex. 4.2 Later variation in *Dechrau* inspired by variation two.

The latter variation (Ex. 4.2) features greater chordal textures and a slightly transformed rhythmic approach where metric alternation occurs more frequently with augmentation of the metric ideas created in the earlier variation. Despite theme and variations often appearing episodic, I would argue that the rhythmic and textural similarities between different variations can establish effective structural links.

Odyssey: Long-form Development

Odyssey is the culminating work of the portfolio, aimed at being the most rhythmically and texturally ambitious piece. The concerto is an amalgamation of influences from my musical education and is linked biographically in its concept and idiom.[3] In some cases, these influences have been realised retrospectively, after listening to past compositions and pieces from other composers. One conscious choice was to engage with the concerto genre after reflecting on my final-year undergraduate compositional portfolio, which also included a piano concerto titled *Storm.* The portfolio was well-received academically; however, I viewed *Storm* as an ambitious but unsuccessful attempt to produce a large-scale work that was an honest reflection of my compositional voice. In pursuit of rectifying this, and as a retrospective acknowledgement to my past music, *Odyssey* was conceived.[4]

The single-movement work is structurally an amalgamation of a *quasi*-rondo structure with foreign elements borrowed from sonata form, such as a *cadenza*, alluding to the commonly used structure for concertos. The piece incorporates sub-metric manipulation, alternating metric patterns, cross-rhythmic textures, displaced rhythmic dissonances, temporal shifting, rhythm and tempo as structural signifiers. This chapter tracks each separate theme's occurrence and rhythmic developments in a chronological order. Table 4.1. sets out the main themes for the work, and Table 4.2 provides a detailed overview of the structure.

[3] Where relevant these biographical references will be discussed later in the chapter.

[4] There is no thematic/motivic material shared between the concertos despite this acknowledgement of its influence.

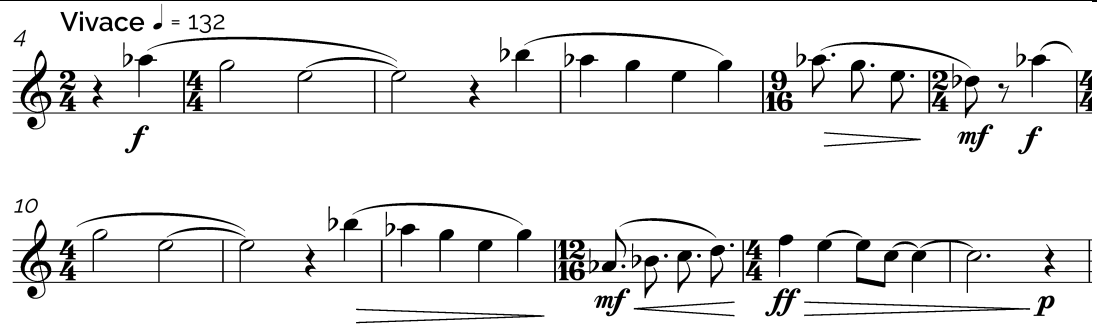
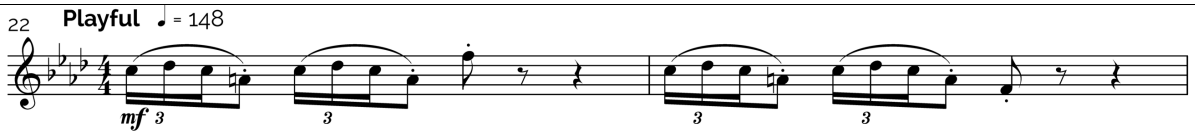
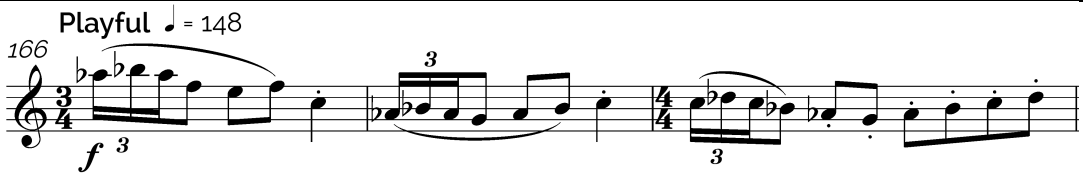
Theme	Example
A	
B	
C	

Table 4.2 Themes from *Odyssey*.

Primarily a legato theme, A is used to represent the journey of the piece and acts as the basis for the *quasi*-rondo structure. In my view, A is a combination of my admiration of Sergei Rachmaninoff and film score composition, due to its allusion to Romanticism in melodic and harmonic construction. B is a playful theme that is characterised by a semiquaver-triplet pattern and is texturally surrounded by vibrant syncopation, sub-metric manipulation and independent rhythmic cells. C melodically resembles the B theme, with its similar use of the triplet semiquaver; important to note that C's development is characterised by textural and rhythmic developments rather than its character. Additionally, C features a harmonic pedal during most of the polyrhythmic textures, producing moments of harmonic stasis whilst the piece develops rhythmically.

bb.	Main Structure	Harmony	Comments/Key Rhythmic Techniques
0–4	Introduction	C Major/Minor	• Sub-metric manipulation. • Irregular grouping (piano).
5–21	**EXPOSITION** A	C Major/Minor	• Sub-metric manipulation. • Metric changes (9/16 + 12/16) • Cross-rhythmic textures.
22–92	B	D♭ Major F Minor	• Sub-metric grouping. • Syncopation. • Cross-rhythmic textures. • Rhythmic unison to highlight structural changes. • Metric triplet interjection.
93–112	A	C Major	• Melodic material metrically displaced. • Driving/syncopated rhythm in lower voices.
113–151	A (Tranquil)	C Major	• Transition to compound time (12/8). • Metric superimposition (piano in sextuplets, melody in duple movement).
152–59	A	C Major	• Cross-rhythmic textures. • Sub-metric manipulation.
160–62	A Transition	Chromatic → C7 chord	
163–262	C	F Minor.	• Metric alternation. • Irregular metric interjections. • Rhythmic diminution.

			• Sub-metric manipulation/conflicts (2+3 *vs.* 3+2). • Syncopated driving rhythms. • Cross-rhythmic textures.
263–304	**DEVELOPMENT** A	E pitch centre C Major/Minor F Minor	• Syncopated string interjections. • Simple/compound metric shifts. • Temporal shifts (ritardando).
305–348	B	B♭ Minor	• Sub-metric grouping. • Syncopation. • Cross-rhythmic textures. • Rhythmic unison to highlight structural changes. • Metric triplet interjection–more frequent occurrence.

349–363	Transition	Moving towards G Minor	• Metric triplet interjection.
			• Confliction rhythmic identities within orchestral families.
			  ○ Piano – octave arpeggios in 4/4.
			  ○ Strings – syncopated sub-metric rhythmic texture.
			  ○ Brass – driving rhythmic pattern.

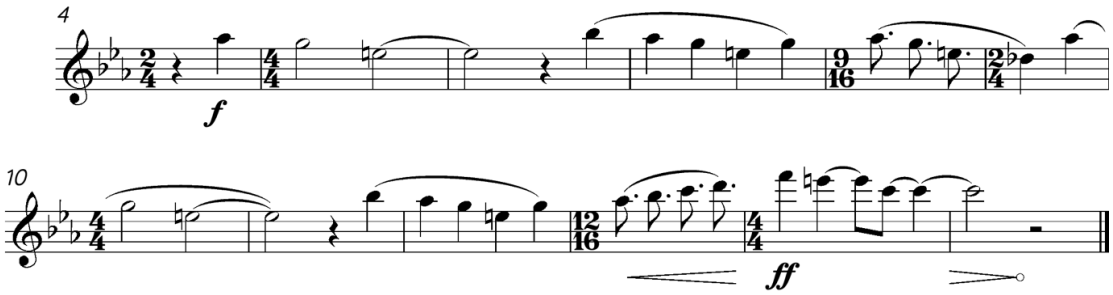
364–435	C	G Minor	• More aggressive and frequent metric irregularity. • Irregular metric interjections.

			• Sub-metric manipulation/conflicts (2+3 *vs.* 3+2) – more intricate textures appearing in the woodwind. • Cross-rhythmic textures. • Driving rhythmic textures (lower voices & harp).
422–31	**RECAPITULATION** A	C Major	• Driving rhythmic textures. • Multiple cross-rhythmic textures (grouping dissonances).
432–46	*Cadenza*	Ambiguous Primarily in C	• Temporal suspension. • Irregular phrasing.
447–81	Triplet A Theme	C Major/Minor	A newly developed A theme that uses triplet rhythms. • Cross-rhythmic textures – straight and syncopated. • A theme now in 3/4 metre.
482–527	C	G Minor	• Temporal accelerando & ritardando. • Metric alternation.
528–43	Transition	Chromatic modulation	• Written rhythmic accelerando (lower voices). • Syncopated woodwind entries. • Cross-rhythmic textures (grouping dissonances).
544–51	A	C Major/Minor	• Complex cross-rhythmic textures (3:7 in piano and harp). • Sub-metric manipulations in brass and lower voices.
552–54	A Transition	C major/minor	
555–62	A (tranquil)	C major/minor	• Displaced dissonances (harp).

			• Metric interjection of 3/4 bb. 560–61.
563–78	Triplet A Theme	C Minor	• Return of the triplet theme • Syncopated woodwind textures. • Mass cross-rhythmic 3 over 2 grouping dissonance.
579–86	Brass fanfare (A theme)	C Minor	• Driving triplet rhythm with irregular grouping. • Cross-rhythm texture from melody *vs.* brass accompaniment.
587–610	A	C Major	• Alternating duplet and triplet antiphonal writing. • Metric diminution that increases the alternating speed.
611–End	**Coda**	C Major Chromatic rising bb.611–617	• Driving rhythmic patterns. • Irregular metric shifts. • Irregular phrasing. • Cross-rhythmic textures.

Table 4.3 Overall structure of *Odyssey.*

A Theme: Journey Theme



Ex. 4.3 A Theme in Violin I from b. 4.

Ex. 4.3 presents the main A theme. Introduced in b. 4, a legato theme with connotations of Romanticism is subverted by sub-metric irregularities within the middleground texture. A's theme is the most rhythmically stable with minimal rhythmic disruptions compared to themes B and C. There is an interruption of 9/16 (b. 8) at the end of the melodic phrases, producing a compound metre punctuation with a homophonic texture. The shifts from duple to triple time disrupt the perceived linear continuity that could be expected from a legato theme in 4/4, shortening the duration of the phrase to an irregular length.[5] Alternatively, the 9/16 could be perceived as an augmentation of a triplet crotchet phrase, normally taking up two beats (and therefore feeling like an augmentation of a 3/4 phrase). By b. 13, there is an augmentation of the 9/16 to a 12/16. The expansion to 12/16, a metric augmentation, creates another contextually unexpected aural event for the listener and produces a subtle development.

[5] In the context of semiquavers, four bars of 4/4 equate to 64 semiquavers; however, in Ex. 4.3, introducing the compound metre at the end of the 4-bar pattern shortens the phrase to 61 semiquavers, creating an irregular phrase.

Exposition: Displaced Return of A

Following the B section, A returns rhythmically displaced amongst the underlying harmonic progression (b. 93), commencing on the 2nd beat instead of on the upbeat. This displacement, inspired by Krebs' discovery of displaced rhythmic layers, weakens the emphasis of the metre by beginning on a 'weak' beat instead of the downbeat.[6] By bb. 101 – 102, the melody is passed to the woodwind, with a further displaced countermelody that commences in b. 102 before aligning to the main melodic material in the oboe. In the middleground, the bassoons, violas, cellos and double basses punctuate with a developed syncopated rhythmic accompaniment. The pattern's attacks land on a triplet grouping within the 4/4 metre, emphasising a two-bar phrase.

At the end of each phrase, the pattern briefly aligns with the overarching metre before shifting again into a triplet grouping pulsation. These moments of rhythmic consonance, focused on beats 1 and 4, reaffirm the main metre used, but also contextualise the previous material as localised moments of rhythmic dissonance that are occurring at a sub-metric level within bar. Using an interpretation of Mark Gotham's approach to mapping metric accentuation, the two-bar section needs to be split into semiquavers due to the level of syncopation; because of this, I have expanded his system to use 5 integers (5 for the strongest accentuation and 1 for the weakest).[7] Moreover, there is also the need to factor in articulatory details that impact the performer's emphasis on a given note. The use of tenuto towards the end of the phrase emphasises to a performer the need to hold the note for the full duration and

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[6] Harald Krebs, *Fantasy Pieces: Metrical Dissonance in the Music of Robert Schumann* (Oxford: Oxford University Press, 1999), p. 34 – 35.

[7] Mark Gotham, 'Towards a Cognitively Based Quantification of Metrical Dissonance', *The Oxford Handbook of Time in Music* (8 December 2021).

is commonly referred to as 'leaning on' the note. This can create an 'agogic' and slight dynamical accent, where both the durational and volumetric emphasis can affect the aural result.[8] To acknowledge this, I have increased those attacks with tenuto markings by an additional integer. The sequence is set out in Table 4.4, each accentuation is split into its own crotchet beat:

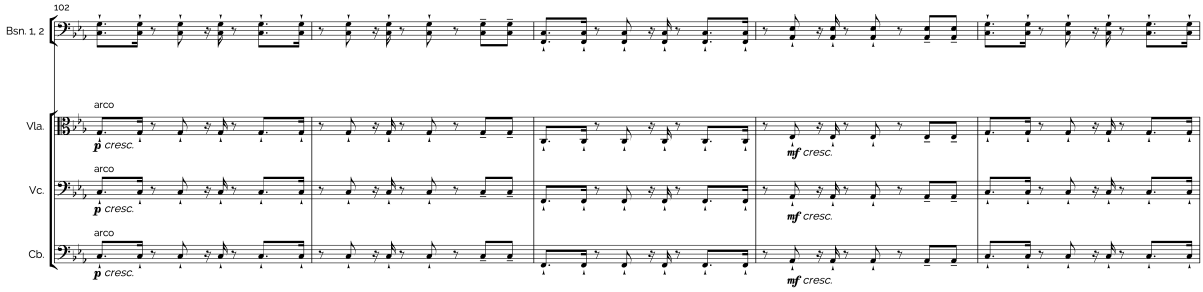
Bar & Beat Number	**104^1**	**104^2**	**104^3**	**104^4**	**105^1**	**105^2**	**105^3**	**105^4**
Gotham's metric accentuation (in semiquavers)	5, 1, 2, 1	3, 1, 2, 1	4, 1, 2, 1	3, 1, 2, 1	5, 1, 2, 1	3, 1, 2, 1	4, 1, 2, 1	3, 1, 2, 1
Simplified accentuation of beats	3,1,2,1,	3,1,2,1,	3,1,2,1,	3,1,2,1,	3,1,2,1,	3,1,2,1,	3,1,2,1,	3,1,2,1,
Odyssey's *syncopated 2 – bar pattern*	**5**, 1, 1, **2**,	1, 1, **3**, 1	1, **4**, 1 1	**3**, 1, 1, **5**	1, 1, **2**, 1	1, **3**, 1, 1,	4,1,2,1	4,1,3,1
Additional Comments	Emphasis on downbeat and start of triplet grouping.	Displaced to 3rd semi-quaver of beat 2.		Brief re-establishment of main metric structure before immediately displacing with the downbeat arriving early.				Increased integers due to tenuto markings. Re-alignment to traditional metric structure.

Table 4.4 Table of metric accentuation using an expansion of Mark Gotham's numbered approach.[9]

[8] An agogic accent is an accentuation on the note produced through duration. For a clear example, please see the glossary in front matter.

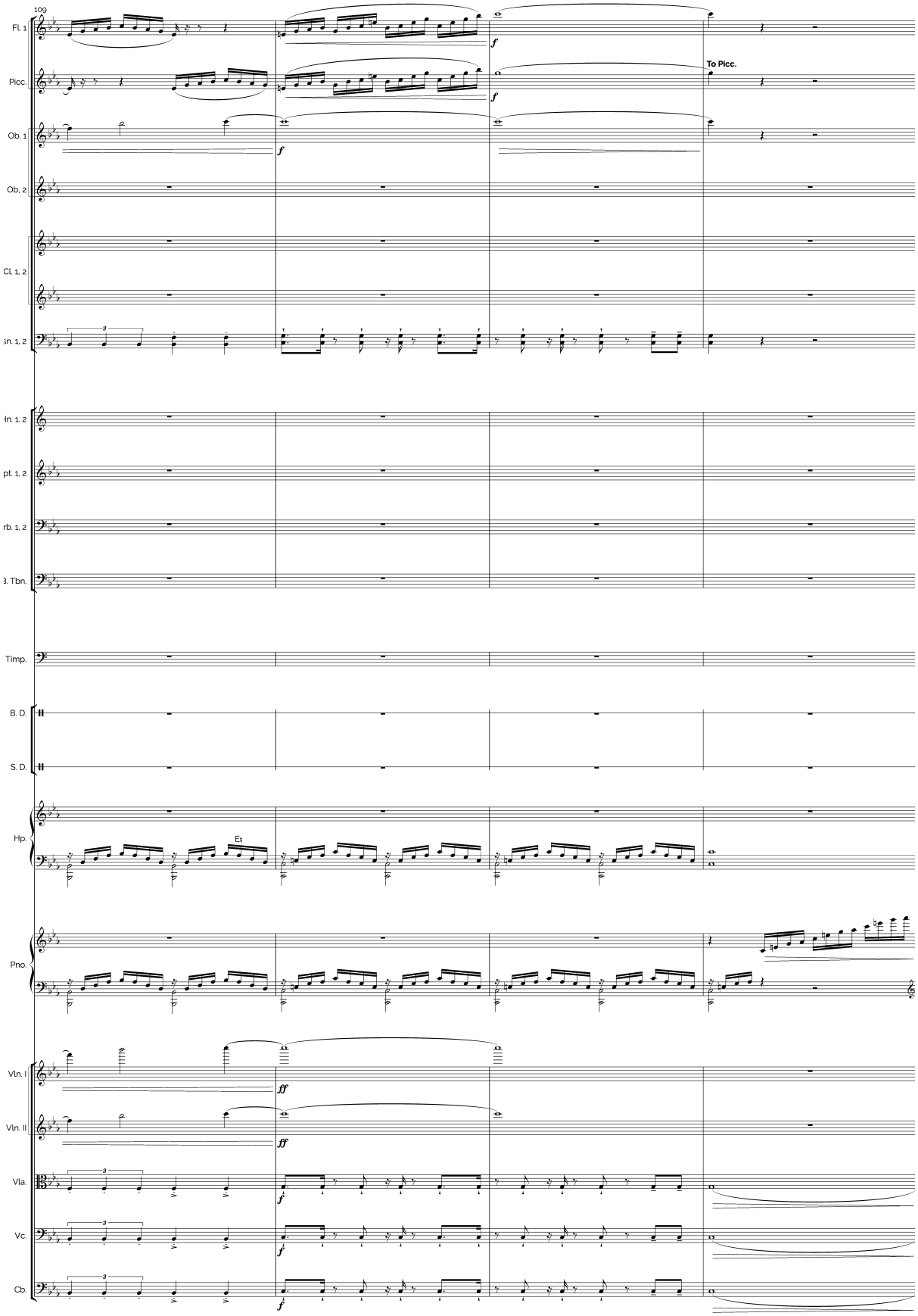
[9] Numbers that are in bold indicate the main crotchet pulse layer (see Gotham's row). For numbers underlined, these are *Odyssey's* attack points and those in bold font emphasise how displaced the rhythm is compared to the traditional metric accentuation.

Using an interpretation of Gotham's table highlights interesting discoveries. Firstly, the irregularity of the triplet groupings creates greater misalignment as each beat diverges further from the 'grid' and becomes more syncopated. Notably, beat 104^4 features a greater syncopation as the main downbeat (that should occur in 105) shifts to the final semiquaver of 104^4.



Ex. 4.4 Development of 3+3+2 motif into a two-bar phrase (see b. 102 onwards).

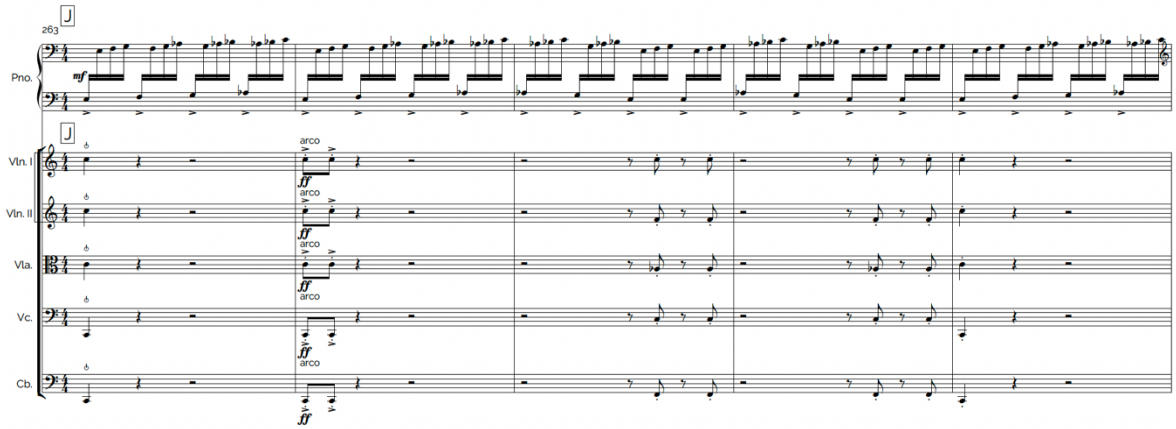
Towards the end of the section, I noticed an idiosyncratic tendency to resolve metric dissonances by introducing allusions of rhythmic consonance through vertically aligning punctuating rhythmic ideas. In Ex. 4.4, the material resolves every two bars, with the 4th beat arriving on-beat.



Ex. 4.5 Metric consonance appearing at the end of bars b. 109 and b. 111, alluding to the end of a phrase.

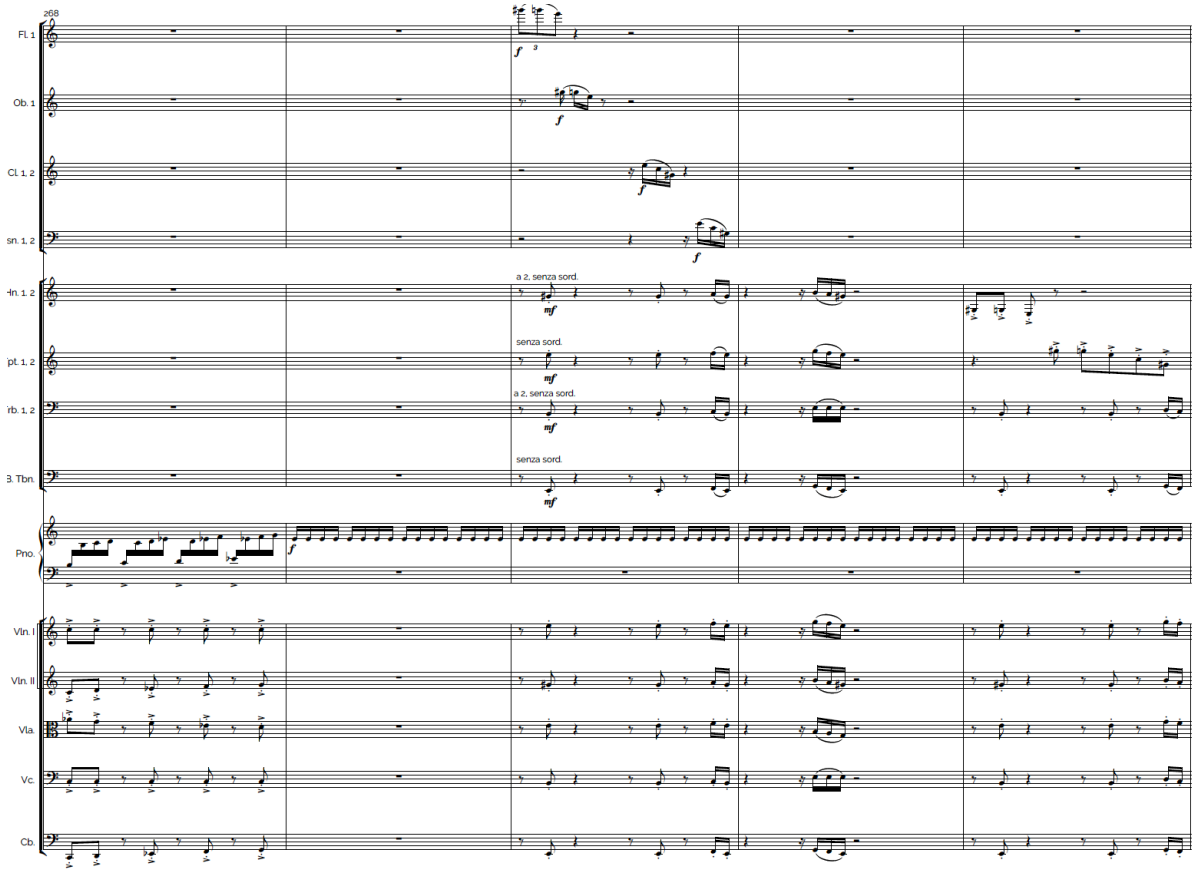
Development: Interjecting Syncopations

Throughout the development section, the A material appears in various guises: interjecting over new textures, hinting at past metric concepts and augmenting them, and being used as material for transitioning.



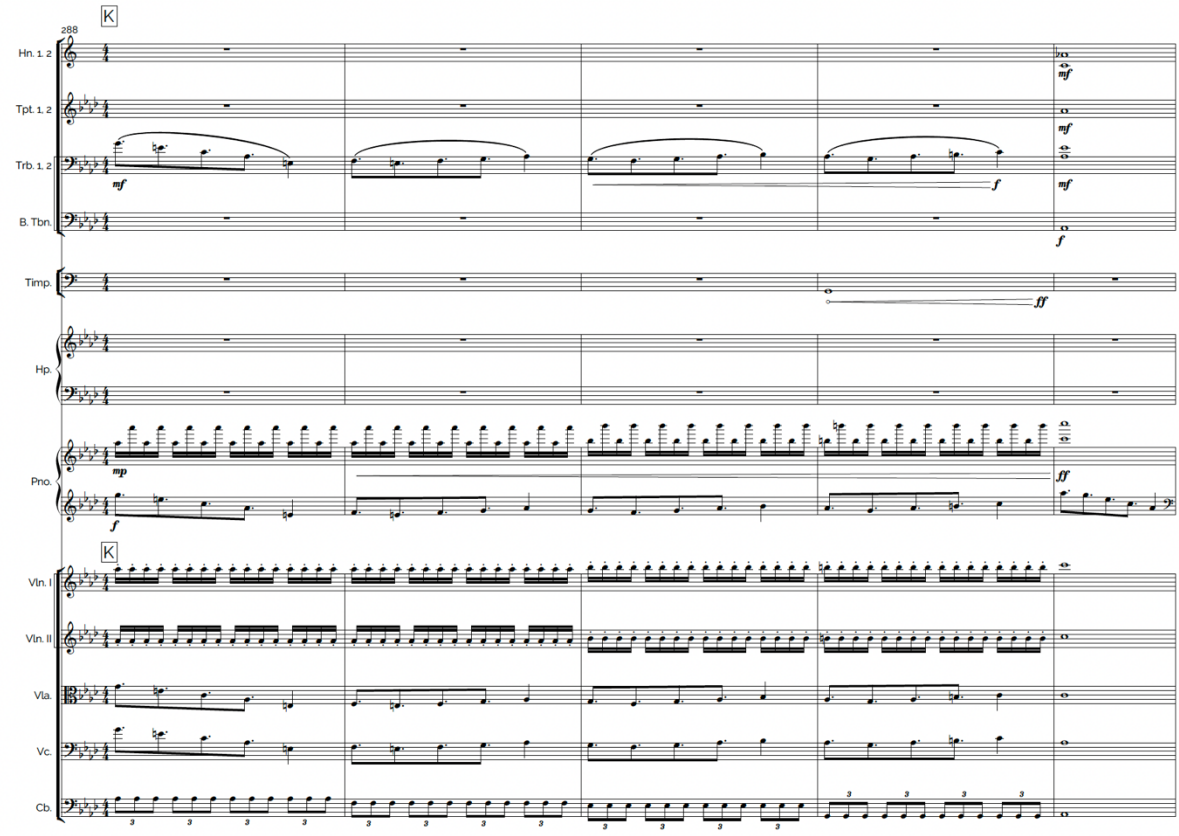
Ex. 4.6 bb. 263–267 from *Odyssey*.

The section starting from b. 263 (Ex. 4.6) introduces drastic developments for the A theme in a *quasi*-toccata style with rapid semi-quaver movement. Cascading interjections of the theme appear at b. 270 (Ex. 4.7) in the orchestra as the piano performs a rhythmic pedal. Syncopated chordal stabs appear in the strings and cascading syncopated woodwind entries, weakening the overall metric strength of the 4/4 bar.



Ex. 4.7 bb. 268–272 from *Odyssey's* development section.

By b. 288 (Ex. 4.8), both compound and simple metre become superimposed, incorporating a triplet quaver pattern in the melody against the violin's repeated semiquaver textures. Similarly to the first version of the A theme, where 12/16 appears as an augmented version of the 9/16 bar from bb. 299–304, the 12/16 returns for the closing material of this section.



Ex. 4.8 bb. 288–292 of *Odyssey.*

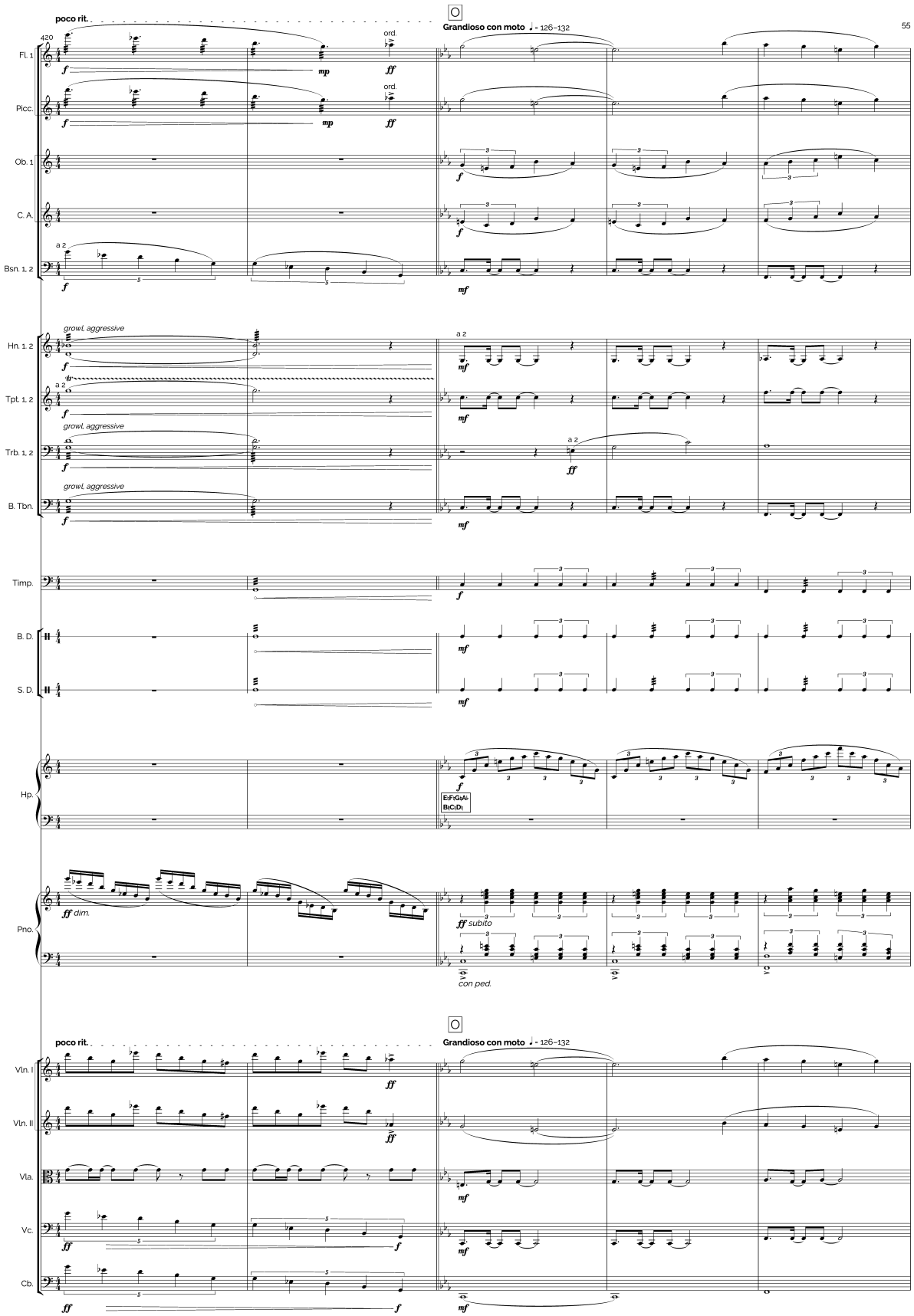
Closing the Development: Dense Orchestral Textures

Bars 420–421 repeat the transitional material inspired by bb. 91–92 using grouping dissonances. The melody, in the flutes, is placed in the 3+3+2 sub-metric grouping. Superimposed on this is a quintuplet grouping dissonance performed in the lower voices.[10] The viola plays a rhythmically diminished version, highlighting a sub-metric group on the semi-quaver rhythmic layer. Furthermore, whilst the violins remain rhythmically consonant, they use an irregular melodic grouping of 3+5 to emphasise the triplet grouping at the quaver-pulse level. As a result, this short section features at least three attempts at manipulating both the rhythm and melody to produce rhythmic dissonance (see Ex. 4.9).

[10] Bassoons, cellos and double basses.

A connection can be made regarding the semantics of a rhythmically dissonant passage. Krebs believed that Schumann used metric dissonance as a form of reflecting his own personal conflicts occurring in his life.[11] In my approach, initial compositional ideas are primarily intuitive, but there is no conscious attempt to produce a cathartic outcome. Instead, I am attempting to use rhythmic and harmonic dissonance as a structural signifier, where a feeling of cadence is not just felt by the harmony and its harmonic rhythm. In addition to those tools, moments of rhythmic consonance can align and signal the end, or beginning, of a texture/section of music. Conversely, one can also use greater moments of dissonance to create tense transitions, such as seen in b.420–421.

[11] Harald Krebs, Fantasy Pieces: Metrical Dissonance in the Music of Robert Schumann (Oxford: Oxford University Press, 1999), p. 172.



Ex. 4.9 bb. 420–425 highlighting transitional material and dense orchestration of A theme.

Temporal Suspension: Piano *Cadenza*

The piano *cadenza* arrives at b. 446 in 'Free Time' (Ex. 4.10). This section allows the pianist and the audience to indulge in temporal suspension where the pulse is lost, and the past metric information is abandoned. This moment acts not only as a time for reflection on the music experienced so far but also as the halfway point in the score. The pianist performs alternating passages: first, the descending A theme, followed by an arpeggio. Similar to *Refractions*,[12] discussed in Chapter Two, the material is intentionally notated with a metric inconsistency,[13] emphasising that different pitches need greater time dedicated to them, but the lack of metric structure infers that this section should have greater temporal freedom. Gradually, the material returns to a pulse and enters the second phase of the *cadenza* at b. 461.

Recapitulation: Developed Journey Theme

The following section (bb.447–468), from my perspective, alludes to the opening of the second movement of Ravel's Piano Concerto in G major, where Ravel opens with solo piano in a waltz style.[14] Inspired by this, the theme begins temporally loose and syncopated, as if trying to find its bearings again, before a strong metric structure gradually returns. A transformed version of Theme A emerges at b. 460, now presented in triplet form. The

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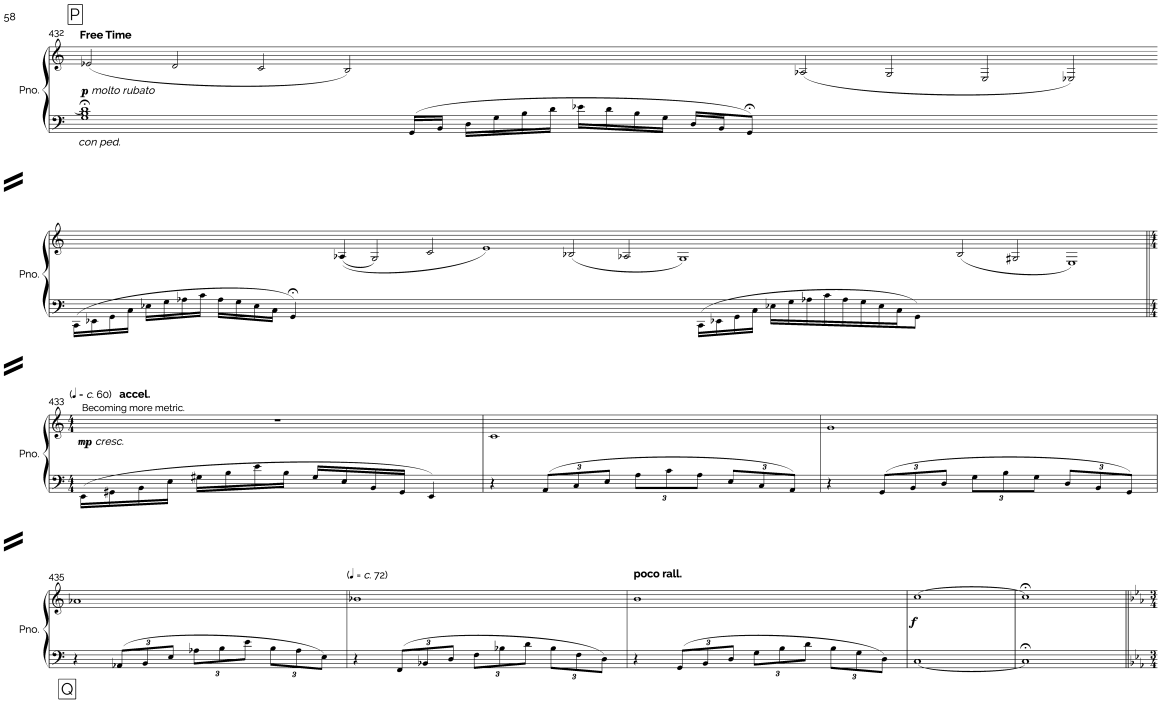
[12] The final variation of *Dechrau* also has a section of temporal suspension.

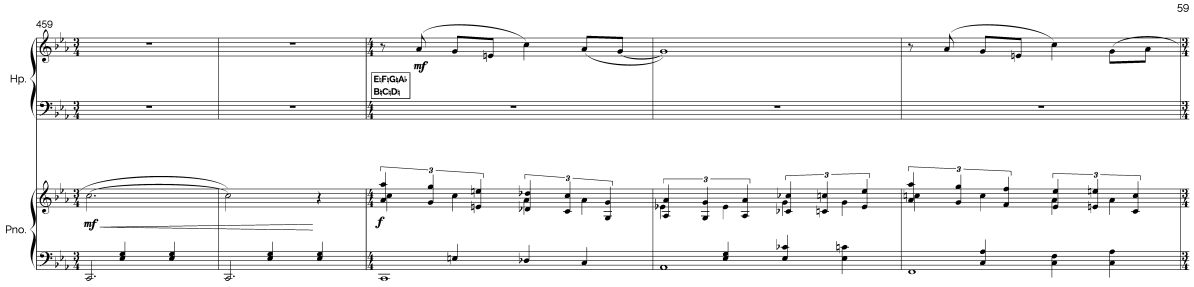
[13] Rhythms are phrased irregularly and use a range rhythmic durations to produce inconsistent lengths.

[14] Ravel's Piano Concerto in G major was a fundamental work in my early education. I studied the piece during my A-level music course and adored the style, orchestration and techniques Ravel employs. For me, the concerto uses an incredible soundworld of harmonic and rhythmic concepts that draws from a range of idioms (Classical, Romanticism, Impressionist, Neoclassical and Twentieth Century) in a way that I find aesthetically pleasing.

melodic contour has been modified to ascend and extend, maintaining an emphasis on the flattened 6th within the melody. This rhythmic conflict intensifies at b. 469 (Ex. 4.11) as the right-hand texture adopts cross-rhythmic patterns. In addition, the harp enters with displaced/syncopated entries. In b. 474, the harp uses a displaced D2+1 quaver pattern and aligns neatly at b. 476 with the piano. The harp's entrance at b. 483 mirrors the piano's earlier entry at b. 463, though it employs regular quavers rather than triplet quavers.



Ex. 4.10 cadenza section bb. 432–437 from *Odyssey*.



Ex. 4.11 Addition of harp in bb. 460 of *Odyssey*.

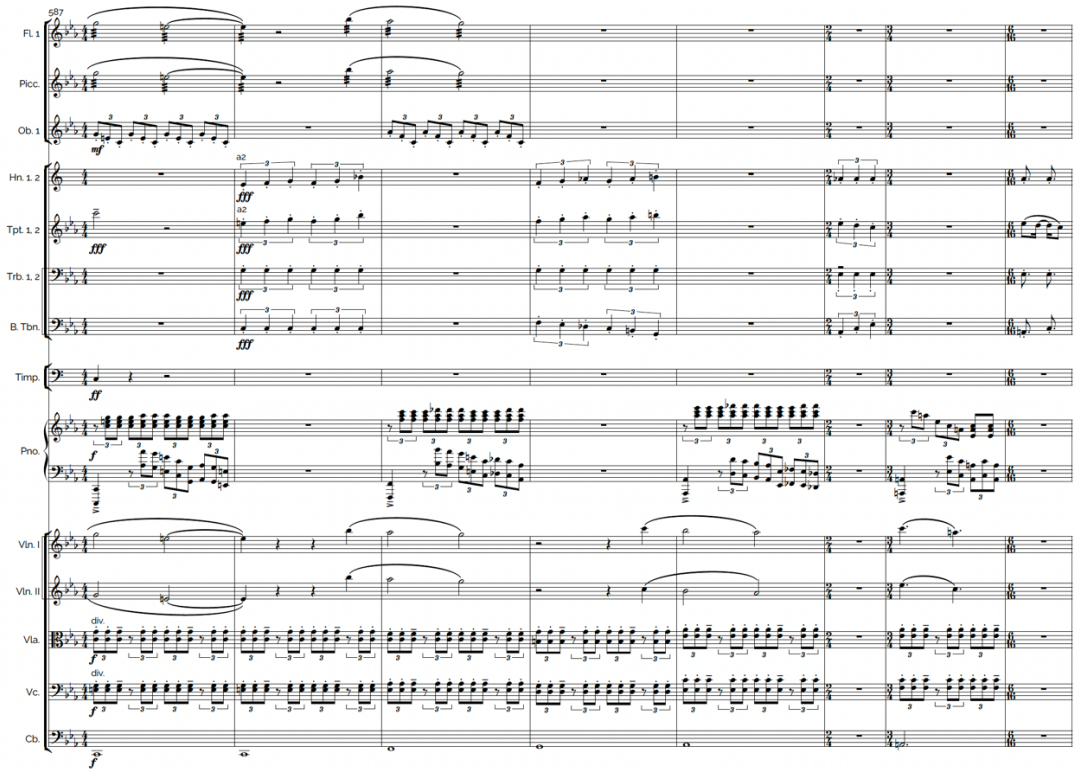
The *Grandioso* version of the theme returns at b. 558 now ascending in pitch. In the piano part, septuplet arpeggios conflict with the harp sextuplets creating a 7/6 grouping

dissonance, a more dissonant development from the previous versions. The conflict resolves at b. 562 as the piano moves into sextuplets, aligning with the harp tuplets. A condensed version of the tranquil theme interjects at b. 569 followed by the return of the cadenza A theme. This time, however, the theme is orchestrated further with syncopated and overlapping woodwind, duplet and tuplet string patterns and a waltz-like accompaniment.

Metrically Alternating Fragments of A: Triplet *vs.* Duplet dissonance

From bb. 587–594, the piece's characteristic triplet *vs.* duplet tension continues as brass triplets interject the A theme's minims antiphonally (Ex. 4.12). The brass triplets also act as an augmentation, aiming to create the perception that the crochet beat pulse is slowing down before being dragged back to the original speed by the melody and surrounding instruments. Melodically, the upper woodwinds and strings are rhythmically static, heavily emphasising the 4/4 metre through mostly minim movement. Against this, the triplet textures of the piano, brass and lower woodwind and strings conflict with the melodic simple metre, creating a dissonant middleground texture that juxtaposes the melodic movement.

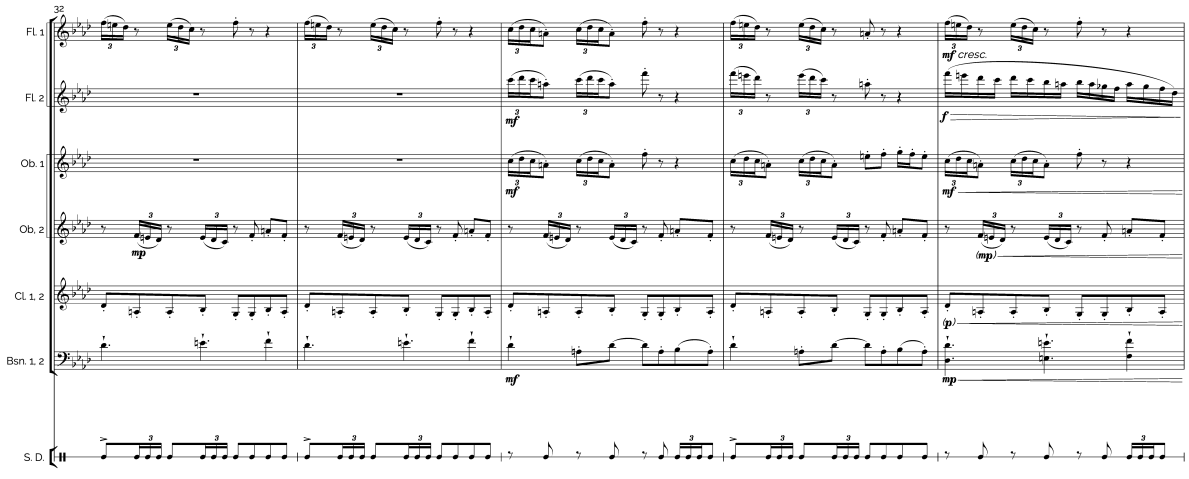
These antiphonal sections gradually compress, shortening the metre and increasing the frequency of the interjections. The metric diminutions also give the impression that the texture is accelerating due to the harmonic rhythm perceptually speeding up. The climactic finale of the concerto (bb. 603-611) is characterised by the return of the piano's semiquaver septuplets and marked 'without rhythmic precision', focusing more on the sweeping gesture. The middleground texture also features the syncopated triplet pattern grouped against the straight minim melody.



Ex. 4.12 bb. 587–594 of *Odyssey*

B Theme: Metric Sub-Division and Metric Shifts

The B theme greatly contrasts the A theme in its overall character but inherits some rhythmic behaviours to create a sense of continuity. The 3+3+2 sub-metric rhythm reappears in the bassoon part. The opening of this theme excludes the piano for the first section. Primarily, the theme is playful and features a semi-quaver triplet figuration as its rhythmic identity.

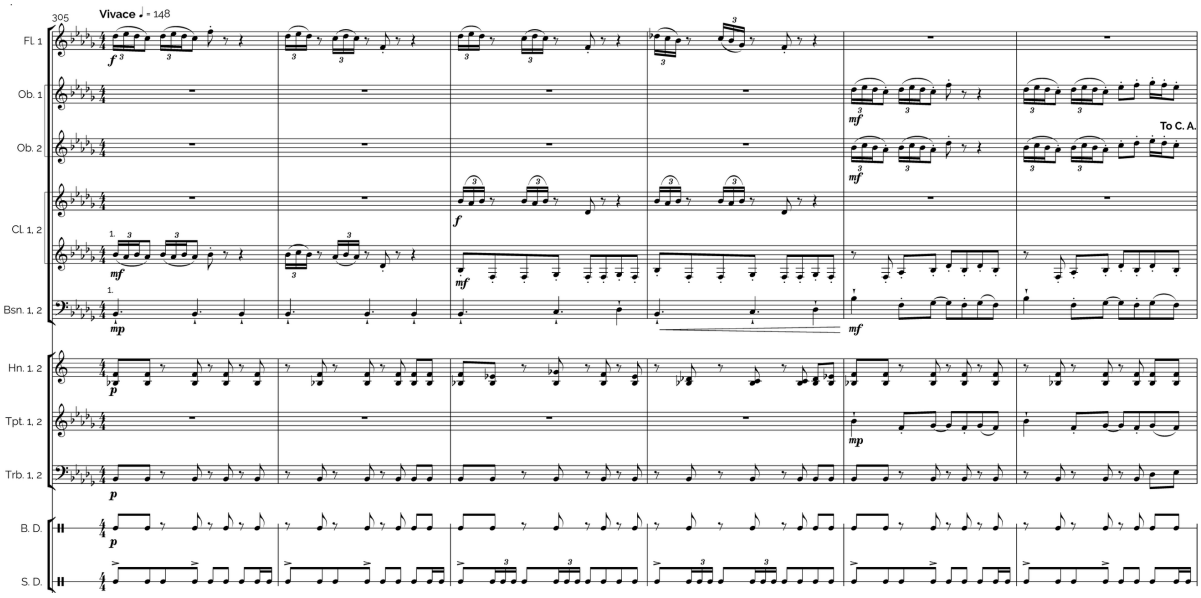


Ex. 4.13 bb. 32–36 rhythmic texture from *Odyssey*.

Ex. 4.13 highlights the different rhythmic layers. In the piccolo, flute and oboes, the melodic material can be heard with independent variations. Simultaneously, the clarinets and bassoons are the 3+3+2 sub-metre through their articulation and melodic contours. In the clarinet quaver movement, using the alternation between different pitches infers the sub-metric shift.

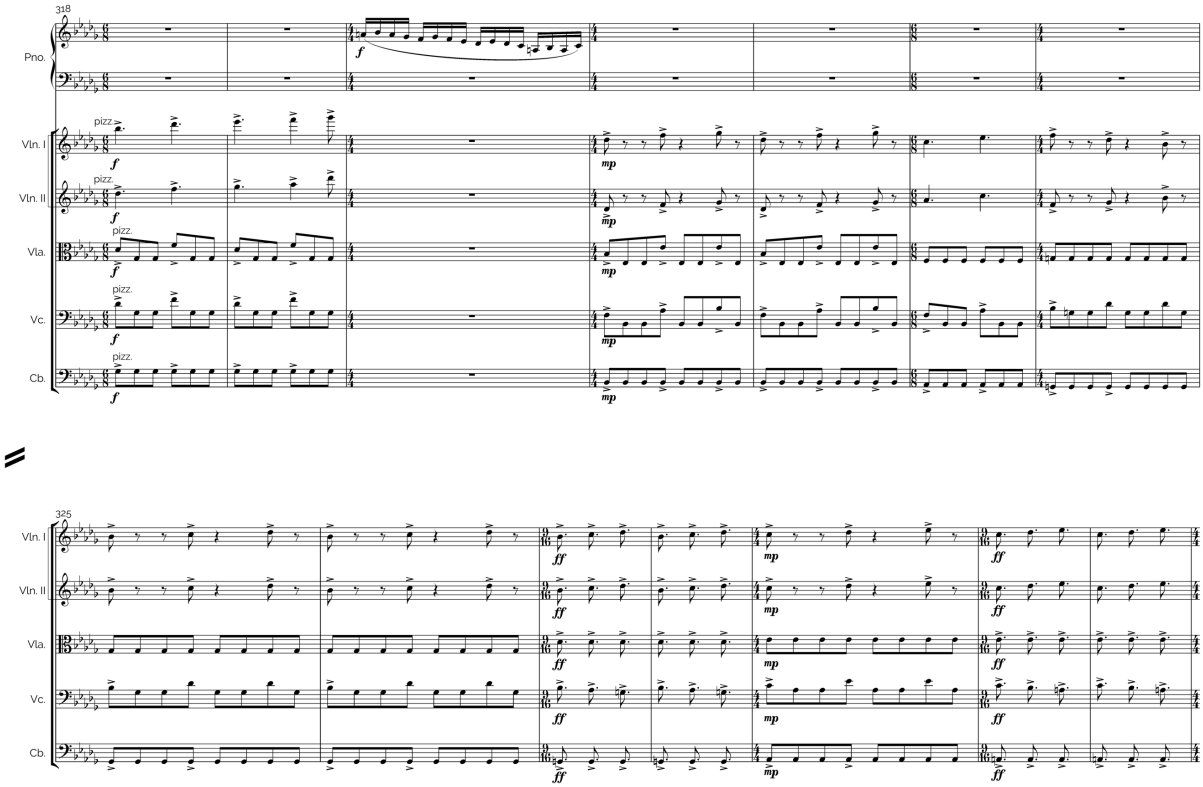
Development section: Theme B

B appears at b. 305 in the development section with new rhythmic layers (Ex. 4.14). Now, in B♭ minor, the material is voiced primarily in the woodwind and brass. Syncopated horn and trombone lines punctuate the texture with a two-bar phrase. Similar textures reappear but with subtle variations, such as the missed quavers in the clarinets at b. 323. Figurations are also morphed, and there is less clarity of the 3+3+2 rhythm.

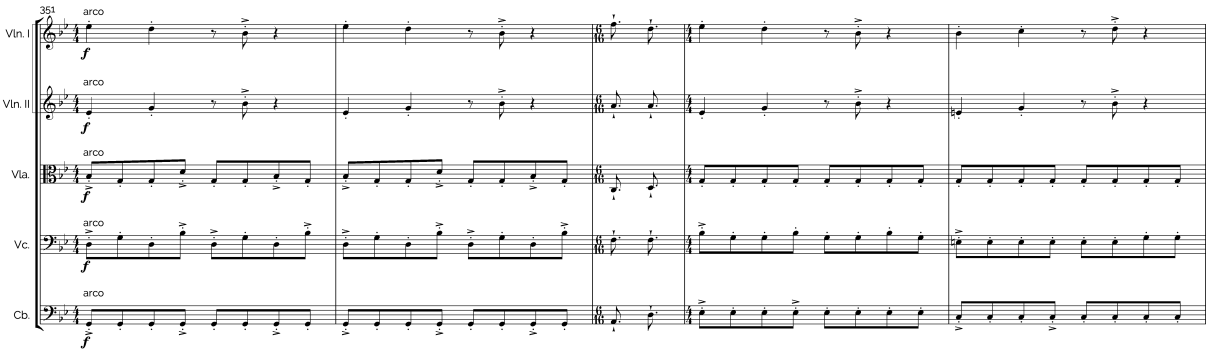


Ex. 4.14 B section appearing in the development bb. 305–310.

As the passage develops, the antiphonal writing reappears but becomes durationally augmented (Ex. 4.16). The passage for strings introduces the 9/16 duplet-triplet conflict again and repeats it. As the material progresses, it becomes more rhythmically aggressive and unstable. By b. 349, The building of syncopated textures reaches a boiling point and breaks into the 9/16 stabs across all the forces playing at bb. 348–349. This is another moment of rhythmic dissonance collapsing into moments of consonance at the end of sections of tension. As Krebs discussed, the harmonic conventions of tension and release also apply to rhythmic material. Moments of tension (i.e. dissonance) need moments of homophony to create a resolution; otherwise, the passages can feel unresolved and perpetually tiring. In a rhythmic context, I often view rhythmic dissonance as an engaging, but potentially tiring aural experience, especially when actively listening to the music analytically. With this in mind, rhythmic consonance can offer listeners an opportunity to rest from the polyrhythmic passages and can help to recontextualise future and past material.



Ex. 4.15 metric alternation of simple and compound metre with augmentation and more frequent alternation.



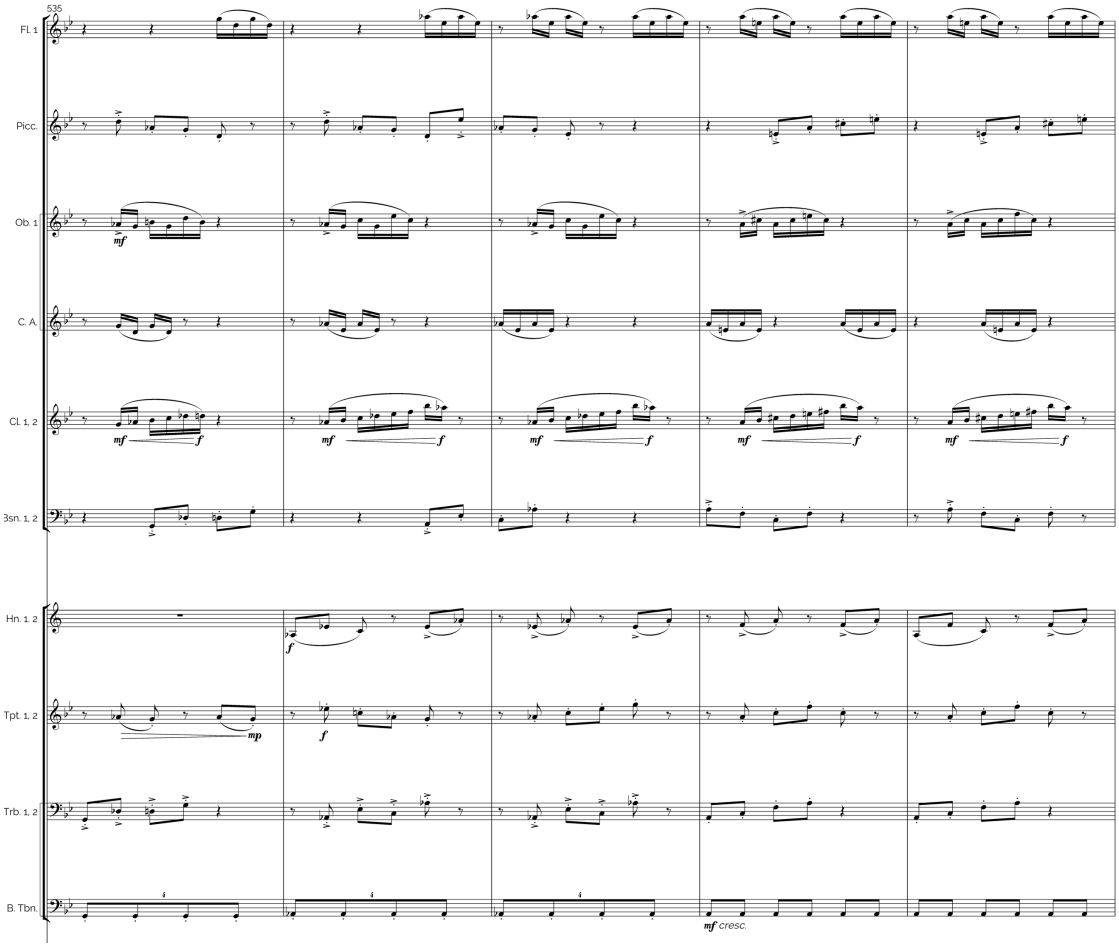
Ex. 4.16 Sub-metric manipulation within the string family.

The preceding string section (Ex. 4.17) at b. 351 manipulates the sub-metric grouping to 2+3+3 attacks against the 3+3+2 lower string material. Mid-texture 6/16 interrupts the passage, highlighting how the compound material has begun consuming the B theme material. In this moment, the rhythmic/metric dissonance throughout the development sections has increased substantially from a horizontal context as a result of greater shifts in simple → compound and compound → simple metres.

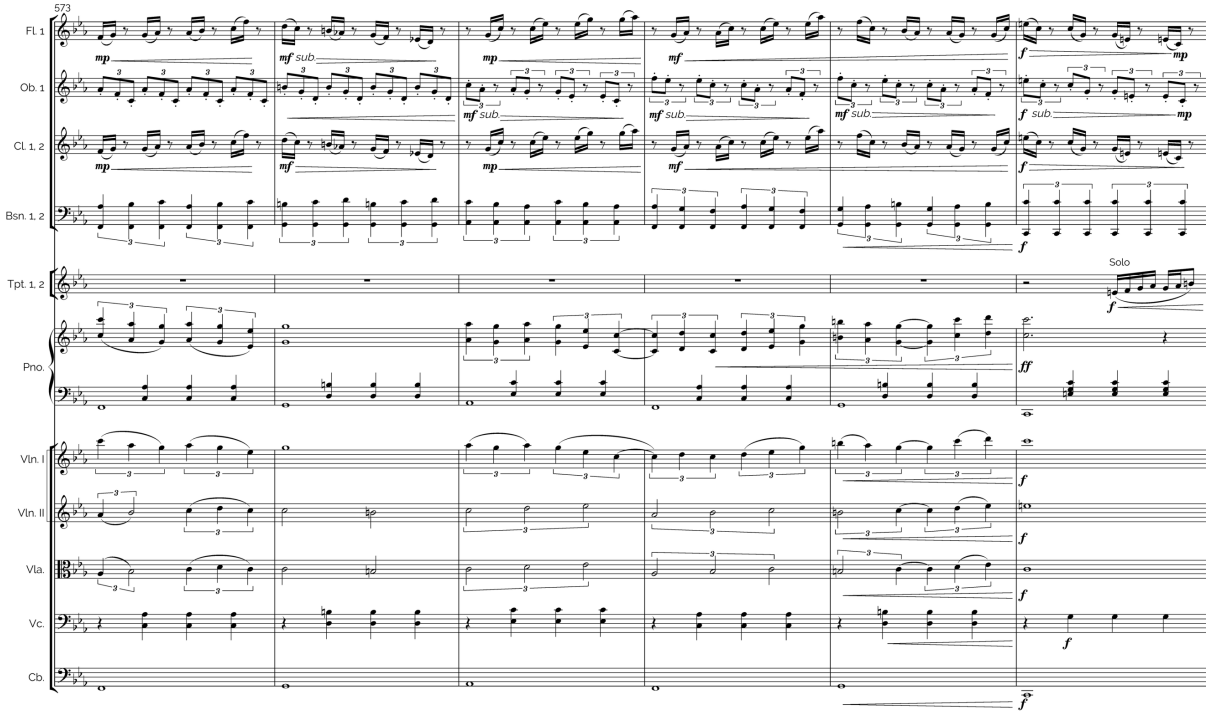
Recapitulation: Musical Concepts

The recapitulation does not bring back the B theme in its entirety; instead, concepts such as the alternating metre explored using the B theme begin to bleed into other thematic material. Antiphonal textures that appear throughout the B sections become common in the recapitulation, such as bb. 587–596. In this section, the A theme becomes fragmented and faces interjections from the brass that imply a triplet metre.

The woodwind textural writing also appears within the transitional period between bb. 535–543 (Ex. 4.17). In this texture, syncopated interjections drive the music and create dense layering. Similarly, the woodwind textures, derived from the B theme, also intensify in texture towards the buildup towards the final A section. Ex. 4.19 highlights the grouping dissonances within the woodwind voices and the switching of the flute and clarinet part from on-beat to off-beat.



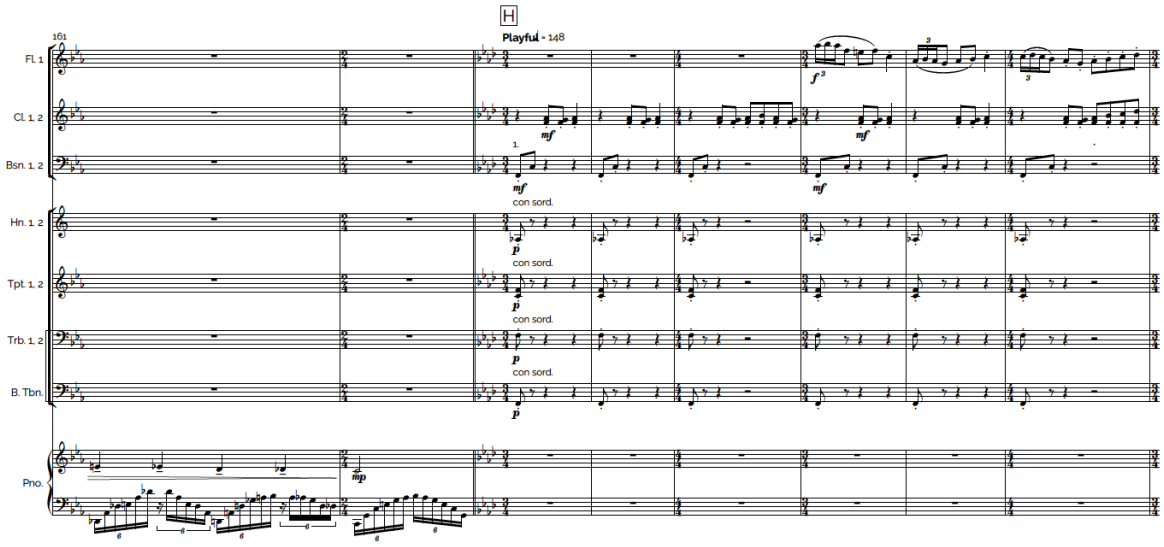
Ex. 4.17 B's woodwind textures influencing A and transitional material.



Ex. 4.18 Intensification of woodwind textures in the build-up to the brass fanfare.

C Theme: Waltz theme and Irregular Metric Patterns

The close melodic relationship between themes B and C broadens my contextualisation of themes/structure to incorporate metric and rhythmic identities. Two concepts underpin the C theme: first, that rhythms or metre can carry semantic weight even without explicit programmatic intent; second, that rhythmic techniques might be sufficient to distinguish between two similar themes.



Ex. 4.19 bb. 161–168 in *Odyssey.*

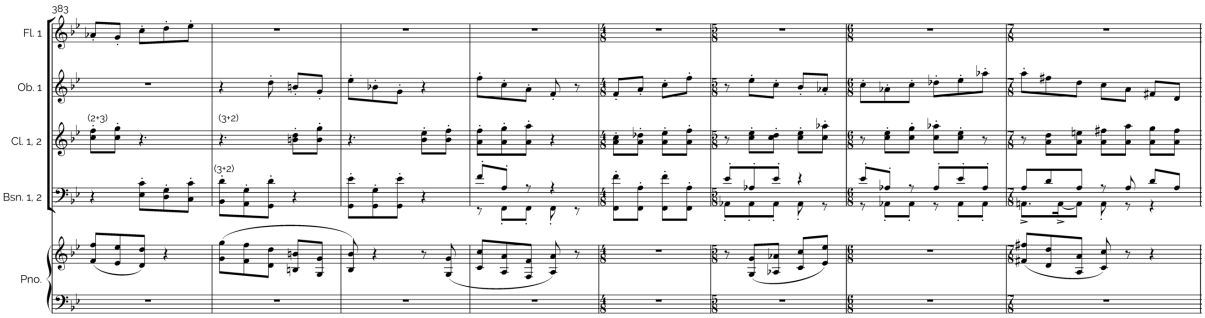
The C theme enters at b. 163 (Ex. 4.19). This irregular waltz-like theme explores metric alternation as the main rhythmic concept. The material starts in 3/4 + 3/4 + 4/4. The material is notated in 2 x 3/4 rather than 6/4 to emphasise the downbeat.[15] This pattern repeats three times, allowing listeners to establish a feeling of pattern regularity, but the pattern shifts to 5/8 in b. 173, creating a feeling of a stutter as the pattern is shortened by a quaver beat.

[15] Gotham, pp. 294 – 295.

The piano enters at bb. 175–177 immediately in an irregular metric pattern (5/8 + 5/8 + 7/8), establishing an analogous connection to the previous material. In this section, the piano primarily pushes for an irregular metric pattern, either using 5/8 or 7/8, until the orchestra concede at b. 195 onwards. Using this concept gives each section, or individual instrument, a rhythmic identity and subsequent meaning. With regards to the C theme, the piano is acting as the rhythmic antagonist, aiming to disrupt the use of simple metres with irregularly grouped metres. Whilst this piece has no definitive programmatic meaning, there is the opportunity to use rhythmic techniques to explore semantic concepts and provide enriching musical outcomes.

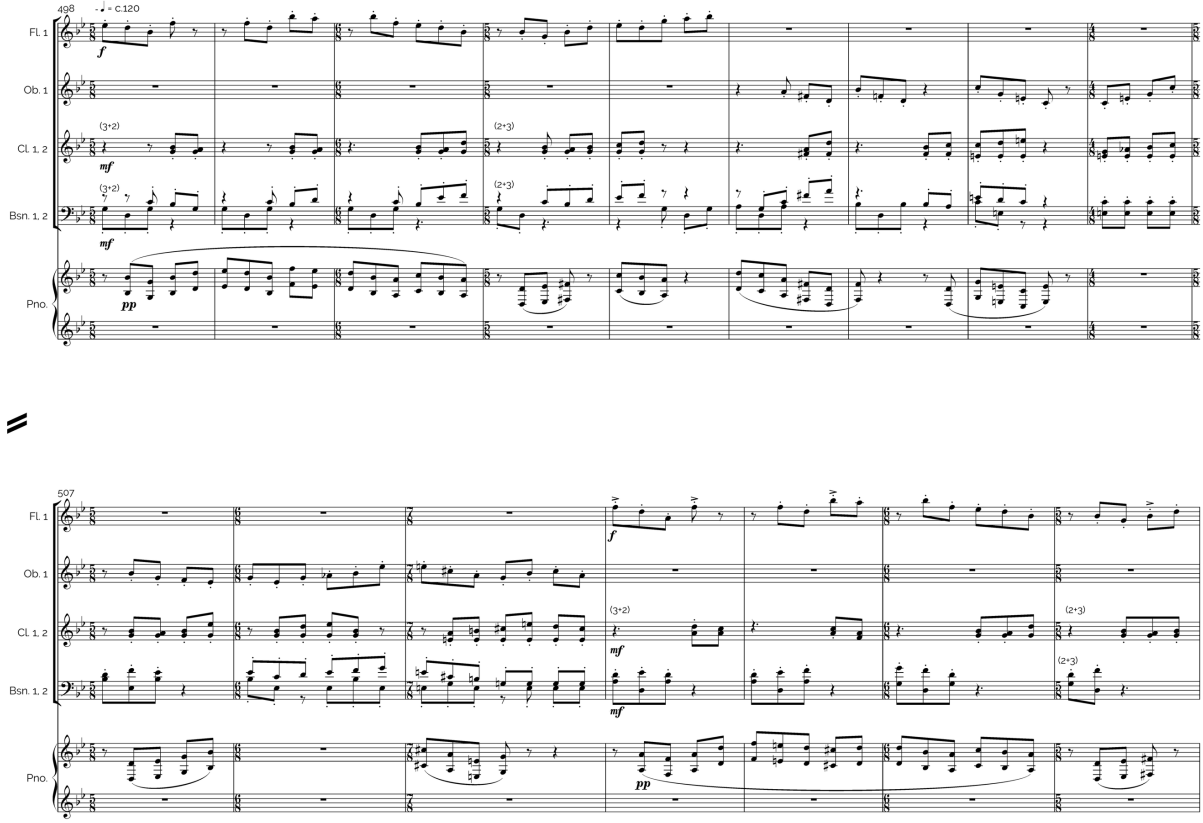
Regular *vs.* Irregular Metric Structures

C returns at b. 364 in a new metric guise of 5/8 + 5/8 + 6/8. The texture and harmonic style help to reinforce that this material is C. In this section, metres augment gradually, often in small increments. Bars 372–375 highlight this as the metre develops 4/8 → 5/8 → 6/8 → 7/8 before resetting to the original 3/4 + 3/4 + 4/4 metric pattern. This repeats at bb. 387–390 and can be seen in Ex. 4.20. These constant metric shifts create a degree of instability that connotes a traditional development section. Bar 397 ushers in the 5/8 building material from b. 238. This time, the material is harmonically developed and helps transition harmonically back to C major/minor.



Ex. 4.20 Example of metric expansion 4/8 → 5/8 → 6/8 → 7/8.

Recapitulation

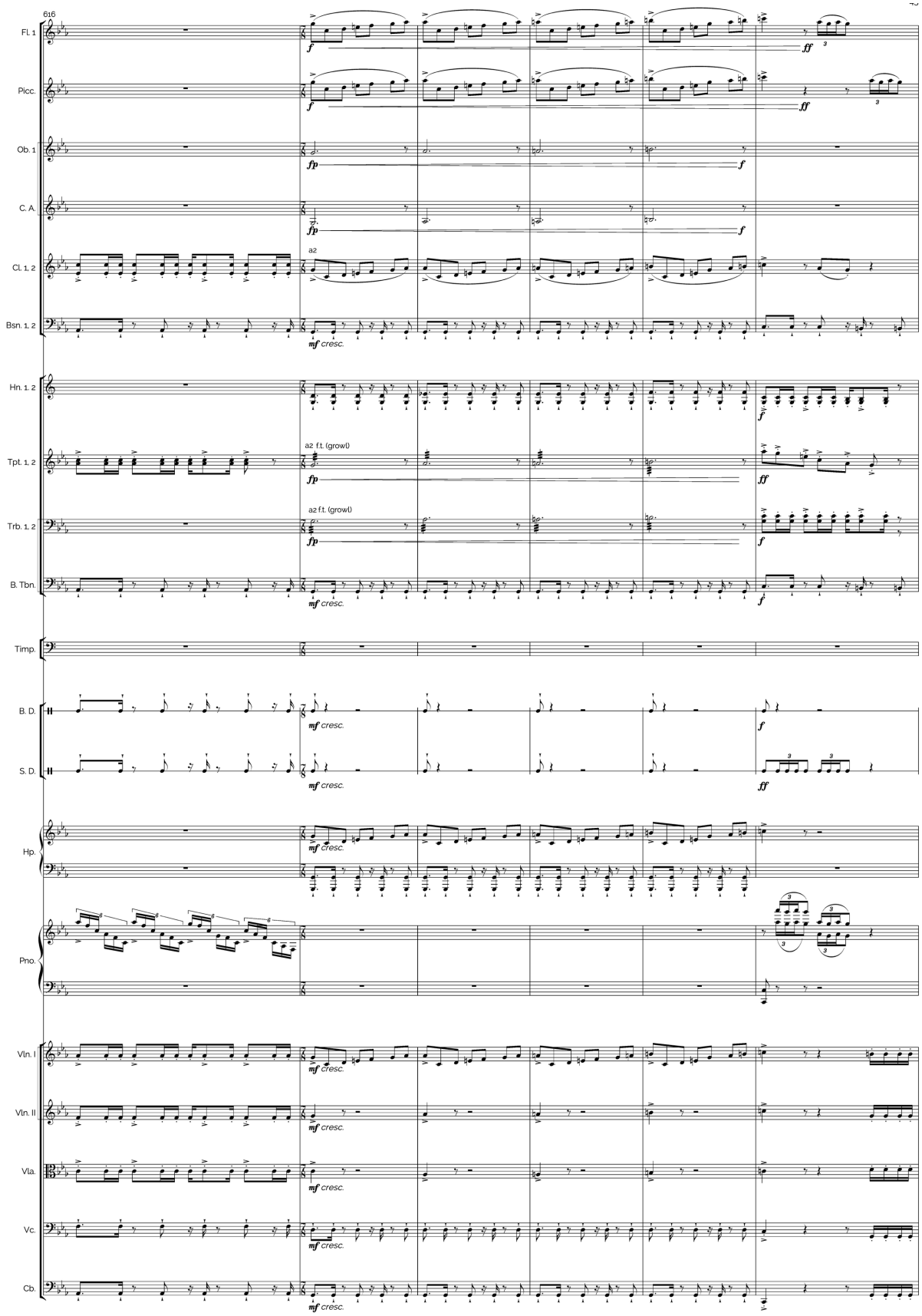


Ex. 4.21 bb. 498–513 sub-metric woodwind textures developed in C.

After the cadenza, C returns temporally transformed and enters at b. 482. This time, the material arrives slower and an *accelerando* brings the material to quaver = *c.*100. This time, only the piano and harp interact due to their relationship previously playing the cadenza material together. Metric alternation appears throughout this section, from simple to asymmetrical (3/4 → 5/8 primarily).

The texture thickens at b. 498 with interplay between the woodwinds with more complex sub-metric clashes (2+3 *vs.* 3+2) between voices (Ex. 4.21). Bar 522 enters with woodwind textures more closely linked to the original C and denser orchestration. The piano now has a flowing melodic passage that commences on the second beat of each metre, diluting the metric emphasis of the own beat within the material. This also occurs subtly in the woodwind parts, where syncopations help to weaken the main downbeat. Towards the

end, the irregular metre returns at b. 616, overtaking the entire orchestra in the build-up (Ex. 4.22). The irregular grouping (3+4), compounded by the lower-voice triplet driving rhythm, helps to propel the music towards the finale.



Ex. 4.22 C theme irregularity impacting the orchestra towards the finale

To summarise, it is evident that rhythmic techniques, particularly those that produce rhythmic dissonance, are effective at developing melodic and textural ideas in both short- and long-form works. Moreover, employing contrasting rhythmic/metric concepts between different sections of music can produce a fruitful result that can create distinction between structural elements of the music. Within short-form works, this is notably effective for conveying two different metric soundworlds. There is also a greater opportunity to explore in multi-movement works, such as *Enchantment,* where rhythm is developed across a multi-movement work, or to condense this into a standalone work's structure, such as *Dechrau* and *Refractions.* For large-scale works, such as *Odyssey,* it is clear that rhythmic techniques, especially those that aim to produce rhythmic dissonance, have enough integrity to withstand scrutiny and use over the course of a long-term work and can be used to effectively develop material. It is, however, important to note that any musical techniques can become monotonous if used repeatedly without variation; it is therefore useful to give each theme a distinct rhythmic identity that uses a different set of compositional tools for development.

In *Odyssey*'s trajectory, each theme had its own rhythmic identity. For theme A, cross-rhythmic/grouping dissonances, temporal suspension and sub-metric layers superimposed by a relatively simple legato melody transform through a number of guises into a theme reminiscent of Romanticism in triplets. In B, the playful theme becomes densely populated with polyrhythmic interjections by the woodwind and strings and is interrupted by metric ideas that expand and begin to appear in the late A theme. C is plagued by irregular metric patterns advocated by the piano, helping to drive the material forward and produce an alternating metric texture that morphs between regular and irregular patterns through augmentation and diminution.

Conclusion

At the start of this research project, three main research questions were posed:

1. What techniques and devices are there that produce rhythmic dissonance? Do these exist within my compositional style?
2. What practices are challenged by the use of rhythmic dissonance (notational/performance practice)? How does a composer negate these problems?
3. To what extent are rhythmic techniques an effective method of compositional development over short- and long-form works?

After exploring the scholarly literature on the topic of rhythmic dissonance, as well as works from past and contemporary composers, it is evident that there is a plethora of rhythmic techniques that create some degree of rhythmic/metric dissonance, ranging from noticeably disruptive devices, such as metric alternation, to more subtle methods, like agogic accents (and other such techniques as presented at the end of Chapter Two). Interestingly, there are greater factors than just using the techniques: dynamics, articulation, timbre, pitch, and register all play a factor in how we experience rhythmic/metric dissonance.[1]

Table 2.1 (recreated as Table 5.1 below) highlighted a range of rhythmic techniques that could be used and offered three main categories: contextual, accentual and temporal. Importantly, I pushed the concept that contextual rhythmic dissonances can occur, allowing monophonic texture to be rhythmically dissonant. In accentual techniques, the pulse is constant, and the accentuation, commonly through metric effects, changes the perception of a musical passage. For temporal techniques, these manipulate the passage on a much larger

[1] Maury Yeston, *The Stratification of Musical Rhythm* (London: Yale University Press, 1976), pp. 39 – 54.

scale, often affecting the entire ensemble simultaneously for a sustained period of time (see Table 5.1).

Contextual	**Accentual**	**Temporal**
Pattern deviation	Agogic accents	Polytempo
Metric deviation	Alternating metre	Pulse labyrinth (Birtwistle)
Temporal Suspension/Hiatus	Cross accent	Tempi as structural signifiers
	Hypermetre	Tempo changes/shifts
	Polymetre	Metric modulation
	Manipulation of metric subdivisions	Opposite Metre (4/4 *vs.* 12/8)
	Syncopation	
	Irregular phrasing	
	Nested rhythms	
	Cross-rhythms	

Table 5.1 highlighting rhythmic techniques from Chapter Two.

Chapter Three primarily explored my notational practice and the guidelines that I have established to maintain consistency. In researching the semantics of metres, barlines and tempo, an interesting, yet paradoxical, concept also arose as a result of my research. In using a Western Classical notational system that relied upon temporal/metric structures, it becomes conflicting to superimpose a degree of rhythmic disorder onto that system. As a result, the practice had to be robust yet fluid and able to accept a degree of tolerance. This was not a challenge I had faced in isolation; scholars such as Cooper and Meyer also highlighted that when rhythmic dissonance occurred, it could often create a level of ambiguity where a range

of metres could be used within a musical passage.[2] I also encountered challenges when presenting polyrhythmic material to performers who predominantly performed monophonic parts. To adapt, this often meant adjusting polyrhythmic material to appear within an 'assimilated' monophonic notational style, which could still be interpreted as having a polyrhythmic intention. When metric concepts became visually simplified, it was paramount to include articulation details, such as accents and tenuto markings, to highlight important metric and sub-metric structure to the performer.

One could argue that these changes imply that the composer is subservient to the performers of their music: I would strongly argue that this is not the case. Instead, it should be seen as a working and malleable relationship that supports the compositional intentions and allows performers to interpret these complex rhythmic textures as quickly as possible. There is no possibility that complex rhythmic ideas can be simplified to the nth degree; otherwise, rhythmic ideas become simplistic. The approach this research has employed aims not to compromise to the extent that the compositional outcome is undermined. This will always be a fluid and ever-developing practice as new compositions require different notational approaches.

Chapters Two and Four address the final question regarding the effectiveness of using rhythmic techniques to develop music. Chapter Two mainly focuses on rhythmic techniques appearing in my chamber works, whilst Chapter Four focuses on the largest work in the portfolio, *Odyssey*. Chapter Two highlights that not only are rhythmic techniques pervasive in my music, but multiple rhythmic techniques are superimposed within the texture to create

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[2] Cooper and Meyer, *The Rhythmic Structure of Music* (Chicago: The University of Chicago Press, 1960), p. 108.

developments, such as multiple cross-rhythms, displaced rhythmic passages alongside timbral and accentual effects.[3]

Chapter Four's exploration of rhythmic techniques within the context of structure illustrated how rhythmic techniques can be used on a large-scale work to sustain interest and development. In *Odyssey*, rhythmic techniques play a crucial role in the structural organisation and distinction between the different themes within the work. It also reflects greater aesthetic concepts, such as using rhythmic cells or techniques to imply extramusical concepts. Furthermore, the concerto's dense instrumentation shows that multiple rhythmic layers can be engaged in separate metric layers simultaneously, offering opportunities for dense polyrhythmic textures. It is clear that rhythmic techniques can be used as a highly valuable and effective toolkit for producing and developing interesting musical textures.

This research has been both a journey of self-discovery and one that has sought to illuminate the importance and effectiveness of rhythmic techniques through a unique compositional approach that consciously engages with them. The result of this has been the emergence of an idiosyncratic style that is fascinated by rhythmic irregularity and the possibilities that lie in polyrhythmic textures.

[3] Crossing The Lines, Ex. 2.4.

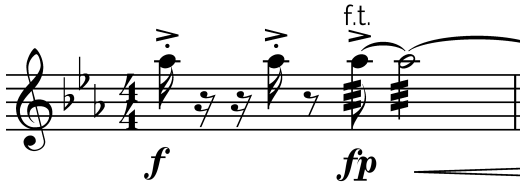
Appendix: *Odyssey*

A Theme: Additional Discussion

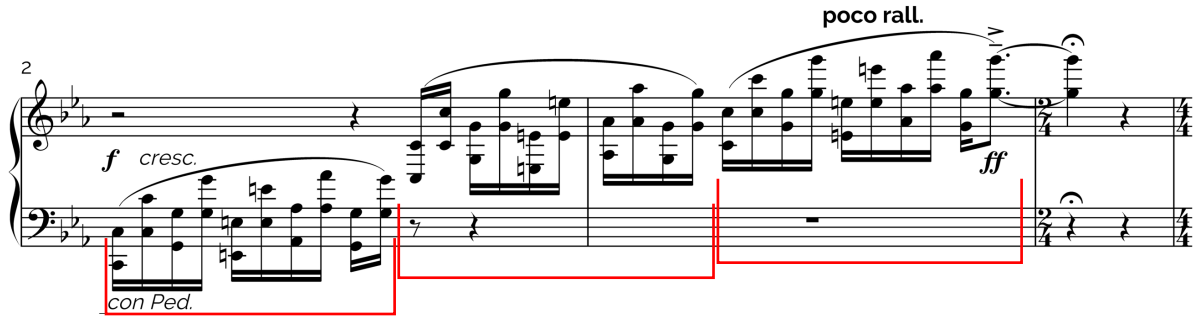
Introduction: Establishing Dissonances

The piece opens with an immediate rhythmic and harmonic dissonance (bb. 1–3), setting the precedent for the composition. The opening rhythm (Ex. 5.1) is an irregularly grouped 3+3+2 (x), a key rhythmic motif that appears throughout A. The irregular grouping has two intentions. Firstly, the rhythm immediately implies that the piece is rhythmically unstable from the outset, establishing expectations of the soundworld for the audience. Secondly, the rhythm becomes a key component explored in the middleground texture throughout the piece.

The ascending piano octaves (Ex. 5.2), whilst rhythmically consonant, are irregularly phrased in a grouping of five pitches (C,G,E,A♭,G). This irregular grouping of pitches emphasises that there is also irregularity in the melodic grouping and exacerbates the concept of instability within the melodic and rhythmic elements of the piece. Moreover, the A theme is almost always in C, maintaining a stable pitch centre that keeps recurring; however, the tonality borrows from both major and minor through the use of E♮ and A♭. These borrowed inflexions imply that the piece's harmonic language will be somewhat unstable.



Ex. 5.1 Example of 3+3+2 rhythm from bb. 1–3.



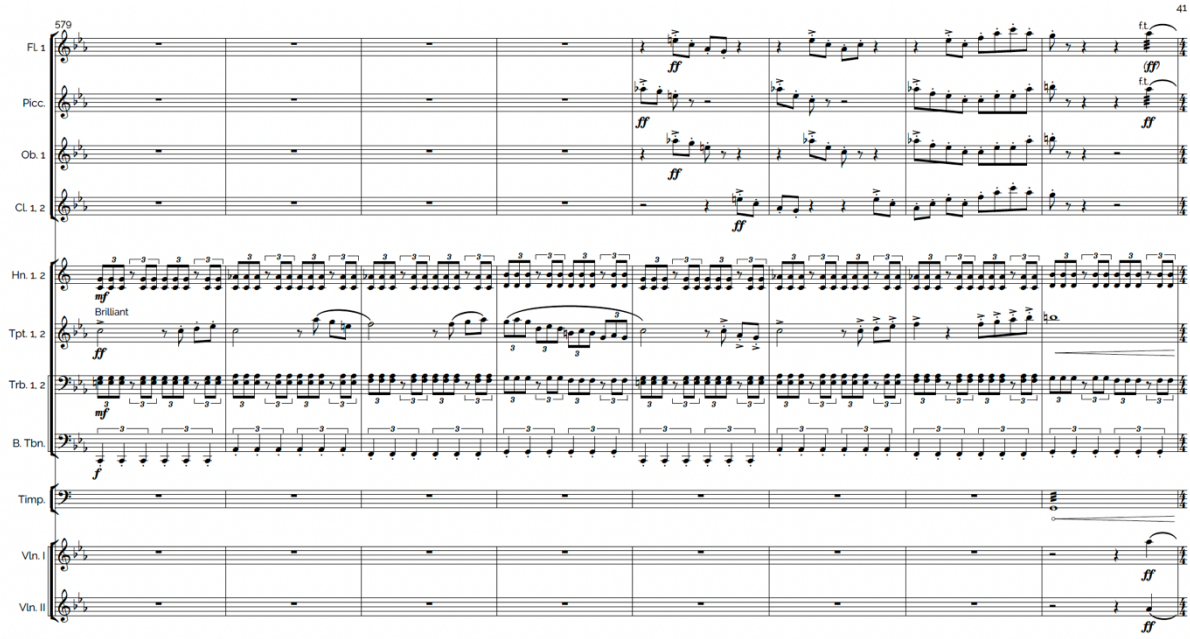
Ex. 5.2 bb. 1–3 piano opening piano octaves.

Bar 113 introduces a metrically augmented, more tranquil version of the theme in compound time. Bar 119 develops this further by repeating the displaced theme in the harp and augments the rhythm again. The temporal effect of the *ritardando* at b. 113 creates a gradual transition to more static material that contrasts the lively rhythmic material of the B and C sections. Bar 145 places a developed A theme back into the piano (reminiscent of bb. 16–21) and absorbs the triplet theme from the B section before we hear a *'grandioso'* theme enter at b. 151. The theme's reappearance is also characterised by a greater presence of tuplet material, and the 9/16 metric interjection is removed and is instead replaced by a crotched triplet pattern (b. 155). Most changes to the material are subtle, yet they try to produce simple but effective developments that create a greater feeling of rhythmic consonance. Despite this, rhythmically dissonant textures still remain that belonged to the initial material, such as the 3+3+2 sub-metric grouping (in the brass).

Brass Fanfare

The brass interjection at b. 579 symbolises the beginning of the end for the A theme (Ex. 5.3). The trumpet presents a triumphant version of Theme A, followed by the theme's concluding material. The horns and trombones provide rhythmic drive, propelling the music toward its conclusion. In this setting, the triplets are missing a single triplet quaver in b. 579, resulting in a chain reaction where the syncopated grouping can be perceived aurally as quintuplet groupings within the triplet texture (2+3). This irregularity is compounded by

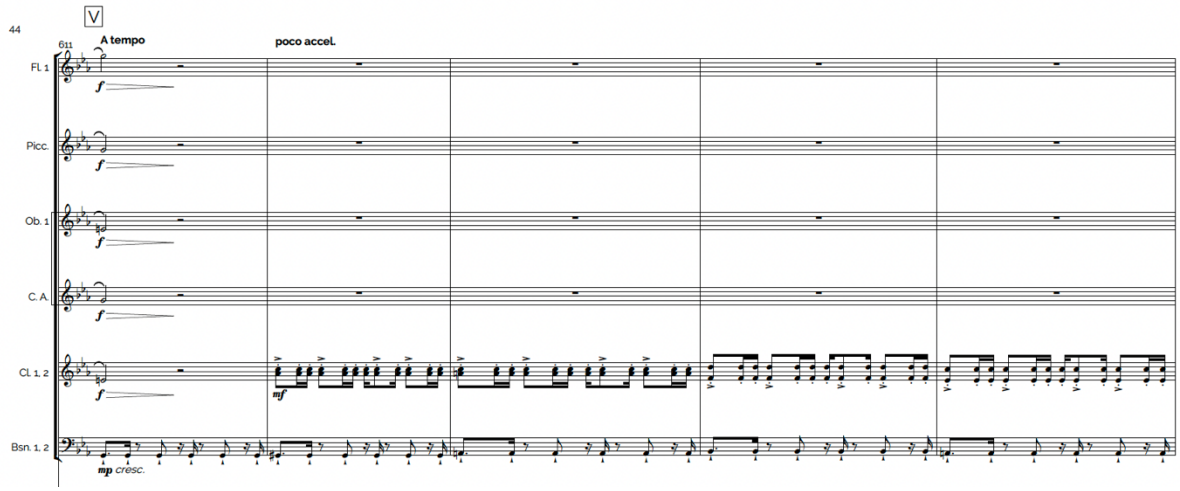
grouping dissonances occurring in the woodwind against the brass as the texture builds to the final A theme.



Ex. 5.3 bb. 579–586 of *Odyssey*.

At b. 610, there is a stronger degree of rhythmic consonance as the phrase ends. As the coda commences at b. 611, two driving rhythms accelerate the texture towards the final moments of the piece. Each pattern uses their own rhythmic technique to try and produce momentum. The first pattern features pulsation grouped in three and is found in the lower voices and percussion. Using this irregular grouping works similarly to the previous examples, where the grouping of three creates irregularity with the overarching duple grouping of the metre. The second driving rhythm features in the middle/upper voices and primarily uses a  pattern until an agogic accent appears on beat three to destabilise the

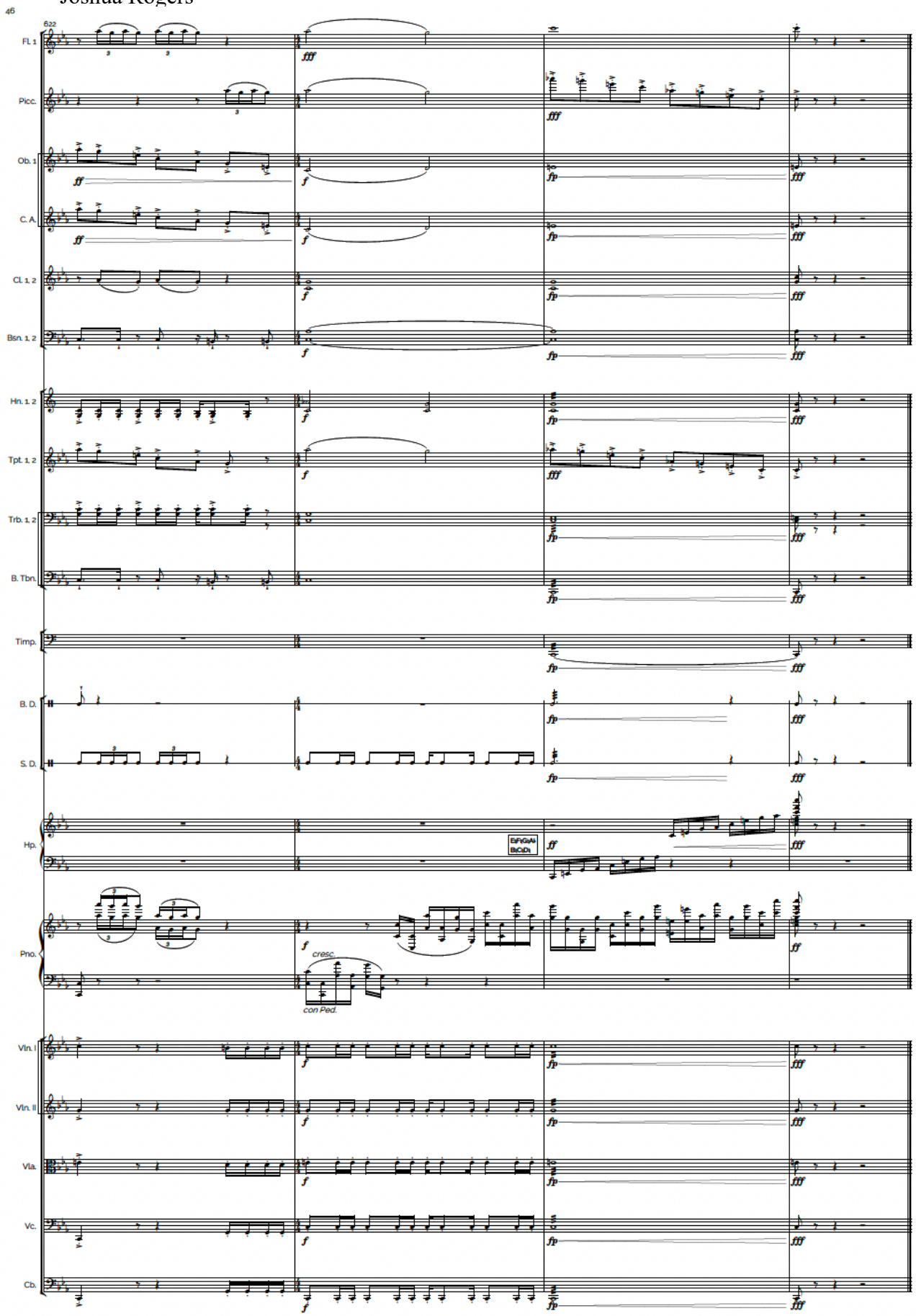
repeating pattern and produces  (Ex.5.4). The accentuation on beat 3, both through duration and the accentuation, creates a subtle emphasis on the syncopation.[1]



Ex. 5.4 Excerpt from bb. 611–615, highlighting two driving rhythmic ideas.

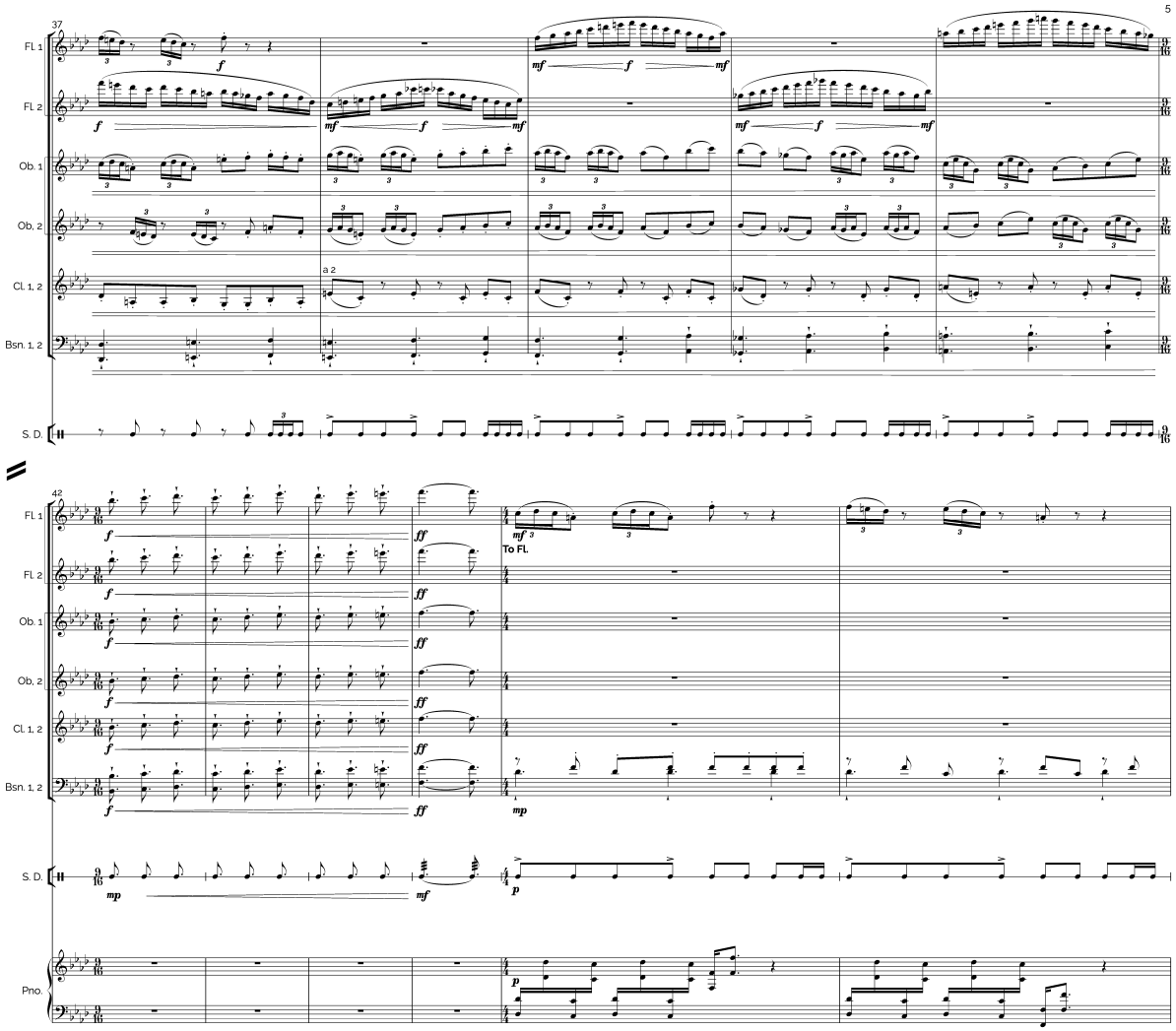
The final moments end viciously (Ex. 5.5), in a similar manner to the beginning. Ascending piano octaves reflecting an opposite contour to the opening material, whilst the majority of the orchestra holds a static chord. Similarly, the melodic phrasing of the piano is in an irregular 3 group (C → A♭ → G) repeating as it ascends.

[1] Harald Krebs, *Fantasy Pieces: Metrical Dissonance in the Music of Robert Schumann* (New York: Oxford University Press, 1999), p. 23.



Ex. 5.5 Final moments of *Odyssey* bb. 622–625

B Theme: Developing Textures

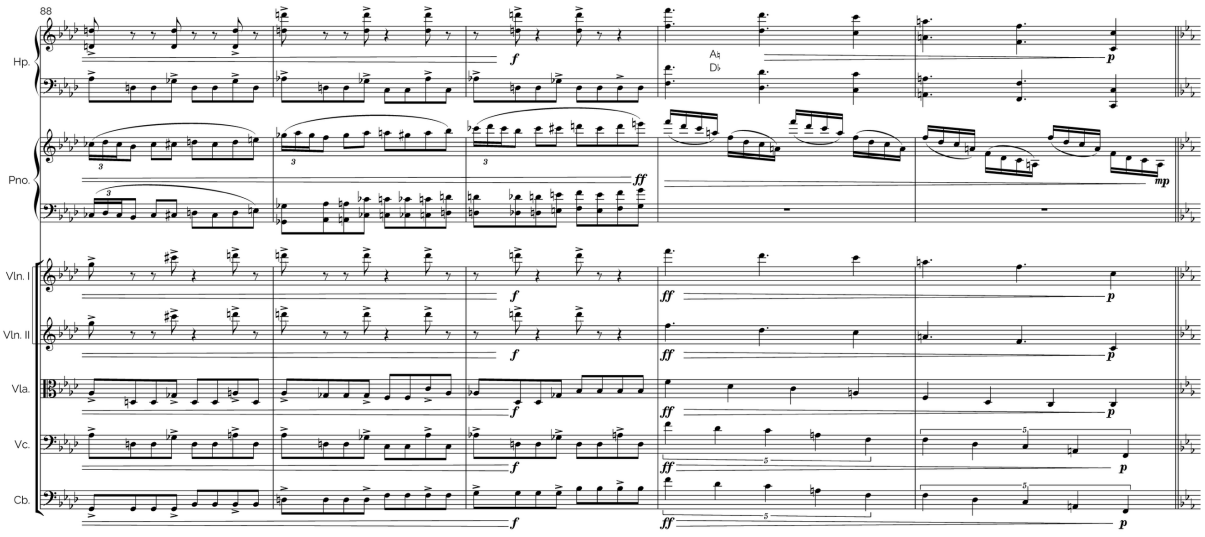


Ex. 5.6 bb. 37–47 of *Odyssey*.

The texture increases in density and reaches a miniature climax at b. 42, the 9/16 concept from the A theme reappears (Ex. 5.6). As seen in the A theme, localised metric consonance appears with rhythmic unison to summarise the section before the repeat. In the repeat, the piano enters with a characteristically different texture using octaves. A snare drum also enters at the same time, driving the 3+3+2 grouping with additional triplet embellishments by b. 48. The addition of percussion in this section also defies a timbral difference between the A theme. Because of the sharp transient attack produced by the snare

drum, the rhythmic material can easily cut through orchestral textures and emphasises the sub-metric manipulation.

As the theme develops, the strings enter through antiphonal writing. Interjecting with their own 3+3+2 interpretation using *pizzicato*. Similar to the use of percussion, this timbral shift emphasises the attack of the strings rather than their sustain. These antiphonal sections become longer as the section expands before transitioning back into the A theme at b. 93.



Ex. 5.7 B section into the transition material bb. 88–92.

The transition material, appearing in bb. 91–92, creates a 5:4 grouping dissonance in the lower strings and piano in addition to the 3+3+2 occurring in the upper strings (Ex. 5.7). The material arrives rhythmically consonant for the new section, marking the return of the A theme.

C Theme: Conflict Between Instrumental Forces

The orchestra returns at b. 195 as if forcing the piano to also return to simple time. Again, the piano tries to be disruptive adding triplets to create that frequent cross-rhythmic conflict seen throughout the other themes. Finally, the orchestra succumb to the irregular metric patterns as the piano interjects at b. 201–209 with a passage in 5/8. The orchestra joins

in at 209, playing a sub-metric clash (3+2 against 2+3) in the string alongside the syncopated woodwind and brass entries. The texture builds with scalic runs in the piano before resetting at b. 232.

Immediately, the material is less stable and does not establish a regular pattern. Almost every bar has a new metre, but the melodic and rhythmic material is reminiscent of the first section, helping to maintain continuity. In b. 252, the 5/8 passage returns. This time, oboes and trumpets decorate the rhythmic bed produced by the strings and piano, building up to the transitional material and moving into the development section.

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