Odd Times: The Uses of Odd-Factored Time Signatures in the Works of Thomas Adès and Brian Ferneyhough

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Doctor of Philosophy (Musicology)

July 2024

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Submitted in total fulfilment for the degree of Doctor of Philosophy (Musicology)

Abstract

Time signatures have conventionally been used to denote a piece's metre. However, in recent decades, following the early innovations of Henry Cowell and others, composers have developed new families of time signatures to manage and notate a wider variety of tempo relationships and rhythmic proportions, sometimes of great complexity. This practice differs significantly with each composer. In some cases, the novel time signatures still retain metric significance, in other cases they facilitate rhythmic practices that attenuate or even abandon metric sensation.

In traditional time signatures, the denominator is always a power of two. In this project, we study time signatures in which the denominator is not a power of two, and we call them "odd-factored time signatures" or "OFTSs". This project examines how OFTSs enable a wide range of proportional relationships, and draw connections and patterns that enrich the compositional and performance experience.

In music that contains frequently changing time signatures or in which the notational techniques are decoupled from metric perception, OFTSs can facilitate or attenuate the sensation and entrainment of metre. However, their use always plays a significant role in provoking and facilitating rhythmic and tempo complexities by dictating diverse pulse speed relationships, broadening the variety of potential rhythms, affecting the absolute duration of the bar, and displacing the expected downbeats of subsequent bars.

This thesis summarises the theoretical underpinnings of OFTSs and discusses some associated interpretational ambiguities. To explore how differently OFTSs may be used, it also analyses selected works by two contemporaneous British composers, Thomas Adès and Brian Ferneyhough, and compares their uses of OFTSs through specific case studies. Adès' *Traced Overhead* and *Piano Quintet* display a diachronic approach to OFTSs, in which some metric sensation persists. By contrast, Ferneyhough's *Superscriptio* and *Mort Subite* demonstrate a generative, process-driven compositional methodology, in which time signatures are one component in a very complex approach to rhythm and temporality, and metric sensation is often difficult to discern.

A sensation of metre is generally apparent throughout Adès' works. He uses OFTSs to alter metric sensation by means of rhythmic interjections, truncations and

elongations, and precise distortions of pulse speed. This is because of the trajectory, continuity, and periodicity found in his pieces. His notational practice also generally expedites the communication chain from composer to performer to listener. His use of OFTSs facilitates the performer's execution of the intended rhythms and notated proportions.

Ferneyhough does not factor metric sensation into his pieces in the same way as Adès. His works generate a multi-layered combination of phrases and structural patterns that result from numerous pre-compositional processes. OFTSs are one of many compositional tools at his disposal to achieve different bar lengths, periodicities, tempi, and gestural phrases. They add new layers of tuplet ratios, and are sometimes also used to show large-scale proportionalities. However, the various layers of different notational techniques obscure the compositional derivation of the complex rhythmic surface. He uses OFTSs as another means of complexity to draw conceptual relationships and patterns that result from the application of pre-compositional procedures.

OFTSs are able to simultaneously indicate and influence multiple time-related musical parameters. Both Adès and Ferneyhough use OFTSs in passages with frequent time signature changes, and this gives OFTSs a comparative quality, a gear-shifting sensation from the different proportional possibilities they enable and juxtapose, even if each composer's music elicits very different experiences for the listener. Ultimately, musical time in these "post-metrical" works is conceived and perceived through the interaction of multiple musical parameters, and this is best exemplified through the many uses of OFTSs.

Declaration

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I certify that the thesis presented by me for the degree of Doctor of Philosophy (Musicology) comprises only my original work except where due acknowledgment is made in the text to all other material used. The thesis is fewer than 100,000 words in length, exclusive of tables, maps, bibliographies, and appendices.

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Acknowledgments

Throughout the writing of this thesis, I have received a great deal of support and assistance. I would first like to thank my supervisors, Professors Richard Kurth and Elliott Gyger: this project would not have been possible without your expertise, guidance, direction, investment, and support. I am particularly grateful to you, Richard, for helping me wrestle with the underpinning concepts of this project and coining the term "odd-factored time signatures", which really aided in my conceptualisation and understanding of the technique. And I am particularly grateful to you, Elliott, for introducing me to OFTSs in the first place and helping me with all the mathematical complexities associated with the device. Thank you both for the hundreds of hours of invaluable supervisory meetings, your patience, wisdom, and understanding.

I would also like to thank Professor Linda Kouvaras for chairing my supervisory committee: your support, insights, and advice were crucial, especially when we had a global pandemic to contend with. I am also grateful to Associate Professor Dylan van der Schyff for agreeing to be my external respondent at my completion seminar: your comments were extremely helpful as I reached the concluding stages of writing. And also to Kyle Manning, my proofreader and editor: thank you for being a great friend, and a meticulous one at that!

I would also like to acknowledge all the people who have supported me personally, especially Jonathan my husband, Mummy, and Didi. Without the three of you, I would not be who I am today, and I am grateful beyond words for your love and encouragement. Also, to my parents-in-law and my brother-in-law: thank you for all of your support and prayers throughout this project. I love you all very much.

Most importantly, I want to thank my Lord and Saviour Jesus Christ, who called me to worship Him through excellence, who gave me love, life, and everlasting hope through His crucifixion and resurrection. He called me to do this PhD, He was with me throughout, and He finished it just as He promised. To Christ be the glory and honour forever.

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Introduction

When metres change frequently, or when harmonies are formed from them, they give pleasure, and it is again of interest to hear them as clearly defined, instead of disguised.[1]

The opinion quoted above, from Henry Cowell's 1930 book *New Musical Resources*, expresses the necessity for clarity in the projection and sensation of time-related musical parameters, particularly in the realms of metre, rhythm, and tempo. Time signatures are so frequently and closely associated with musical metre that the two have historically been viewed as synonymous.

This project, however, is not a study of metre. It is a study of musical time as configured by a certain class of time signatures, and an exploration of selected music by two composers who have used them. More specifically, this project will examine "odd-factored" time signatures, and the multiple implications they have on the performance of rhythmic and tempo proportions, phrasing, accent placement, periodicities, metre (where it can be attested), and other time-related parameters in some of the music of Thomas Adès and Brian Ferneyhough.

Here we define odd-factored time signatures to be those with denominators (beat values) that have at least one odd number in their prime factorisation, e.g. time signatures such as *x*/**3**, *x*/**5**, *x*/**6**, *x*/**7**, *x*/**9**, *x*/**10**, *x*/**11**, *x*/**12**, *x*/**13**, *x*/**14**, *x*/**15**, and so forth. We allow any number of beats in the bar, expressed here generically by "*x*", which may have any integer value. Note that some of these denominators listed above are off prime numbers (i.e. 3, 5, 7, 11, 13); and others are even numbers that are odd prime numbers multiplied by a power of two (i.e. 6, 10, 12, 14). The list of such time signatures can be extended infinitely, through all positive integers that contain at least one odd prime factor—the vast majority of positive integers, in fact.

In some respects, it may be easier to define odd-factored time signatures by what they are *not*. Almost all music of the Western tradition involves time signatures with denominators that are purely powers of two (such as *x*/**4**, *x*/**8**, and *x*/**16**). These time signatures involve beat values derived from the semibreve (𝅝) and the process of

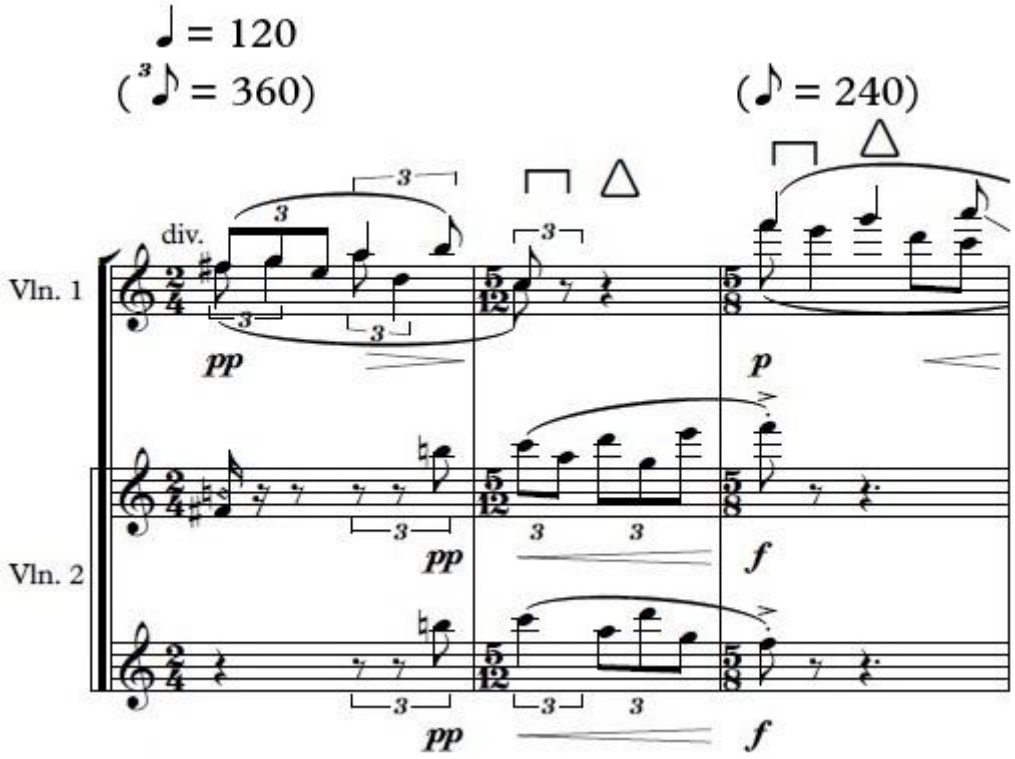
[1] Henry Cowell, *New Musical Resources* (Cambridge: Cambridge University Press, 1930), 71.

halving. For example, the ***4***-denominator in ***2/4*** indicates a beat duration of a 𝅝 divided in half and again in half (i.e. a crotchet (♩), which has the duration of a quarter of a 𝅝).

In other words, the beat value of these time signatures is always signified by a number that is a power of two, as a division of the underlying 𝅝 into two equal parts. Hereinafter, these time signatures will be referred to as "conventional time signatures", the time signatures whose denominators are *not* odd-factored; they can also be called "purely even-factored", in that they are base-2 numbers.

However, there are also time signatures that do not conform to this power-of-two convention. Consider, for instance, the second bar of Example A, which is notated in ***5/12***. This time signature features odd-factored values in two senses: the ***5***-numerator, which indicates the bar containing five beats; and the ***12***-denominator, which indicates the beat value is the duration of a twelfth of a 𝅝 (i.e. a ^{3}♪).

Example A: Thomas Adès, *Totentanz* (bars 137-139), violin lines.[2]



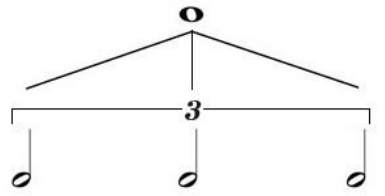
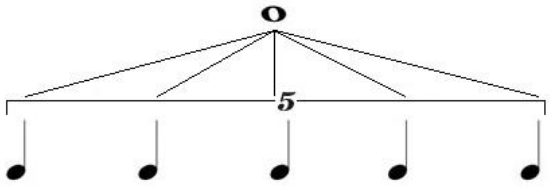
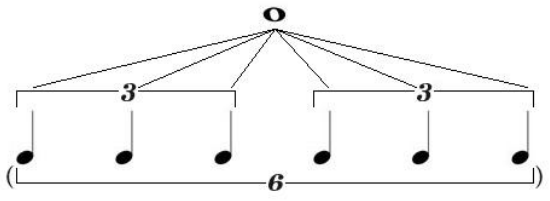
It is the ***12***-denominator (and not the ***5***-numerator) that marks this time signature as being an "odd-factored time signature" under our definition. The numerator is of course of great interest also, but can range freely over any even or odd positive integer.

[2] Thomas Adès, *Totentanz* (London: Faber Music, 2013), 10-11.

The *denominators* of these particular unconventional time signatures are the focus of this thesis.

The ***12***-denominator symbolises the process of the 𝅝 being divided by two, divided by two again, and then divided by three.[3] Indeed, composer Thomas Adès uses triplet notation in this bar to clarify the continuity and preservation of the beat durations and tempo relationship from the previous bar.

Table A: Different divisions of the semibreve to imply tuplet durations.

Semibreve Division	Time Signature Denominator	Implied Duration
	***x/3***	$\overset{3}{\text{𝅗𝅥}}$
	***x/5***	$\overset{5}{\text{♩}}$
	***x/6***	$\overset{3}{\text{♩}}$

Put another way, 12 is factored as 2 × 2 × 3. That last 3 is an odd-numbered factor in the division of the 𝅝 . When the 𝅝 is divided into three equal parts, it results in a $\overset{3}{\text{𝅗𝅥}}$ duration, and so the denominator of a time signature that implies such a beat value would be ***3***. If the 𝅝 is divided into five equal parts, it results in $\overset{5}{\text{♩}}$, with a ***5***-denominator.

[3] Although the factorisation has been framed in that sequence, there is no implication in the OFD which necessitates that order. By convention, OFDs will normally be conceptualised with factors listed in increasing orders of magnitude. However, different orders of factorisation are possible, leading to different ways of cross-grouping the same values, and composers explore this particularly when denominators have at least two *different* odd factors. Generally, these different groupings will be shown on the surface of the music as will be discussed later in chapter 2 with the denominator of ***15***, for example, which can be grouped either by 3 groups of nested $\overset{5}{\text{♪}}$ (i.e. the factorisation sequence being 15 = 3 × 5, which adheres to the normal sequence of listing factors in increasing orders of magnitude), or 5 groups of nested $\overset{3}{\text{♪}}$ (i.e. 15 = 5 × 3). For discussion around the partitioning and subdivisions of the hierarchical system implied by time signatures, see Jordan Alexander Key, "Pan-Rational and Irrational Rhythm: The History, Development, and Modern Implementation of Non-Dyadic Rational Rhythms in Western Music" (PhD dissertation, University of Florida, 2021), 34-35.

If the 𝅝 is divided into six, it results in 𝅗𝅥 or 𝅗𝅥 (in this instance, 𝅗𝅥 and 𝅗𝅥 denote the same duration).

Henceforth, any time signature with at least one odd number in the prime factorisation of its denominator (i.e. any denominator that is not purely a power of two) will be referred to as "odd-factored time signature(s)" or abbreviated to "OFTS(s)". Henry Cowell is generally credited for inventing the idea and notational device.[4] Such time signatures have often been called "irrational", but that term is inaccurate and misleading, since the numbers are simple integers, making for purely rational-number proportions. The terminology used here was suggested by my supervisor Richard Kurth, as a way to identify the defining property of the integers involved.[5]

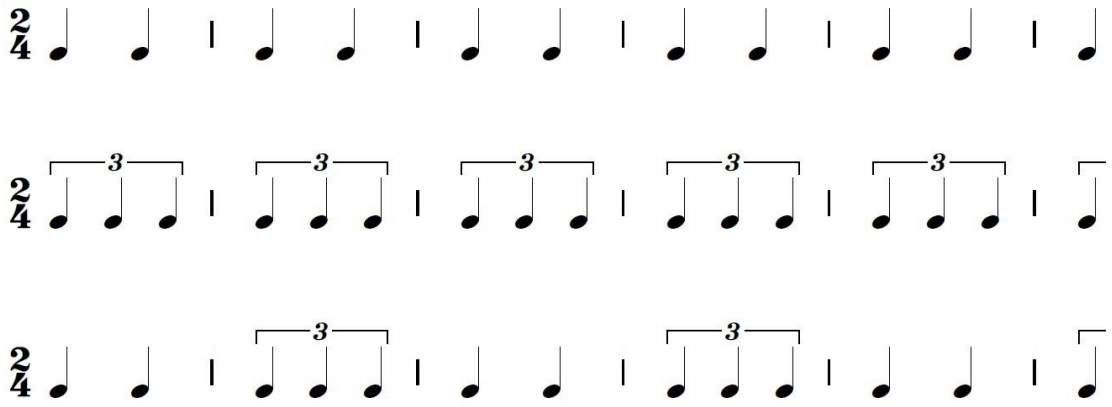
Table B: Some examples of OFTS denominators.

Time Signature	Implied Beat Duration	Denominator Factorisation	Notes
***x*/6**	𝅗𝅥	2 × 3	Odd factor: 3
***x*/7**	𝅗𝅥	7	A prime number greater than 2, therefore inherently an odd number
***x*/10**	𝅘𝅥𝅮	2 × 5	Odd factor: 5
***x*/12**	𝅘𝅥𝅮	2 × 2 × 3	Odd factor: 3

Some examples of odd-factored denominators (henceforth abbreviated to "OFD(s)") are listed in an abridged table above but will be discussed in greater detail in chapter 2. Note that all the OFDs in Table B, apart from **7**, are even numbers. The "oddness"—as opposed to "evenness"—of the denominator itself is not what makes the time signature an OFTS; rather, it is the inclusion of an odd number in the *prime factorisation* of the denominator that designates it as such. To put it another way, consider a series of ***2*/4** bars as a simple example:

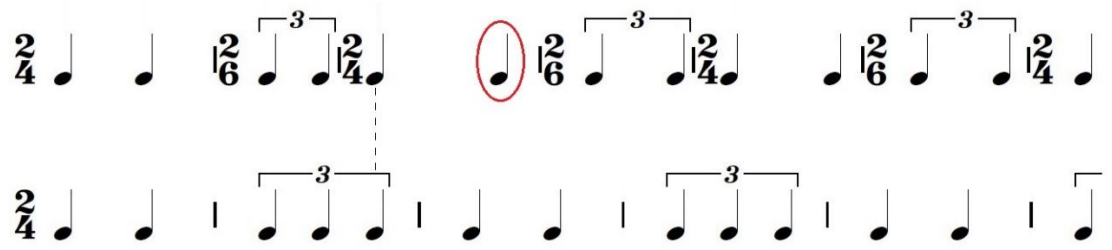
[4] Cowell, *New Musical Resources*, 67.
[5] Richard Kurth, supervisory meeting, November 9, 2020.

Example B: Straight and triplet crotchets in *2/4*.



The time signature of ***2/4*** equates to a total bar duration of a 𝅗𝅥, and this duration could be split into ♩ ♩ or ³♩ ³♩ ³♩. The third system of Example B displays what happens when these two pulse durations alternate between bars. On the surface, there are obvious rhythmic changes due to the alternation of pulse durations. In another sense, changes of pulse *speed* are also felt as it transitions from ♩ to ³♩. If the final ³♩ was removed from each alternating bar to make bars of only ³♩ ³♩, that would create ***2/6*** bars instead:

Example C: Mutation into alternating *2/4* and *2/6* bars.

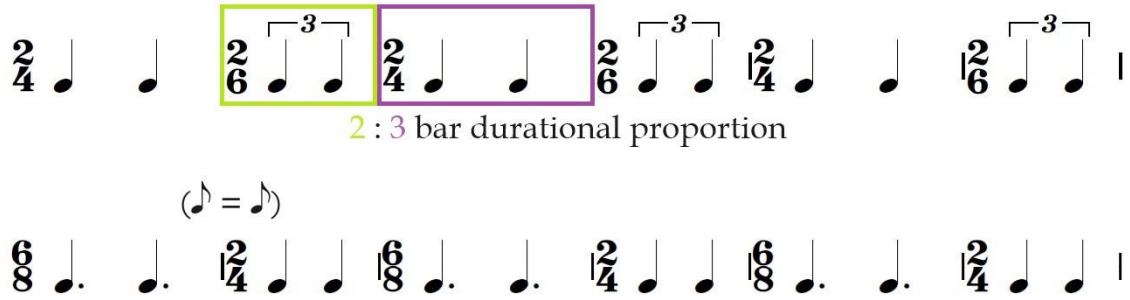


The alternation between ***2/4*** and ***2/6*** bars creates several simultaneous effects. Notationally, ♩ ♩ are contrasted against ³♩ ³♩, which enables a rhythmic difference. Sonically, the first ♩ of the first displaced ***2/4*** bar still falls at the same attack point where that final ³♩ used to be (see the dotted coordination line in Example C). Therefore, in an aural sense, assuming the downbeats are not accented, the second non-tuplet ♩ (circled in red) would sound like a rhythmic hiccup of sorts. This introduces some rhythmic ambiguity, at least on the sonic level.

Going from one bar to the next, since the note durations repeat, there is also an alternation of pulse speed from ♩ to ³♩. Furthermore, if the first system in Example C was preceded by a long series of consecutive ***2/4*** bars, so much so that a ***2/4*** metre could

be entrained to and projected, then the alternating ***2/4*** and ***2/6*** bars would produce a distortion of the original ***2/4*** metric grid. Finally, the bar durations also change where every alternating ***2/4*** bar is shortened to become a ***2/6*** bar. In other words, a ***2/6*** bar is two-thirds the length of a ***2/4*** bar. This establishes a 2:3 durational proportional relationship.

Example D: Renotation of alternating *2/4* and *2/6* bars into conventional time signatures with metric modulation.



This 2:3 ratio could be renotated into conventional time signatures with metric modulation. However, there is a major disadvantage to this approach: renotation will not be able to clearly or simply capture any proportions more complex and less easily rationalisable than 2:3. Proportions such as 7:11 and 15:16, which will be encountered in later examples, cannot be simply renotated using normal notational methods.

Furthermore, although the renotation into alternating ***6/8*** and ***2/4*** bars with metric modulation is widely accepted, it presupposes the common smaller value of the ♪ linking both time signatures. The OFTS notation does not highlight these common smaller note values as structurally important.

The above examples demonstrate that OFTSs do not only illuminate the metre of the bar or influence the sensation and entrainment of metre; they also dictate the pulse speed, broaden the potential rhythms that may be used, affect the absolute duration of the bar, and speak to any accent displacements imposed upon the subsequent bars. Although metre should be considered an important implication of time signatures, the specific uses of OFTSs make it apparent that there is a clear distinction between time signatures and metre.

Most contemporary music theorists define metre as arising from two or more hierarchically-nested pulse streams, such that it can be entrained to and projected over

time.[6] In music of the common practice, time signatures signify this hierarchic organisation.[7] OFTSs as a notational device are labelled here only as *time signatures*, not "odd-factored *metres*", because they can be, and often are, used in music where metre is not experienced in a phenomenological sense.

OFTSs draw relationships, connections, and patterns that enrich the compositional and performance experience. In this "post-metrical" context where music contains frequently changing time signatures or where the notational techniques are decoupled from metric perception, OFTSs no longer act as mere interlopers in the conventional metric grid.

Rather, OFTSs take on a more significant role in provoking and facilitating rhythmic and tempo complexities. OFTSs have many more implications across numerous musical facets, particularly time-related musical parameters, and this project seeks to explore them in detail.

Research Questions, Research Method, and Thesis Scope

With this in mind, OFTSs are of particular interest when exploring new music due to the succinct notational simplicity yet wide-reaching conceptual complexity that they provide. There are several pertinent research questions that should be addressed with regard to this notational device, beginning with the most important: what are the advantages of using OFTSs? And what circumstances determine their effectiveness?

Answering these questions requires examination of the musical contexts in which OFTSs allow efficient notation and consideration of how the performer is afforded a more accurate understanding of the manipulation of tempo and note grouping, depending on accentuation. This introductory chapter provides examples to capture a snapshot of the implications and importance of the notational tool, but the breadth and depth of the device is explored throughout this thesis to better equip composers and enhance informed practice for performers.

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[6] Grosvenor E. Cooper and Leonard B Meyer, *The Rhythmic Structure of Music* (Chicago: The University of Chicago Press, 1960), 4; Justin London, *Hearing in Time: Psychological Aspects of Musical Meter* (Oxford: Oxford University Press, 2004), 4-5; Christopher F. Hasty, *Meter as Rhythm* (Oxford: Oxford University Press, 1997), 84; Mark Gotham, "Hierarchy and position usage in 'mixed' metrical structures," *Journal of New Music Research* 46, no. 2 (2017): 103.
[7] Richard Rastall, "Time signature," in *Grove Music Online*, *Oxford Music Online*, http://www.oxfordmusiconline.com, accessed August 14, 2023.

Also, in the music that employs OFTSs, how does the metrical notation reflect other aspects of the musical discourse (such as rhythm, tempo, accent, and periodicity)? Moreover, why are OFTSs important in understanding the relationships between metre, rhythm, tempo, and other time-related parameters in a musically innovative context?

As the next chapter explores the historical progression of OFTSs in greater detail, it will become clear that these time signatures are situated within the exploratory musical practice of the 20th and 21st centuries. The ways such composers conceptualise and interact with different elements of musical time will have repercussions for the interconnectivity of other time-related parameters.

Furthermore, considering the greater ramifications of their practicality, how do OFTSs help composers and performers grapple with and understand musical time? This is especially pertinent when much of the Western analytical discourse has been focused on pitch-related subjects instead.[8] As this project is specifically focused on OFTSs as a notational practice, the composer-performer relationship will be the primary reference point.

How a score is notated will affect how performers approach and execute the score. Generally speaking, the score itself has an indirect influence on the listener. Therefore, any speculations on the aural reception of the notation will be kept to a minimum as the focus of this project is on the notation. Furthermore, any speculations will focus mainly on how the notation encodes and preserves the compositional process.

To approach these research questions, I will be analysing and categorising the uses of OFTSs in some of the works by Thomas Adès and Brian Ferneyhough. There will be specific focus on the derivation of metrical, rhythmic, and tempo phenomena in the specific contexts of case study pieces, and the ways in which they are distorted and/or perturbed by OFTSs.

The approach to analysis will involve surveying these composers' oeuvres, discerning the types of pieces OFTSs are utilised in, observing the concentration of OFTS usage in works containing them, finding degrees of alignment and non-alignment between metrically distinct layers, investigating formal/structural and rhythmic surface patterns involving OFTSs, and particularly scrutinising any uses of OFTSs that seem to

[8] For more detailed discussion, see Justeen Wheatley, "The Use of Irrational Time Signatures in Thomas Adès' Works" (BMus(Hons) dissertation, the University of Melbourne, 2019), 9-10.

be self-defeating or redundant. My analysis will not involve any deep investigation into the intersection between time-related musical parameters and any other non-temporal parameters, such as pitch, harmony, or form, as it is beyond the scope of this thesis.[9]

This method of analysis and categorisation will be made under two assumptions. The first is that OFTSs, and the notation of the scores in general, are significant: they fundamentally influence the way the music is conceived and communicated. The decisions composers—particularly Adès and Ferneyhough—make about time signatures are profoundly meaningful and syntactic with what the music is deeply about. The time signature is not a notational nuisance: it is deeply imbricated with the surface and structure of the music in a variety of ways. This point will be addressed in the next subsection "Research Significance and Justification of Notational Focus".

The second assumption is that Adès and Ferneyhough are compositionally different and therefore they will be using OFTSs differently. There will be some overlaps, but as they are unique individuals who compose different types of music and speak about their compositional output in different ways, it is likely their approaches to using the notational device will be different as well.

This thesis includes the following chapters:

1. A summary of the theoretical underpinnings of OFTSs: preliminary definitions of fundamental musical concepts and the historical progression leading to Cowell's conception of OFTSs;
2. The interpretational ambiguities of OFTSs: because OFTSs are a modification of standard notation, some complexities arise from the way these conventions are manipulated, and they therefore create challenges composers must solve in different ways;
3. Composer introduction of Thomas Adès: an overview of Adès' oeuvre and how he generally uses OFTSs;
4. Concentrated example of *Traced Overhead* by Adès: a more in-depth examination of Adès' uses of OFTSs in this work;
5. Case study of *Piano Quintet* by Adès: a thorough analysis of Adès' uses of OFTSs in this work;
6. Composer introduction of Brian Ferneyhough;
7. Concentrated example of *Superscriptio* by Ferneyhough;

[9] See Curt Sachs, *Rhythm and Tempo: A Study in Music History* (London: J. M. Dent & Sons, 1953), 16-18.

8. Case study of *Mort Subite* by Ferneyhough; and
9. A conclusion comparing: the two major case studies of *Piano Quintet* and *Mort Subite*; different forms of instrumentation and how they affect OFTS use; and the two composers' compositional approaches to OFTSs. Also, the research questions will be answered and avenues for future research will be addressed.

Adès and Ferneyhough have been chosen because they are two of the most well-known/high profile composers who use OFTSs consistently. They both use OFTSs substantially in their oeuvres and they use OFTSs in different ways.[10] This final reason was particularly compelling as that allows a wide breadth of uses to be covered. Furthermore, Adès and Ferneyhough are relatively comparable in that they are contemporaries who both originate from England with overlapping influences.[11]

After my previous undertaking of studying some of Adès' uses of OFTSs in my honours dissertation, it became clear that there was more to explore in his oeuvre, as there were more implications to the uses of OFTSs than the ones previously identified. Ferneyhough then emerged as an ideal alternative choice, because his approach to the notational convention seems diametrically opposed to Adès'.

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[10] See Christopher Fox, "Tempestuous Times: The Recent Music of Thomas Adès," *The Musical Times* 145 no. 1888 (2004): 41-56; Daniel Fox, "Multiple Time-Scales in Adès's *Rings*," *Perspectives of New Music* 52, no. 1 (2014): 28-56; John Roeder, "Co-operating Continuities in the Music of Thomas Adès," *Music Analysis* 25, no. 1/2 (2006): 121-154; Philip Stoecker, "Aligned Cycles in Thomas Adès's Piano Quintet," *Music Analysis* 33, no. 1 (2014): 32-64; Key, "Pan-Rational," 291-295; Huw Belling, "Thinking Irrational: Thomas Adès and New Rhythms" (MM thesis, Royal College of Music, 2010); Brian Ferneyhough, *Brian Ferneyhough: Collected Writings*, ed. James Boros and Richard Toop (Amsterdam: OPA, 1995); Stuart Paul Duncan, "Re-Complexifying the Function(s) of Notation in the Music of Brian Ferneyhough and the "New Complexity"," *Perspectives of New Music* 48, no. 1 (2010): 136-172; Stuart Paul Duncan, "The Concept of New Complexity: Notation, Interpretation and Analysis (Part I)" (D.M.A. dissertation, Cornell University, 2010); Christopher Fox, "British Music at Darmstadt 1982-90," *Tempo* New Series, no. 186 (September 1993): 21-25; Richard Toop, "On Superscriptio: An Interview with Brian Ferneyhough, and an Analysis," *Contemporary Music Review* 13, no. 1 (1995): 3-17; Richard Toop, "Brian Ferneyhough's *Lemma-Icon-Epigram*," *Perspectives of New Music* 28, no. 2 (1990): 52-100.

[11] Roeder, "Co-operating Continuities," 121; Richard Taruskin, "A Surrealist Composer Comes to the Rescue of Modernism," in *The Danger of Music: And Other Anti-Utopian Essays* (California: University of California Press, 2009), 147-149; Tom Service, "A guide to Thomas Adès's music," The Guardian, published October 2, 2012, https://www.theguardian.com/music/tomserviceblog/2012/oct/01/thomas-ades-contemporary-music-guide; Thomas Adès and Tom Service, *Thomas Adès: Full of Noises. Conversations with Tom Service* (London: Faber and Faber, 2012), 75; Key, "Pan-Rational," 289-291; Duncan, "The Concept of New Complexity," 3-4, 7-8; Christopher Fox, "A Darmstadt Diary," *Contact* 29 (1985): 45; Michael Finnissy, "Biting the Hand that Feeds You," *Contemporary Music Review* 21, no. 1 (2002): 75; Fox, "British Music," 23; Lois Fitch and Martin Iddon, *Brian Ferneyhough* (Bristol: Intellect, 2013), 3; Richard Toop, "Four Facets of 'The New Complexity'," *Contact* 32 (1988): 5.

The phrase 'seems diametrically opposed' has been used for a few reasons. Adès is a composer and also a performer; he is a pianist and has often played or conducted the premieres of his works.[12] In his interview with Tom Service, he has stated that he aims to make his notation simpler so performers may apprehend his intention as clearly as possible.[13]

Conversely, Ferneyhough is a composer and also a theorist, analyst, and scholar. In many of his essays, he has specifically expressed his generative process-driven compositional approach, and this will be discussed in more detail in his composer introduction (chapter 6).[14] Ferneyhough's attitude towards the "perfect" or most accurate performative realisation of his works is that it is not necessarily the purpose of the composition.[15]

The reason Ferneyhough gives for his position is that '[n]o notation, of whatever iconically representational state, can presume to record information encompassing all aspects of the sonic phenomenon for which it stands.'[16] Therefore, Ferneyhough does not write his scores with the view of only presenting a single path for performance interpretation, 'but rather a labyrinth with multiple entrances and exits.'[17] Through multiple layers of notational complexity, Ferneyhough poses considerable challenges to the performer's ability to comprehend his pieces, and this will be addressed later in chapters 6-8.

In any case, these are quite different compositional approaches, and they seem to be diametrically opposed *prima facie*. Furthermore, although the composers are contemporaries, Ferneyhough (born in 1943) belongs to an older generation than Adès (born in 1971). Their musical styles differ significantly.

Ferneyhough has been labelled the "Father of New Complexity" due to his Modernist tendencies towards formalisation and notational maximalism, and pushing

[12] Belling, "Thinking Irrational," 37; as cited by Key, "Pan-Rational," 295.
[13] Adès and Service, *Full of Noises*, 67, 107.
[14] Fitch and Iddon, *Brian Ferneyhough*, 31; Ferneyhough, *Collected Writings*; Toop, "*Lemma-Icon-Epigram*," 56.
[15] Toop, "Four Facets," 5; Ferneyhough, *Collected Writings*, 7-8, 71; Duncan, "The Concept of New Complexity," 7-9.
[16] Ferneyhough, *Collected Writings*, 3; as quoted in Duncan, "The Concept of New Complexity," 27.
[17] Duncan, "The Concept of New Complexity," 38.

the limits of rhythmic and metric notation.[18] Fitch and Iddon go as far as calling Ferneyhough's level of detail in his scores 'an unreasonable level of complexity'.[19] Adès, in comparison, has been considered a contemporary, eclectic, surrealist composer with a propensity for reinvention and musical volatility.[20] Adès, in his own words, seeks an "organicism" in his compositional style.[21]

Specifically with regard to OFTSs, both composers treat the notational device quite differently. Based on the way he writes, Adès expects listeners and performers to entrain to the music he composes with OFTSs (at least some of the time).[22] He generally uses proportions he anticipates will be audibly discernible as seen with his uses of ossia.[23] Ferneyhough, on the other hand, is not as concerned with metric audibility and entrainment with his use of OFTSs. Both composers make sufficiently broad and varied use of OFTSs throughout their output to the point where one may be able to draw generalisations and conclusions about their practice.

The minor concentrated examples of *Traced Overhead* and *Superscriptio*, by Adès and Ferneyhough respectively, establish some preliminary patterns of OFTS use by both composers which will then gradually lead into the major case studies. The major case study pieces were written 10 years apart (*Mort Subite* in 1990 and *Piano Quintet* in 2000). Neither work represents either composer's first engagement with OFTSs.

Mort Subite is possibly the most metrically simple work in Ferneyhough's output (or, at least, the generative compositional process is potentially the most transparent here). By contrast, *Piano Quintet* is possibly the most metrically and rhythmically complex work in Adès' oeuvre (save perhaps for his *Concerto for Piano and Orchestra* (2018)). Thus, these specific pieces have been chosen as major case studies to cover a spectrum of uses of OFTSs.

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[18] Duncan, "The Concept of New Complexity," 7-8; Fox, "A Darmstadt Diary," 45; Finnissy, "Biting the Hand," 75; Fox, "British Music," 23; Fitch and Iddon, *Brian Ferneyhough*, 3; Toop, "Four Facets," 5; Key, "Pan-Rational," 236.
[19] Fitch and Iddon, *Brian Ferneyhough*, 31
[20] For 'eclectic', see Roeder, "Co-operating Continuities," 121; for 'surrealist', see Taruskin, "A Surrealist Composer," 147-149; for 'propensity for reinvention', see Service, "A guide to Thomas Adès's music"; for 'musical volatility', see Adès and Service, *Full of Noises*, 75.
[21] Adès and Service, *Full of Noises*, 8, 15, 19, 47, 50-51, 58, 96, 151. Since Adès never fully elaborates or defines 'organic' throughout his interviews with Tom Service, I will refrain from using this term due to its multiple and heavy-laden connotations.
[22] Roeder, "Co-operating Continuities," 144.
[23] Ossia can be found in works such as Adès' *Piano Quintet* (2000), *Violin Concerto: Concentric Paths* (2005), *Lieux Retrouvés* (2009), and his second *Mazurka for Piano* (2009).

Both minor concentrated example pieces are solo works, whereas both major case study pieces are chamber ensemble works. The conclusion of this thesis will examine the ramifications for solo pieces where the performer does not need to coordinate with any other player, compared to non-conducted chamber works (such as *Piano Quintet*), compared to non-conducted chamber pieces involving another external measure (such as the click track in *Mort Subite*), and compared to conducted orchestral works (such as *Totentanz* (2013)). This project aims to determine whether all the OFTS uses explored could theoretically be synthesised into a single work or if Adès and Ferneyhough's approaches are disparate enough to make this impossible.

Research Significance and Justification of Notational Focus

Much of the Western analytical discourse surrounding musical theories has centred around pitch, harmony, and tonality, and there has been a relative lack of interest surrounding the development of time-related musical parameters.[24] As Jonathan D. Kramer asserts in *The Time of Music*:

> Most theories of music have been concerned not with time but with pitch, in part because pitch is discretely defined, precisely notated, and hence quantifiable. The musical score, which provides data for pitch studies, does not unfold in time, whereas heard music exists only in experienced duration. The majority of works on musical time have dealt with rhythm and meter—once again, notated parameters, although their appearance on the page is less precise and less complete than is pitch notation.[25]

Furthermore, in his dissertation, Jordan Key agrees with Gardner Read's assessment that

> Most inventors of unorthodox notational systems [throughout the 17th to 20th centuries]… concentrate[ed] their reform efforts on pitch clarification. Only when the procedure that individualized pitch made time values unclear did the reformers search for new approaches to indication of duration.[26]

[24] Ian D. Bent and Anthony Pople, "Analysis," in *Grove Music Online, Oxford Music Online*, http://www.oxfordmusiconline.com, accessed May 11, 2018; Elliott Carter, *The Writings of Elliott Carter*, eds. Else Stone and Kurt Stone (Bloomington: Indiana University Press, 1977), 166.
[25] Jonathan D. Kramer, *The Time of Music: New Meanings, New Temporalities, New Listening Strategies* (New York: Schirmer Books, 1988), 2.
[26] Gardner Read, *Source Book of Proposed Music Notation Reforms* (New York: Greenwood Press, 1987), 135; as cited in Key, "Pan-Rational," 206-207.

Key notes that Read surveys over 100 proposals of rhythmic notation reform in his *Source Book of Proposed Music Notation Reforms*, and only those of Laura Beswick, Henry Cowell, and Bruno Bartolozzi 'offer a method of notating rhythms outside the typical dyadic-rational system of subdivisions and partitions'.[27] Key then asks 'why nearly no composer or music theorist, in almost half a millennium, seems at all concerned about this deficiency while many have been historically concerned about the precise and diverse notation of pitch quality'?[28] Paul Creston, in his book *Rational Metric Notation*, also questions why 'imprecision and incompleteness' are tolerated in the realms of time-related musical parameters but not in the area of pitch.[29]

This focus on pitch-related elements over musical time has become so egregious that 'many books purportedly written on the subject of rhythm hardly deal with rhythm or metre at all and instead concentrate on other aspects of music'.[30] This is especially true of rhythmic and metric notation. For example, in Curt Sachs' book *Rhythm and Tempo*, only two pages are dedicated to "recent" innovations of time signatures, and he does not even mention OFTSs despite the fact that it was published two decades after *New Musical Resources*.[31] Therefore, this relative lack of interest in the time-related aspects of music and their notation has created an opportunity for further exploration and study.

With regard to the existing writings on OFTSs, they generally focus more on just one specific aspect of OFTSs, such as performance practice involving OFTSs, or the metrical or tempo elements implied by OFTSs, yet they do not necessarily provide a broad canvas of the uses of the notational convention itself. Covering the wide variety of compositional uses of OFTSs will be the main purpose of this project.

One may ask why this thesis is focused on a notational device rather than the musical parameter of metre. After all, music has always been a multisensorial phenomenon, particularly (but not exclusively) performative and auditory.[32] It has been

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[27] Key, "Pan-Rational," 207; Laura H. Beswick, Musical Notation, U.S. Patent 733,351, and issued July 14, 1903; Cowell, *New Musical Resources*; Bruno Bartolozzi, "Proposals for Changes in Musical Notation" *Journal of Music Theory* 5, no. 2 (1961). See also Key, "Pan-Rational," 187-206. For the use of the term 'dyadic-rational', see the discussion in the chapter 1 subsection "The Final Stage: Odd-Factored Time Signatures," 74-75.
[28] Key, "Pan-Rational," 207. See also Key, "Pan-Rational," 151, 163; Sachs, *Rhythm and Tempo*, 331.
[29] Paul Creston, *Rational Metric Notation: The Mathematical Basis of Meters, Symbols, and Note-Values*, (Hicksville: Exposition Press, 1979), 36.
[30] See also Wheatley, "Irrational Time Signatures," 9-10.
[31] Sachs, *Rhythm and Tempo*, 361-362.
[32] Emma Dillon, "Music Manuscripts," in *Cambridge Companion to Medieval Music*, ed. Mark Everist (Cambridge: Cambridge University Press, 2011), 291; as cited by Floris Schuiling,

conceived by music-making practice and inherited from one generation to the next through aural tradition for millennia.[33]

However, with the advent of written documentation instilling a sense of permanence to historical records, notation and visual representations have gained more significance.[34] In contemporary notational practice, some aspects of notation may be prescriptive, intended for precise realisation in performance, while other aspects may be more descriptive, implicitly allowing the performer wider latitude in execution. Prescriptive and descriptive aspects may both operate within a short sequence of musical notation, even simultaneously in a single notehead, specifying duration, articulation, dynamics, timbre, and even expressive character to varying degrees of precision (or without any specification of certain aspects).

In some ways, Adès takes a prescriptive approach with much of his rhythmic notation, as he seeks to clarify his intention to performers by using notation which is as accessible and efficient as possible.[35] The intended performability of his works will be discussed further in chapters 3-5. On the other hand, being a performer himself, Adès takes a descriptive approach where he allows for, and expects, performative freedom.[36] When Tom Service asked him in an interview if he was ever tempted to make 'a fixed recorded version of [his works], and not [be] bother[ed] with a score and performers', he replied:

> It's tempting, but it is not in the nature of the music that I write to be fixed. … The alchemy of live performance is more elusive… Your mood might have slightly shifted in five minutes in some way that then affects what you do with the balance of a chord or the exact timing of a rubato. You're still doing what it says on the page, but the variables are infinite. So when it comes to one's own music, there are infinite different ways of performing it while still sticking strictly to the score.[37]

"Notation Cultures: Towards an Ethnomusicology of Notation," *Journal of the Royal Musical Association* 144, no. 2 (2019): 429-430.

[33] Jonathan Sterne, *The Audible Past: Cultural Origins of Sound Reproduction* (Durham: Duke University Press, 2003), 15-19; as cited by Schuiling, "Notation Cultures," 430.

[34] Thomas Forrest Kelly, "Notation I," in *The Cambridge History of Medieval Music*, eds. Mark Everist and Thomas Forrest Kelly (United Kingdom: Cambridge University Press, 2018), 236.

[35] Adès and Service, *Full of Noises*, 67.

[36] Adès and Service, *Full of Noises*, 107.

[37] Ibid.

Conversely, the complexity and informational density of Ferneyhough's scores have often led to performers assuming his prescriptive approach to notation, where the 'performer's role as interpreter' is eliminated due to the wealth of instruction being provided in the score.[38] However, Ferneyhough presents the score as though it is 'a map, incorporating a variety of paths through which the performer, instead of the composer, becomes the musical filter'.[39] He explains:

> Things in the present-day would surely move rather quickly. It seems rather anomalous to expect our art to be easily understandable; I don't see music as providing a sort of breathing space between bouts of confrontation with the outside world! It is also not directly about offering privileged insights, but more about how to create *one's own insights* when immersed in the complex ambiguity of the art object.[40] [Emphasis added]

In this sense, Ferneyhough actually uses a descriptive approach to notation where he invites the performer to create their 'own insights' and interpretations. Notation has also been exploited to test the limits of musical theory and practice, and to speculatively explore what is possible in performance, and Ferneyhough certainly does push notational boundaries as part of his generative, process-driven compositional methodology. This will be discussed later in chapters 6-8.

The prescriptive and descriptive aspects of musical notation speak to the fundamentally reciprocal interaction between notation and performance. Notation facilitates a chain of communication from composer to performer, and from performer to listener.[41] Ultimately, the evolution of time signatures is a fascinating example of these prescriptive and descriptive aspects of notation, and this will be explored in more detail in the next chapter.

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[38] Key, "Pan-Rational," 265; Duncan, "The Concept of New Complexity," 5.
[39] Duncan, "The Concept of New Complexity," 3, 20.
[40] Ferneyhough, *Collected Writings*, 373; as quoted in Duncan, "The Concept of New Complexity," 2-3.
[41] Kelly, "Notation I," 236. See also the discussion of the 'clear communicative chain' by Frank Cox, "Notes Toward a Performance Practice for Complex Music," in *Polyphony and Complexity, Music and Aesthetics in the 21st Century*, eds. Claus-Steffen Mahnkopf, Frank Cox and Wolfram Schurig (Hofheim: Wolke Verlag, 2008), 71-74; Roger Smalley, "Some Aspects of the Changing Relationship between Composer and Performer in Contemporary Music," *Journal of the Royal Music Association* 96 (1969/1970): 73-75; as cited in Duncan, "The Concept of New Complexity," 21-25. Compare to counter-arguments by Roger Redgate, "On Music, Philosophy, and Creativity," *Naked Punch* 6 (Spring 2006): 99-100; Ferneyhough, *Collected Writings*, 3; as cited in Duncan, "The Concept of New Complexity," 26-27.

What is significant about the research presented in this project is the broad array of uses of OFTSs taken from different compositional approaches. This will not only inform future compositional techniques and methodologies, but it will also aid in performance practice, as performers will be able to better comprehend the composer's intent, which will in turn enhance their execution of the score. Furthermore, a particularly unique portion of this research is found in chapter 2, which focuses on the interpretational ambiguities of OFTSs (a topic that has not yet been comprehensively covered in writings on OFTSs).

As music in the Western Art canon has evolved throughout the past few centuries in particular, time signatures have come to represent much more than the fundamental conception of metre in a piece of music. As will be discussed later with regard to the case study pieces, their utility has expanded to incorporate other musical parameters and para-musical relationships, such as rhythm, tempo, and time-related proportionalities. Therefore, this project will focus on the notational convention of OFTSs and all its musical implications rather than examining the parameter of metre alone.

Chapter 1: Theoretical Underpinnings of Odd-Factored Time Signatures

Preliminary Definitions and the Common-Practice Conceptualisation of Time Signatures and Metre

Before discussing OFTSs, we must first apprehend the common-practice understanding of the construction of time signatures. This will allow us to better comprehend what conventions OFTSs are developing and advancing, as well as the value OFTSs provide.

Furthermore, it should be noted that this project is not a study on metre. Metre is a sophisticated and nuanced phenomenon in tonal music that exhibits clear periodicity. The music being analysed in this dissertation does not have consistent periodicity, and at times does not have any discernible periodicity at all. Therefore, it is not always possible to be analysing metre in the context of the repertoire being explored.

This project focuses specifically on how OFTSs are used as a technical element to manage time flow and rhythm. Consequently, the literature on metre will not be dealt with in any extensive way, and the following preliminary definitions and conceptualisations are to provide a consistent taxonomy for this dissertation.

Jordan Alexander Key detailed an extensive history of rhythmic development in his dissertation, and he specifically highlighted rhythmic and metrical innovations of the Middle Ages, Renaissance period, and 20th century.[42] I will be particularly drawing on some of his commentary surrounding the rhythmic diversity of the 20th century throughout this chapter.[43]

As a first step in apprehending the common-practice understanding of time signatures and metre, the base layer of a fundamental pulse stream is laid. This base pulse stream may be made explicit by sounded durations, or it may be implied.

[42] Key, "Pan-Rational," 45-48.
[43] Key, "Pan-Rational," 170-301.

For the purposes of this project, a *pulse stream* will be defined as a distinct, regular continuity of implied pulses.[44] In other words, 'a series of repeated durations' which is 'created when at least two equal timespans are marked off by three… timepoints' or onsets.[45]

Continuity is both 'an association between two percepts, formed when the second realises a mental projection that was made as part of the first', and—more simply—'the 'directedness' of 'structured time''.[46] The reason why pulse streams are defined in terms of continuity is because they are '[reactivated] by suitable accents at expected timepoints', in line with the notion that 'continuity [generally] manifests itself in sequences' or successions.[47]

More fundamentally, *pulses* themselves will be identified as the repeating, evenly-spaced articulations within the flow of musical time, which are not necessarily phenomenally present.[48] Pulses arise 'through the listener's cognitive and kinaesthetic response to the rhythmic organisation of the musical surface'.[49]

The base fundamental pulse stream is then grouped into periodicities by *accents*, which are generally implied.[50] However, when sounded, the accents will have more prominence by way of articulation, alteration in dynamics, lengthened duration, or a

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[44] Sachs, *Rhythm and Tempo*, 15-16.
[45] John Roeder, "Interacting Pulse Streams in Schoenberg's Atonal Polyphony," *Music Theory Spectrum* 16, no. 2 (1994): 232-233; John Roeder, "Pulse Streams and Problems of Grouping and Metrical Dissonance in Bartók's "With Dreams and Pipes"," *Music Theory Online* 7, no. 1 (2001): https://mtosmt.org/issues/mto.01.7.1/mto.01.7.1.roeder.html; Danuta Mirka, *Metric Manipulations in Haydn and Mozart: Chamber Music for Strings 1787-1791* (Oxford: Oxford University Press, 2009), 4.
[46] Roeder, "Co-operating Continuities," 122, 150. On continuity as 'an association between two percepts', Roeder cites Christopher F. Hasty, "Rhythm in Post-tonal Music: Preliminary Questions of Duration and Motion," *Journal of Music Theory* 25, no. 2 (1981): 189-190; Christopher F. Hasty, "On the Problem of Succession and Continuity in Twentieth-Century Music," *Music Theory Spectrum* 8 (1986): 59. On 'the 'directedness' of 'structured time'', Roeder cites Barbara R. Barry, *Musical Time: The Sense of Order* (New York: Pendragon Press, 1990), 251-252.
[47] Roeder, "Interacting Pulse Streams," 234; Roeder, "Co-operating Continuities," 122.
[48] Justin London, "Pulse," in *Grove Music Online, Oxford Music Online*, http://www.oxfordmusiconline.com, accessed August 14, 2023.
[49] Ibid.
[50] Sachs, *Rhythm and Tempo*, 27.

variety of other techniques.[51] *Periodicities* are regarded as the repetition or recurrence of content at regular intervals.[52]

In music of the common practice, the durations of these periodicities are usually delineated by the bar line, and the strongest accents fall on consistent points within each bar, thus producing metre.[53] The generated periodicities may create *syncopations* relative to the notated metre where a weak beat or pulse is accented due to a rhythmic shift against the normal metric positioning of beats and pulses.[54]

Metre arises from two or more hierarchically-nested pulse streams (i.e. when another slower or faster pulse stream is placed in alignment with the base fundamental pulse stream).[55] The more pulse streams that are layered, the stronger the sense of metric hierarchy, and therefore the general sense of metre, in common practice. Some pulse streams will be faster, and therefore shorter; while others are slower, and therefore longer, leading to hypermetre at the phrase and other multi-bar levels.[56]

In music of the common practice, the *time signature* signifies the hierarchic organisation of metre.[57] The denominator of a time signature determines the value of the beat or pulse in a bar, and the combination of both the numerator and denominator dictates the bar duration (as the numerator acts as a multiplier of the duration implied by the denominator).

To differentiate pulses from beats, *beats* are regarded as 'regularly spaced timepoints' throughout the bar used as 'a metric for rhythm', compared to pulses, which

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[51] Hasty, *Meter as Rhythm*, 8; Matthias Thiemel, "Accent," in *Grove Music Online, Oxford Music Online*, http://www.oxfordmusiconline.com, accessed August 14, 2023.
[52] Michael Tenzer, "Generalized Representations of Musical Time and Periodic Structures," *Ethnomusicology* 55, no. 3 (2011): 371.
[53] For metre as 'duration by length' or rhythmic organisation by duration, see Sachs, *Rhythm and Tempo*, 27; for the concepts of the bar and bar line, see David Hiley, "Bar," in *Grove Music Online, Oxford Music Online*, http://www.oxfordmusiconline.com, accessed August 14, 2023.
[54] "Syncopation," in *Grove Music Online, Oxford Music Online*, http://www.oxfordmusiconline.com, accessed August 25, 2023.
[55] Cooper and Meyer, *The Rhythmic Structure of Music*, 4; Mark Gotham, "The Metre Metrics: Characterising (dis)similarity among metrical structures" (PhD dissertation, University of Cambridge, 2015), 6-7.
[56] Edward Cone, *Musical Form and Musical Performance* (New York: Norton, 1968), 39-42; Jason Yust, "Hypermeter," in *Organized Time: Rhythm, Tonality, and Form* (New York: Oxford University Press, 2018), 123; Mark Gotham, "Hypermeter," Open Music Theory, accessed September 29, 2023, https://viva.pressbooks.pub/openmusictheory/chapter/hypermeter/.
[57] Rastall, "Time signature."

make the rhythm itself.[58] For the purposes of this project, pulses form the subdivisions of beats.[59] So for example, in ***6/8*** time, the pulse would be a 𝅘𝅥𝅮 pulse, whereas the beat would be a 𝅗𝅥. (hence why ***6/8*** is conventionally regarded as compound duple time).

Fred Lerdahl and Ray Jackendoff provide a list of Metrical Well-Formedness Rules (MWFRs) which listeners may use (knowingly or unknowingly) to 'associate a metrical structure with a musical surface':[60]

> MWFR 1: Every attack point must be associated with a beat at the smallest metrical level present at that point in the piece.
> MWFR 2: Every beat at a given level must also be a beat at all smaller levels present at that point in the piece.[61]
> MWFR 3: At each metrical level, strong beats are spaced either two or three beats apart.[62]
> MWFR 4: The tactus [i.e. the level of beats that is conducted and with which one must naturally coordinate foot-tapping] and immediately larger metrical levels must consist of beats equally spaced throughout the piece. At subtactus metrical levels, weak beats must be equally spaced between the surrounding strong beats.[63]

Lerdahl and Jackendoff assert that these MWFRs help the listener to identify metre in common-practice, tonal music. Their appropriateness and application with regard to non-tonal music (and, more specifically, music involving OFTSs) will be discussed towards the end of this chapter.

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[58] Roeder, "Interacting Pulse Streams," 234, footnote 12. N.B. Roeder also comments on the fact that there are some psychologists who do not make a distinction between pulses and beats. According to Kramer, *The Time of Music*, 37, pulses are heard as an event in the music, whereas beats are intuited and implicit. Needless to say, there are many different definitions and delineations for pulse and beat, but the ones provided above will be utilised for the remainder of the thesis.
[59] Hasty, *Meter as Rhythm*, 26; Cooper and Meyer, *The Rhythmic Structure of Music*, 4-5.
[60] Fred Lerdahl and Ray Jackendoff, *A Generative Theory of Tonal Music* (United States of America: The Massachusetts Institute of Technology, 1983), 68.
[61] Lerdahl and Jackendoff, *A Generative Theory*, 72.
[62] Lerdahl and Jackendoff, *A Generative Theory*, 69.
[63] Lerdahl and Jackendoff, *A Generative Theory*, 71-72.

Challenging the Common-Practice Conceptualisation of Time Signatures and Metre

One final but foundational point to note about the common-practice understanding of metre is that metre's regularity can be intuited, projected, and/or entrained to after at least two repetitions.[64] This predictability, or 'expectation of regularity', is crucial to the conceptualisation of metre.[65] Therefore, the most significant hindrance to the application of this common-practice construction of metre is when the music being scrutinised involves constant irregularity in musical time (e.g. in the tempo, periodicities, phrasing, or bar lengths).[66]

Constant irregularity in musical time is found frequently in much of the non-tonal music of the 20th and 21st centuries (especially when compared with tonal works). Often, in such music, the quality and duration of beats and pulses are in a constant state of flux from bar to bar, as are the tempi, pulse speeds, and accent placements (thus also affecting note groupings). In this fluctuating context, it is much more difficult—and sometimes impossible—to entrain to and project the metre for a sustained period of time.

The rhythms of non-tonal music may at times involve irregular accents that do not conform to the notated time signatures due to the extreme interplay of rhythmic complexity.[67] Rhythms may not conform to any single regular pulse, as seen in Example 1.1 'wherein one can see 3:4:5:9 [rhythmic proportions] all contextualized with complex… syncopations'.[68] The quintuplet rhythms in the trombone particularly play against the regular pulse of both time signatures as it plays 5:4-quintuplets in the ***4/4*** bars but 5:3-quintuplets in the ***3/4*** bars. Sometimes, certain rhythms may even work against the metre implied by the time signature, as will be discussed later in greater detail with Example 1.28.

[64] London, *Hearing in Time*, 4-5; Hasty, *Meter as Rhythm*, 84; Gotham, "The Metre Metrics," 6.
[65] David Epstein, *Beyond Orpheus: Studies in Musical Structure* (Oxford: Oxford University Press, 1987), 60.
[66] Roeder, "Co-operating Continuities," 134.
[67] Ibid.
[68] Key, "Pan-Rational," 172.

Example 1.1: Charles Ives, *Tone Roads No. 3* (bars 4-9), selected parts.[69]

The sense of a hierarchical metric structuring of multiple layers of pulse streams is often substituted for far more complex surface-level rhythms in non-tonal music (in a sense, similar to the complexity found in the music of the ars subtilior style).[70] Just as

[69] Charles Ives, *Tone Roads No. 3* (New York: Peer International, 1952), 5-6.
[70] For a detailed discussion regarding the rhythmic and notational innovations of the ars subtilior, see Key, "Pan-Rational," 59-78; Anne Stone, "Ars subtilior," in *The Cambridge History of Medieval Music*, eds. Mark Everist and Thomas Forrest Kelly (United Kingdom: Cambridge University Press, 2018), 1125-1146.

harmonic dissonance was emancipated in a non-tonal context, it may be argued that so too were rhythmic and metric dissonance.[71] The musical parameters that impact formal structure (and the very concept of formal structure itself) are challenged and reimagined in much of non-tonal music, and this will be explored in greater depth in the case studies of this project, particularly in chapters 5 and 8.

The Historical Context and Evolution of Odd-Factored Time Signatures[72]

Now that we have established that the common-practice conceptualisation of metre is not suitable for non-tonal music, and that it does not adequately explain the historical progression that led to the invention of OFTSs, we must ask the question: *what does*?

I had debated whether or not to answer this question in a chronological fashion, similar to how Key provided a concentrated historical survey which covered the rhythmic, metric, and notational innovations (characteristic of 'the "counter-revolutions" to [rhythmic notational] "standardizations"') of the ars subtilior in the late 14th and early 15th centuries, the Elizabethan avant-garde in the late 16th century, and the further experimentations of the 20th century.[73] However, a more optimal way to present the historical context and evolution of OFTSs would be to trace the conceptual alterations required to transform a metrically and notationally simple piece of music to one which invites the use of OFTSs.

For the sake of argument, let us assume that the starting point is an initial piece of music that has only one time signature and adheres to all of Lerdahl and Jackendoff's MWFRs. (Although most 20th-century composers would contest the second *prima facie* assumption, the adherence to the MWFRs is included for the coherence and flow of the following argument.) Given these assumptions, what changes need to be made to the initial piece of music in the realms of metre, rhythm, and tempo to lead to the use of OFTSs?

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[71] Arnold Schoenberg, *Style and Idea: Selected Writings of Arnold Schoenberg*, ed. Leonard Stein (New York: St. Martins Press, 1975): 258-264; Key, "Pan-Rational," 209-220.
[72] The remainder of this chapter was inspired by and is heavily derivative of conversations I had with Elliott Gyger in several supervisor meetings.
[73] Key, "Pan-Rational," 49-50.

Cowell laid the groundwork for the conceptualisation of OFTSs in *New Musical Resources* by addressing three fundamental concerns: 1. Metre as 'the result of rhythmically regular accent'; 2. Using the 𝅝 as the fundamental unit of musical time and then exploring the process of subdividing it in ways other than halving; and 3. The proportional relationship between differing consecutive tempi.[74]

1. Note Grouping

Example 1.2: Johannes Brahms, Piano Sonata No. 1 in C Major, mvt. IV (bars 25-32).[75]

Consider music in which the rhythmic accents are placed at irregular and/or inconsistent intervals along the pulse stream, effectively giving rise to or articulating pulse groupings different than those suggested by the time signature.[76] (Bear in mind that the term "accent" here is used loosely to refer not only to notes with the accent symbol or loud dynamics, but also to notes with any particular stress, whether that is expressed as longer held or sustained notes, thicker textures such as chords, entries of other instruments, the start of notated phrases, etc.) The final movement of Johannes Brahms' Piano Sonata No. 1, set well within the tonal context, provides several pertinent examples for this starting point.

The movement begins in a very clear ***9/8*** metre, as established by the bass line, which continues to arpeggiate in ascending ♩♩♩ groups. However, at bar 25, Brahms

[74] Cowell, *New Musical Resources*, 49, 53, 66, 90-91.
[75] Johannes Brahms, Piano Sonata No. 1 in C Major (Leipzig: Breitkopf & Härtel, 1926-1927), 23.
[76] This is explored thoroughly and succinctly encapsulated in the first chapter of Harald Krebs, *Fantasy Pieces: Metrical Dissonance in the Music of Robert Schumann* (Oxford: Oxford University Press, 1999), 7.

introduces some rhythmic displacements with syncopated held chords (see Example 1.2).

In Example 1.3, he begins to regroup the rhythms more obviously at bar 45 where the bass line, which had thus far been enforcing the ***9/8*** metre, starts to play six-note phrases, even going so far as to span across the bar line. These six-note phrases in the left-hand also incorporate the right-hand chords.

The metre in Example 1.3 is much more fluid than before; it could be argued that this passage (or at least bars 45-46 and 49-50) should be notated in ***6/8***. Hemiola relationships are arguably one of the most foundational elements of note regrouping, and the metric hemiola produced in the passage below, where the notated ***9/8*** is played in conjunction with rhythms grouped in ***6/8***, makes this such a pivotal moment in the work.[77]

Example 1.3: Brahms, Piano Sonata No. 1 in C Major, mvt. IV (bars 45-51).[78]

Even when both hands come back in rhythmic unison in bars 47 and 51, they synchronise in the middle of each bar after a long-sustained chord, which could easily disorient the listener's sense of the downbeat of each bar. Bar 48 is also difficult to decipher, as the left-hand accent articulation in the middle of the bar contradicts the harmonic change on the downbeat of the bar. Thus, the metric ambiguity is compounded across multiple layers of the music.

[77] Lawrence Earp, "Notation II," in *The Cambridge History of Medieval Music*, eds. Mark Everist and Thomas Forrest Kelly (United Kingdom: Cambridge University Press, 2018), 691-692, 694.
[78] Brahms, Piano Sonata No. 1, 24.

Later, in bar 135, Brahms includes other patterns of 2:3 relationships in the movement by contrasting different subdivisions of the beat (see Example 1.4). The bass line is purposefully playing ***9/8***, to the point where Brahms has notated the left-hand arpeggiations in groups of nine ♪ in bars 135-138. Up until the ***6/8*** time signature change, the right hand is also adhering to the three ♩. beats per bar. However, it begins to regroup the ♪♪♪ groups so that four are being played in the time of three (i.e. the ♪♪♪ groups become ^{2}♩ ^{2}♩ instead).

Example 1.4: Brahms, Piano Sonata No. 1 in C Major, mvt. IV (bars 135-145).[79]

Brahms then begins to alternate between two bars of ***9/8*** and three bars of ***6/8***, definitively regrouping and reaccenting hypermeasures of 18 ♪ through the use of differing time signatures and bar lines (see Example 1.5). This regrouping using changing time signatures was rarely seen prior to the 20th century. However, given the gradual progression of rhythmic displacement and note regrouping throughout the movement, Brahms builds up to this naturally and smoothly.

[79] Brahms, Piano Sonata No. 1, 27.

Example 1.5: Brahms, Piano Sonata No. 1 in C Major, mvt. IV (bars 176-185).[80]

A famous example of regrouping threes to twos (and vice versa) is seen in the song *America* from the musical *West Side Story*. Although Leonard Bernstein's work is within the era when changing metre was already commonplace, it shares commonality with Brahms' piano sonata in that it is still considered within the tonal oeuvre.

There is certainly metre in Example 1.6, to the point where Bernstein actually notates the implied metre in the alternating bars as ***3/4*** in parentheses. The differing accent placements change the note groupings, from two groups of threes in the ***6/8*** bars (i.e. ♩♩♩ ♩♩♩) to three groups of twos in the ***3/4*** bars (i.e. ♩♩ ♩♩ ♩♩), as is typical of huapango music.[81] As this alternating note grouping is borrowed from the Mexican tradition, it naturally does not conceive of metre in the traditional European way.

[80] Brahms, Piano Sonata No. 1, 28.
[81] Gerard Béhague, E. Thomas Stanford, and Arturo Chamorro, "Mexico, United States of (Sp. Estados Unidos Mexicanos)," in *Grove Music Online, Oxford Music Online*, http://www.oxfordmusiconline.com, accessed March 17, 2025; Carter, *The Writings of Elliott Carter*, 162; Henry Schmidt, "The Huapango: A Dithyrambic Festival," Project Muse, published on December 20, 2019, https://muse.jhu.edu/pub/172/oa_monograph/chapter/2473205#:~:text=Traditional%20and%20modern%20sones%20are,4%20or%202/4%20time.

Example 1.6: Leonard Bernstein, *America* from *West Side Story* (rehearsal mark 46), string lines.[82]

A more extreme example of differing accent placements that affect note grouping is found in Stravinsky's *The Rite of Spring*. He sets up the ♪ pulse stream in ***2/4*** time but then begins to tamper with and fluctuate the note groupings by placing accents at irregular intervals.[83] From bar 3 in Example 1.7, the note groupings are set at 1-2-6-3-4-5-3 notes according to the accent placement and coinciding *sforzando* chords.

There may not be metre in Example 1.7 according to the standard, common-practice definition, and indeed some composers such as Boulez argue that *The Rite of Spring* is a departure from metre.[84] This argument is based on the fact that the '[s]elected accents added to the series of quavers do not comply with the notated ***2/4***' and instead 'establish the fleeting presence of a conflicting aural ***2/4***'.[85] However, despite the note groupings seeming unpredictable when first experienced, it could be argued that this particular passage can still be entrained to and projected over time upon multiple hearings due to the fact that the whole rhythmic pattern '[recurs] at different points in the dance'.[86]

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[82] Leonard Bernstein, *America* from *West Side Story* (New York: Boosey & Hawkes, 1957), 175-176.
[83] See also Carter's discussion of Stravinsky in Carter, *The Writings of Elliott Carter*, 161.
[84] Pierre Boulez, "Stravinsky Remains," in *Stocktakings from an Apprenticeship*, ed. Paule Thévenin, trans. Stephen Walsh (Oxford: Clarendon Press, 1991), 56-57, 68-70; Wai Ling Cheong, "*The Rite of Spring*: Rhythmic Rebirths as Delivered by Messiaen and Boulez," in *Zeitgestalten – Zeit gestalten: Festschrift für Gesine Schröder zum 60. Geburtstag*, eds. Martina Sichardt, Christoph Hust and Constanze Rora (Hildesheim: Georg Olms Verlag, 2019), 27-29.
[85] Cheong, "*The Rite of Spring*," 27.
[86] Cheong, "*The Rite of Spring*," 29.

Example 1.7: Igor Stravinsky, *The Rite of Spring* (rehearsal mark 13).[87]

Furthermore, the rest of the music in this section of *The Rite of Spring* is fairly straightforward in its adherence to the ***2/4*** time signature. Therefore, the listener is effectively given multiple attempts at making sense of the irregular rhythm within the ***2/4*** metric framework.

This notion of potentially entraining to an irregular rhythm by exposure to larger repeated units of time will be encountered again when Ferneyhough uses OFTSs to signify bar durations, as discussed towards the end of chapter 6. There will be detailed discussion surrounding Ferneyhough's argument that the subtlety of cognitive perception to delineate 'expressions of ratio relationships and proportionally-related structures' is exploited over a piece's relatively long period of time.[88]

Thus far, the note regroupings have been consecutive and adjacent. In contrast, the third movement of Béla Bartók's String Quartet No. 5 explores the superimposition of various note regroupings (see Example 1.8).[89] The numerator of the time signature is already peculiar; "***4***+***2***+***3***" indicates different note groupings to the usual ♩♩♩ groups

[87] Igor Stravinsky, *The Rite of Spring* (Berlin: Editions Russes de Musique, 1921), 11.
[88] Brian Ferneyhough, "Duration and Rhythm as Compositional Resources," in *Brian Ferneyhough: Collected Writings*, ed. James Boros and Richard Toop, 52.
[89] See also Carter's discussion of Bartók in Carter, *The Writings of Elliott Carter*, 161.

inferred by the normal ***9/8*** time signature. Additionally, he starts to superimpose different note groupings on top of each other.

Example 1.8: Béla Bartók, String Quartet No. 5, mvt. III "Scherzo" (bars 33-43).[90]

Initially, in bars 33-35, the violin 2 and viola lines are in canon with the cello, and so the cello figures are rhythmically displaced by a ♩ duration. Although this may seem like the superimposition of different note groupings, it comes in earnest in bar 36 where the violins and viola lines break away from the 4-2-3 note groupings entirely due to the

[90] Béla Bartók, String Quartet No. 5 (New York: Schott Music, 1934), 36-37.

consecutive 𝅗𝅥 𝅗𝅥 𝅗𝅥 𝅗𝅥 figures. They are played against the cello which, from the beaming, seems to continue the original note groupings; however, the phrase marks (and implied phrasal accents) indicate otherwise. These differing accent placements and note groupings are the fundamental first step towards OFTSs.[91]

2. Different Divisions of the Semibreve

Both Cowell and other composers have identified the 𝅝 as the fundamental unit in the measurement of musical time.[92] The denominator of a time signature is derived from how the 𝅝 is subdivided to 'vary the length of the time-unit' of a metre's beat value.[93] However, Cowell goes on to identify the limitations with the current system of rhythmic notation:

> But if we wish to introduce into a composition a whole measure of normal length divided into three notes of equal length, there is no way of doing so except by the clumsy expedient of writing the figure 3 over three successive half-notes filling a measure. In other words the notes as written down have a certain time-value impossible under the circumstances, and the discrepancy is reconciled by explaining that in reality notes of a different time-value are intended.[94]

The principle of subdividing a 'musical measure by a different number of subunits: 2 or 4 in the time of three, 4 in the time of 9 and so on', thereby creating tuplets, has existed since the ars subtilior movement.[95] This is not a new phenomenon, but when the modern notational system started to harbour a propensity toward binary subdivisions, different subdivisions of the 𝅝 and other musical measures were neglected.

The development towards different subdivisions can be seen in the second movement of György Ligeti's *Chamber Concerto* (see Example 1.9). The 𝅗𝅥 beat initially

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[91] Key explores how different *rhythmic* notations could be used to indicate various strata of note groupings and beat 'partitions' in much greater depth: see Key, "Pan-Rational," 34, 37-38, 206. However, I will not be discussing this in detail as I am concentrating only on the uses of OFTSs. The notational convention of time signatures alone cannot provide the necessary level of information succinctly or effectively. OFTSs themselves actually create ambiguities in this area which will be further explored in chapter 2 of this thesis.
[92] Cowell, *New Musical Resources*, 49; Brian Ferneyhough, *Etudes Transcendantales* (London: Edition Peters, 1982–85), 6; Creston, *Rational Metric Notation*, 35.
[93] Cowell, *New Musical Resources*, 49.
[94] Cowell, *New Musical Resources*, 49-50.
[95] Stone, "Ars subtilior," 1132.

stays at the same tempo, but he proceeds to subdivide it in different ways. In bars 57-60, he crossfades the subdivisions from sextuplets, to quintuplets, to the normal groups of four (i.e. 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯), and finally to triplets. Ignoring the superimposed *allargando* at bar 60 and subsequent tempo changes, and looking purely at the notated note durations, the beat speed and duration remain consistent (i.e. at the ♩).

Example 1.9: György Ligeti, *Chamber Concerto*, mvt. II (bars 56-69), violin 1 line.[96]

These different subdivisions of the beat speak to the idea of relative pulse speeds. Instead of the performer conceptualising each tuplet speed at a precise BPM mark, bar 57 deals with a pulse speed ratio of 6:5, compared to the 5:4 ratio in bar 58 and the 4:3 ratio in bar 60. There is an enforced deceleration of pulse speed despite the fact that the ♩ beat tempo has remained consistent throughout those bars (up until the *allargando* at bar 60).

Elliott Carter uses a similar technique in *Triple Duo*, except he layers and superimposes the different subdivisions on top of one another instead of sequentially. So, in Example 1.10, where the time signature is also ***4/4***, the strings play in normal 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 groups while the piano and percussion are in quintuplets, and the wind instruments play triplets. However, as with the previous example, it is important to note that the ♩ beat lengths remain the same. This notation enables the projection of contrasting pulse speeds while keeping the notated beat duration consistent.

[96] György Ligeti, *Chamber Concerto* (New York: Schott Music, 1969-1970), 52-58.

Example 1.10: Elliott Carter, *Triple Duo* (bars 4-6).[97]

Ferneyhough takes this a step further by not only subdividing the 𝅝 fundamental unit, but by conceptualising the length of a bar as a duration to be subdivided as well:

> […] a measure is not primarily a unit of emphasis […] but a space, serving to delimit the field of operations or presence of specific sound qualities, of musical processes. The consistency of iterative impulses serves primarily to set off the limits, operative boundaries between one such space and another.[98]

This is akin to earlier mensural theory based on the 'principle of division' where

> Duration represented by a rhythmical value equivalent to one measure was subdivided into shorter durations. By recursively applying this operation to lower metrical levels, music theorists were able to account for various metrical hierarchies encountered in individual pieces.[99]

Subdividing the bar as a structural unit will not only be explored in more detail in the *Mort Subite* case study in chapter 8, but it will also be discussed later in this chapter with regard to the ***3/8*** bar in Example 1.28 (which is divided into quarters instead of thirds as the numerator of the time signature would imply).

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[97] Elliott Carter, *Triple Duo* (New York: Hendon Music, 1983), 1.
[98] Ferneyhough, "Duration and Rhythm," 52.
[99] Mirka, *Metric Manipulations*, 3.

In Ligeti's *Étude 13: L'escalier du diable*, the technique of subdividing the bar is taken a step further by the irregular regrouping of notes in a hypermetrical context (see Example 1.11). Although the time signature is ***12/8***, he includes a footnote indicating that the real metre is every three ***12/8*** bars. The overall rhythm of bar 5 is replicated in bar 6. The rhythms locally adhere to asymmetrical note groupings of twos and threes, while in a broader phrasal context, they are in groups of seven, nine, and 11 notes (i.e. the end of each phrase is indicated by two-note slurs).

Example 1.11: György Ligeti, *Étude 13: L'escalier du diable* (bars 5-6).[100]

Ligeti admits that the ***12/8*** time signature merely serves as a notational aid, and as a result, the ♩. beat implied by the compound time signature is not observed. Even the metronome mark refers to the 𝅗𝅥. unit instead of the normal ♩. beat. The hypermeasures of 36 ♪ are presented as the true structural units of the piece, as can be seen by the bar numbering and dotted bar lines.

[100] György Ligeti, *Étude 13: L'escalier du diable* (New York: Schott Music, 1985), 48-49.

However, the time signature of ***36/8*** would not be practical to notate, as that would not be conducive to the performer's comprehension of the work. The metronome mark of 𝅗𝅥. = 30 can be counted and felt by the performer, whereas 𝅘𝅥𝅯𝅗𝅥. 𝅗𝅥. = 10 would not be. These practical considerations are likely why the hypermeasure of ***36/8*** was not notated as the actual time signature.

In Example 1.11, Ligeti combines the idea of note regrouping using irregular accent placement with the notion of subdividing the structural unit in ways other than halving. However, the subdivisions here are not only tuplets, which are equal subdivisions by nature; they are *asymmetrical* subdivisions of the hypermetrical unit. This presents a slight tangent away from OFTSs, as OFTSs still adhere to the equal subdivision of the bar.

3. Metric Modulation

Considering Cowell's third concern regarding the proportional relationships between differing consecutive tempi, he explains:

> In current musical practice the tempo of a given piece is the same for all the parts that are being played simultaneously, and it is likely to be the same, if not for the entire piece, at least for a passage of considerable length. If the tempo is changed within a given piece, there is no system determining the ratio between the consecutive tempi. Usually the relative speed of two portions is not evenly accurately designated, but merely indicated by the general captions, fast, slow; or *allegro, adagio*.[101]

There is imprecision involved in the subjective tempo labelling systems to which Cowell is referring. Thus far, this chapter has examined note regroupings due to different placements of accents as well as the establishment of different pulse speeds as enacted by different subdivisions of the 𝅗𝅥 fundamental unit, bar, or other musical structural unit.

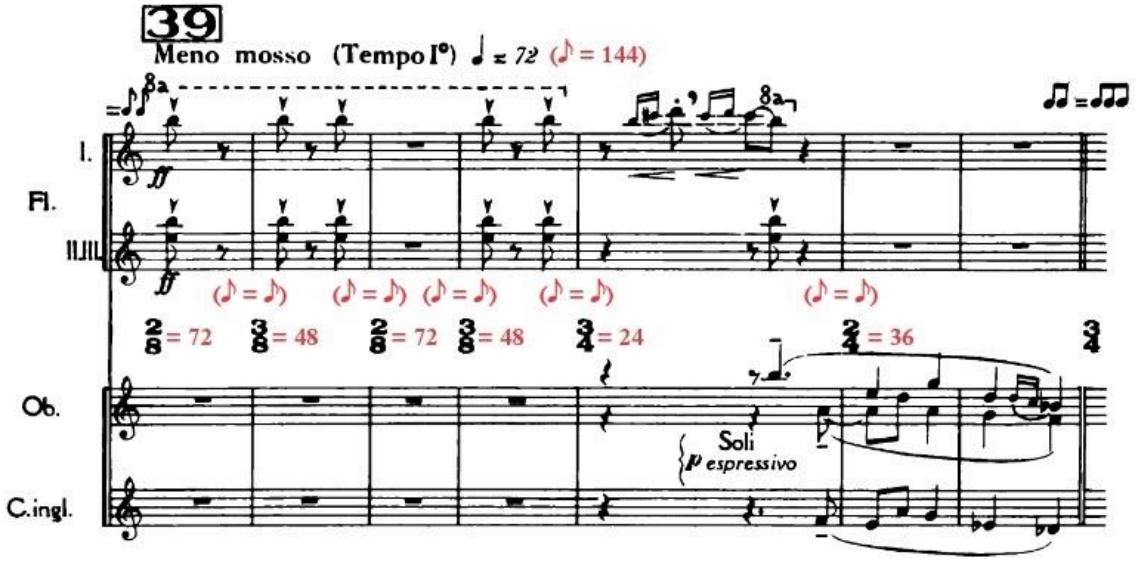
The penultimate step leading up to OFTSs occurs when the regrouping extends to the metre and the time signature, and thus, we encounter metric modulation. Lorraine Vaillancourt specified three prerequisites for metric modulation to occur:

[101] Cowell, *New Musical Resources*, 90-91.

1. 'There has to be an exact relationship between two different tempi
2. A common pulse must exist between these two tempi
3. The name and function of the pulse changes.'[102]

Unlike Examples 1.9 and 1.10, where the beat lengths remained consistent, in Stravinsky's *Symphonies of Wind Instruments*, the pulse durations are the constant factor instead. Example 1.12(a) is similar to the passage from *The Rite of Spring*, except in Example 1.7, the note groupings were not delineated by bar lines. The ***2/8***, ***2/4***, and ***3/4*** bars in the below example have ♩ beats. The ***3/8*** bars have ♩. beats (as ***3/8*** is a compound time signature). The ♪ pulse durations are shared across all time signatures and they are maintained across the bar lines.

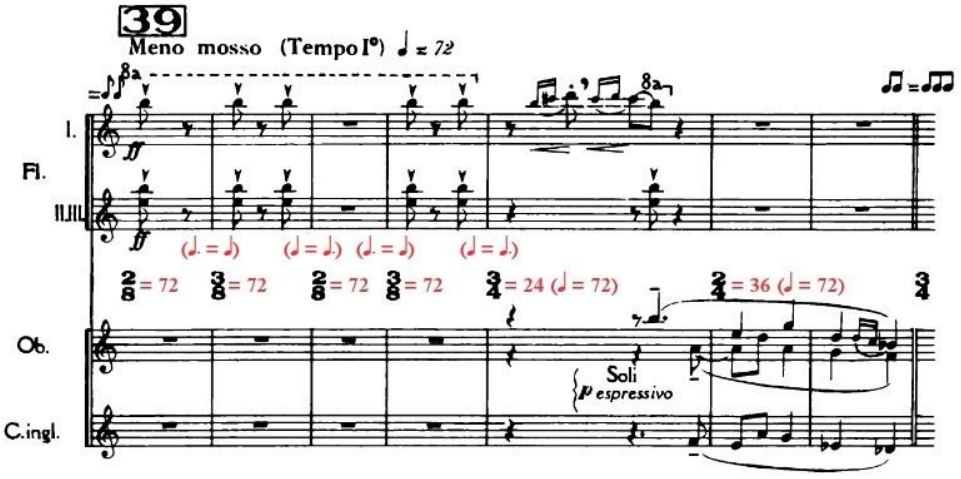
Example 1.12(a): Igor Stravinsky, *Symphonies of Wind Instruments* (rehearsal mark 39), selected parts.[103]



As per the metronome mark, if ♩ = 72, then ♪ = 144. The red annotations refer to the total bar durations as expressed as metronome marks due to the ♪ = ♪ metric modulation. If Example 1.12(a) were to keep the *beat* durations consistent (like Examples 1.9 and 1.10) instead of the ♪ *pulse* (as was originally notated), this would change the tempo of the ***3/8*** bars as that would involve ♩. = ♩ metric modulation instead (see Example 1.12(b)).

[102] Elliott Carter and Lorraine Vaillancourt, *Elliott Carter* (Outremont: Disques Atma, 2001), 15; as quoted in Key, "Pan-Rational," 226.
[103] Igor Stravinsky, *Symphonies of Wind Instruments* (Berlin: Edition Russe de Musique, 1926; revised New York: Boosey & Hawkes, 1952), 18.

Example 1.12(b): Example 1.12(a) with different metric modulation annotations.[104]



With the ♩. = ♩ metric modulation, the ***3/8*** bars would enact an artificial acceleration instead which was not intended in the original score. If ***3/8*** = 72, then ♩. = 72, which means ♪ = 216 (which is 1.5 times faster than the ***2/8*** bar's ♪ = 144).

The concept of alternating bars of different lengths with a consistent pulse speed was something Stravinsky was already notating in *Petrushka* and *The Rite of Spring*. *Symphonies of Wind Instruments* is the first time in which he gears together different tempi with strict proportional relationships, and it is also the first time he uses it as a structural device to unify the entire piece.

The most noteworthy part of the passage in Example 1.12(a) is actually the ♫ = ♬ metric modulation at the end of the system, so the excerpt has been extended to include the next system in Example 1.13. This demonstrates how the metric modulation simultaneously affects the pulse speeds and bar durations.

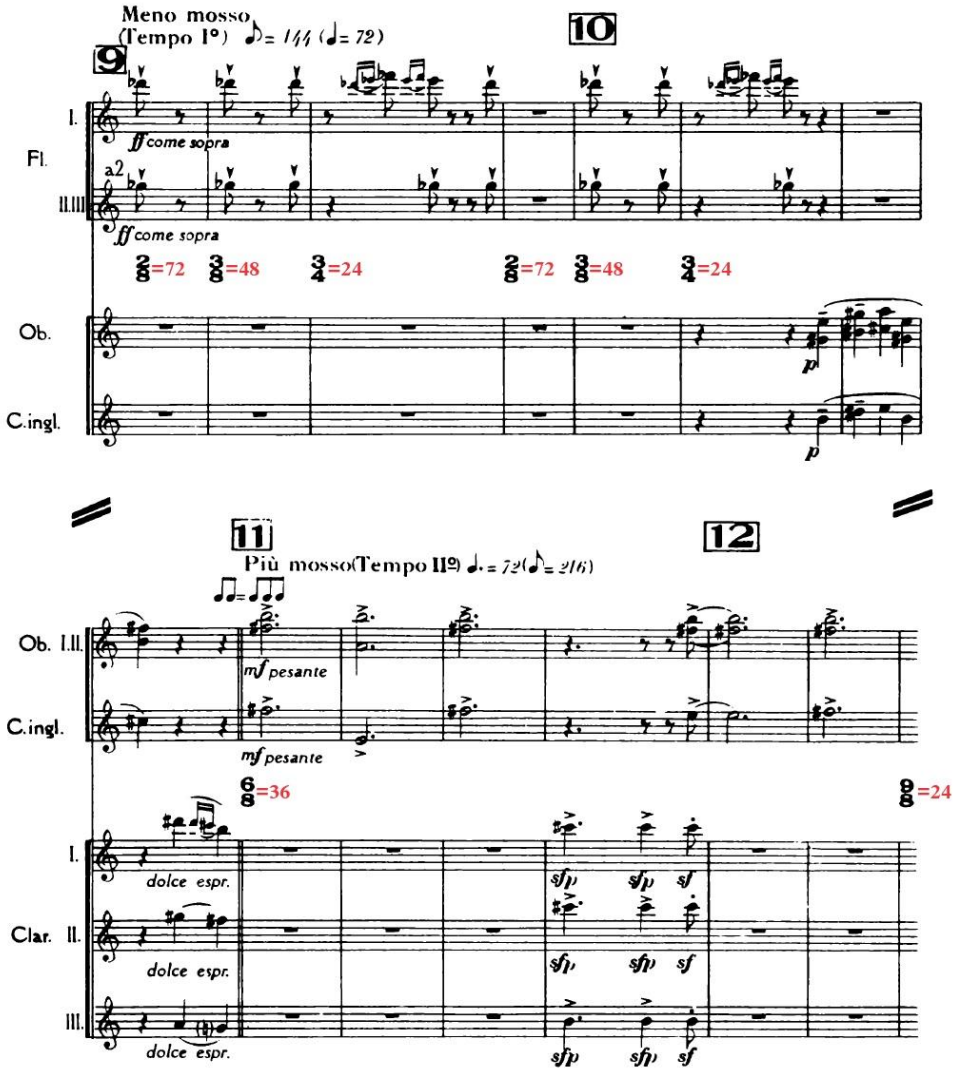
[104] Ibid.

Example 1.13: Stravinsky, *Symphonies of Wind Instruments* (rehearsal marks 39-40), selected parts.[105]

The first time the ♫ = ♬ metric modulation appears is much earlier at rehearsal mark 11 (see Example 1.14). In this earlier section, the metric modulation is conceptually profound but practically milder than Example 1.13, as the music in the example below transitions from ***3/4*** to ***6/8***, which would normally be the same bar length without metric modulation. However, due to the ♫ = ♬ (i.e. ♩ = ♩.) marking, it changes both the pulse speeds and bar durations. Although in contemporary music, this is a common use of a 2:3 proportional relationship executed through a metric modulation, it was rarely seen at the time.

[105] Ibid.

Example 1.14: Stravinsky, *Symphonies of Wind Instruments* (rehearsal marks 9-12), selected parts.[106]

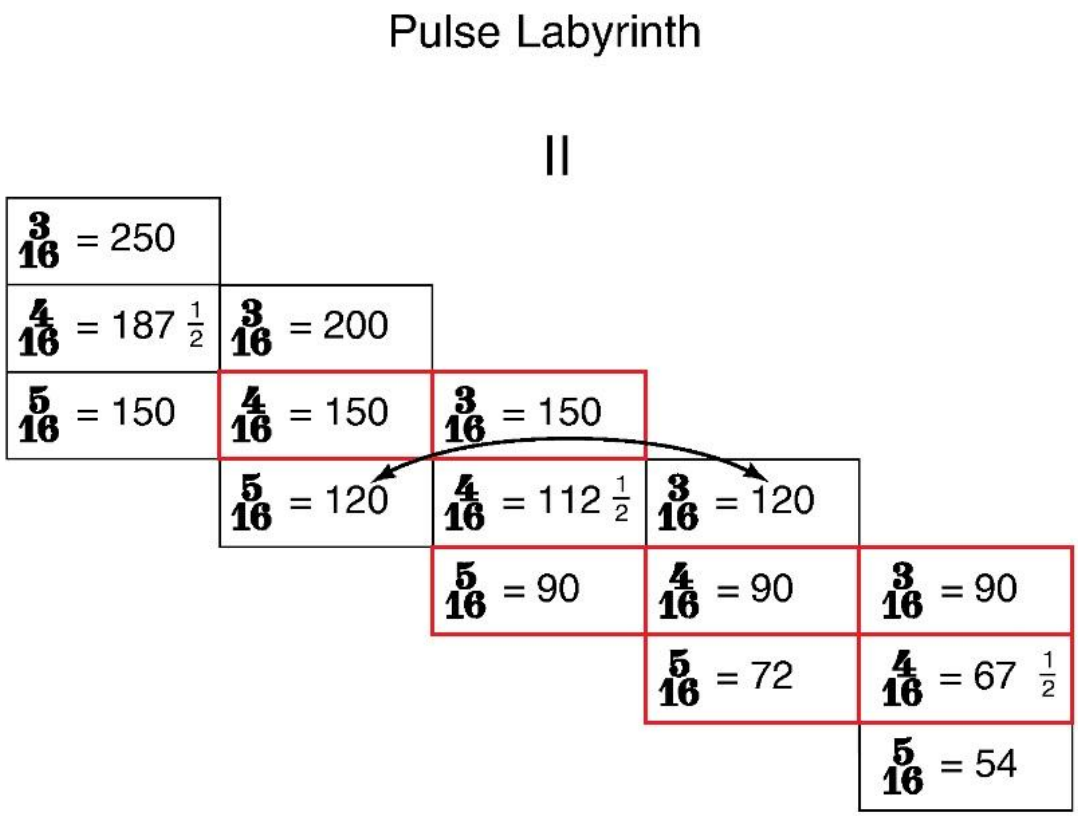


In possibly the most didactic example, Harrison Birtwistle systematically explores the potential of metric modulation in *Silbury Air* when the music alternates between keeping the slower and faster pulse durations consistent across bar lines. Example 1.15 is a rhythmic reduction of rehearsal marks 7-9 (bars 78-96).[107] The centred, parenthesised time signatures and solid bar lines in the example below refer to what is actually written in the original score, but the time signatures used in the staves and the dotted bar lines are specified due to the intended procedures referenced in the Pulse Labyrinth (which is detailed in Example 1.16).

[106] Stravinsky, *Symphonies of Wind Instruments*, 6-7.
[107] Harrison Birtwistle, *Silbury Air* (London: Universal Edition, 1979), 14-19.

Example 1.15: Rhythmic reduction of Harrison Birtwistle, *Silbury Air*, rehearsal marks 7-9 (bars 78-96).

Example 1.16: Birtwistle, *Silbury Air*, Pulse Labyrinth II.[108]



The red-box highlights in the Pulse Labyrinth indicate the specific metric modulations used in Example 1.15. Each box displays the absolute bar duration, and thus the slower pulse, given as a metronome mark (e.g. "***3/16*** = 150" would mean ♪. = 150 BPM). Each column shares the same ♪ (faster) pulse duration (i.e. ♪ = ♪ metric modulation), and certain rows that share the same metronome marks would provide a way to transition and metrically modulate to other columns (as they share the same slower pulse duration). Birtwistle states in his programme note that:

> The Pulse Labyrinth shown at the start of the score is not intended as a conducting aid. Rather, it gives an indication of the compositional logic behind the interrelationships of tempi used in the piece. This is based on a process of continuous metric modulation.[109]

In the second system of the score in Example 1.15, transitioning from ***4/16*** (***3/4***) at ♩ = 150 to ***3/16*** (***9/16***) at ♪. = 150 would involve the slower pulse remaining consistent. The top two red boxes of the Pulse Labyrinth in Example 1.16 are the corresponding

[108] Birtwistle, *Silbury Air*, Pulse Labyrinth.
[109] Birtwistle, *Silbury Air*, programme note.

metronome marks. When it changes to ***5/16*** (***25/16***) at ♩ ♪ = 90 in the third system of the score, the ♪ (faster) pulse stays the same (hence the corresponding red box in the Pulse Labyrinth shares the same column as ***3/16*** = 150).

Essentially, any time the metric modulation is parenthesised in the score, the faster pulse duration is maintained (i.e. they will be in the same column on the Pulse Labyrinth). Whenever the metric modulation is not parenthesised, the slower pulse duration is preserved (i.e. they will be in the same row on the Pulse Labyrinth).

This thorough approach reveals how metric modulation can be exploited to provide precise and accurate ratios between consecutive tempi by means of differentiating between the beat and pulse, or two different interacting pulse layers, thereby specifying which metric level dictates the tempo to determine the relationship between bars. This is invaluable when it applies to transitions between simple and compound time signatures, as the beat and pulse values are the metrically distinguishing feature.

In summary, there has been a progression of what duration has been kept as the constant value throughout the history of metric modulation. First, the beat duration was kept constant (e.g. where ***3/4*** to ***9/8*** would experience ♩ = ♩. metric modulation). Second, the pulse duration was the consistent factor (e.g. where ***3/4*** to ***9/8*** would experience ♪ = ♪ metric modulation). Third, the absolute bar duration was kept consistent (e.g. where ***3/4*** to ***9/8*** would become 𝅗𝅥. = 𝅗𝅥. ♩.). This third stage includes the hypermeasure, where multi-bar phrases experience durational equivalence, and this will be explored later in the case study of *Mort Subite* in chapter 8.

Synthesising All Three Stages

Throughout the evolution of time signatures and metrical notation, rhythmic features such as hemiola, differing note groupings, and rhythmic displacements—found in the works of tonal composers such as Brahms and Bernstein—progressively became more encoded into the way metre itself behaved. Composers such as Stravinsky then pushed the process further by proposing that the goal of accent displacement need not purely exist in a stable metrical or temporal framework, but the score could instead allow for note re-grouping, re-barring, and metric modulation.

Charles Ives, Conlon Nancarrow, and Elliott Carter pushed all of these developments to their extreme given the constraints of the notational system they inherited.[110] Ives stratified time signatures, tempi, and tuplets (which included the procedure of nesting tuplets), and 'explored proportional, asymmetric, and syncopated polymeter' in complex and sometimes incommensurate relationships.[111] Most of these techniques can be seen in Example 1.17 where, due to the relatively abstract tempo markings, the exact proportional relationships between the flutes and the other instruments are not quantifiable.

Nancarrow took these complexities further as his experimentations with polyrhythms and tempo superimpositions became so complex in the mid- to late-20th century that musicians were reluctant to play his works and he resorted to writing pieces for the player-piano.[112] His *Rhythm Studies for Player-Piano* were of particular note as he showcased 'temporal dissonance' which Key described as 'the temporal conflict among simultaneous layers of music… [employing] rhythmic and "rhythmo-tempic" proportions in various ways'.[113]

On the first page of Nancarrow's score for *Rhythm Study No. 1 (for player-piano)*, there is a footnote which states:

> This score, like all the recent music of Conlon Nancarrow written for player-piano, has been recorded by him on a piano roll by punching accurately spaced holes. In this way he is able to achieve rhythmic combinations that otherwise would be practically unplayable.[114]

In this work, Nancarrow explores the proportional 'relationships between different simultaneous tempos'.[115] He initially starts the piece with a 7:4 ratio between one staff notated in ***7/8*** (♪ = 210) and another staff notated in ***4/4*** (♩ = 120). As more staves are added, the different tempi are derived from the ♪ = 210 metronome mark belonging to the ***7/8*** metre (see Example 1.18).

[110] Key, "Pan-Rational," 238.
[111] Key, "Pan-Rational," 171, 178; Carter, *The Writings of Elliott Carter*, 163-164.
[112] Key, "Pan-Rational," 210.
[113] Ibid.
[114] Conlon Nancarrow, *Rhythm Study No. 1 (for player-piano)* (Los Angeles: New Music Society of California, 1952), 2.
[115] Key, "Pan-Rational," 211.

Example 1.17: Charles Ives, *The Unanswered Question* (strings' bars 47-53).[116]

[116] Charles Ives, *The Unanswered Question* (New York: Southern Music Publishing Co. Inc., 1908), 7; as cited in Key, "Pan-Rational," 181.

Example 1.18: Conlon Nancarrow, *Rhythm Study No. 1 (for player-piano)* (bars 51-52).[117]

The first (top-most) staff of Example 1.18 shares the same tempo of ♪ = 210 with the fourth staff; the second staff has a tempo of ♪. = 280 (i.e. 210 × 4/3 = 280); and the fifth (bottom-most) staff has a tempo of ♫ ♪. = 168 (i.e. 210 × 4/5 = 168). The only staff in Example 1.18 that does not derive from the same ♪ = 210 tempo is the third/middle staff which is maintaining the ♩ = 120 tempo instead. For convenience, the table below sets out the metronome marks, as well as the individual note speeds of each staff which are calculated using the durations between each attack, expressed as tempi.

Table 1.1: Tempi of *Rhythm Study No. 1* (bars 51-52).

Staff	Time Signature	Metronome Mark	Note Speed
1	***7/16***	♪ = 210	𝅘𝅥𝅯 = 420
2	***9/32***	♪. = 280	♪. = 280
3	***4/4***	♩ = 120	𝅗𝅥 = 60
4	***7/8***	♪ = 210	♩ = 105
5	***15/32***	♫ ♪. = 168	♫ ♪. = 168

The ratios of note speeds between each staff—as in, those of the 'stratified polyrhythmic proportions' found in Example 1.18—are as detailed in Table 1.2.[118] Since

[117] Nancarrow, *Rhythm Study No. 1*, 13; as cited in Key, "Pan-Rational," 212.
[118] Key, "Pan-Rational," 211. Note that Key miscalculated the proportions between staves 1 and 5 (he wrote it as a 5:4 ratio) and between staves 2 and 4 (he wrote it as a 4:3 ratio). See also

the first and fourth staves share the same plane of rhythm—as confirmed by the shared metronome mark of 𝅘𝅥𝅯 = 210—the ratio between these staves is the simplest out of all the polyrhythmic ratios explored in the excerpt. The most complex ratios, the 14:3 and 5:14 ratios, involve the third staff, which stands to reason as it is the only staff based on the opposing 𝅘𝅥 = 120 tempo.

Table 1.2: Ratios of tempi between staves of *Rhythm Study No. 1* (bars 51-52).

Staves		Ratio
1	2	3:2
𝅘𝅥𝅯 = 420	𝅘𝅥𝅯. = 280	
1	3	7:1
𝅘𝅥𝅯 = 420	𝅗𝅥 = 60	
1	4	4:1
𝅘𝅥𝅯 = 420	𝅘𝅥 = 105	
1	5	5:2
𝅘𝅥𝅯 = 420	𝅘𝅥𝅯 𝅘𝅥𝅯. = 168	
2	3	14:3
𝅘𝅥𝅯. = 280	𝅗𝅥 = 60	
2	4	8:3
𝅘𝅥𝅯. = 280	𝅘𝅥 = 105	
2	5	5:3
𝅘𝅥𝅯. = 280	𝅘𝅥𝅯 𝅘𝅥𝅯. = 168	
3	4	4:7
𝅗𝅥 = 60	𝅘𝅥 = 105	
3	5	5:14
𝅗𝅥 = 60	𝅘𝅥𝅯 𝅘𝅥𝅯. = 168	
4	5	5:8
𝅘𝅥 = 105	𝅘𝅥𝅯 𝅘𝅥𝅯. = 168	

It is little wonder that Nancarrow wrote this for player-piano when he had layered so many complex polyrhythms throughout the work. The lack of coordinated bar lines attests to the intricate nature of these stratified tempi, and this will be seen again later with the case study piece of *Piano Quintet* in chapter 5.

Carter wrote extensively on Ives, as Ives championed Carter in his formative years as a composer.[119] Carter also shared in Nancarrow's 'interest in complex stratified polyrhythms' and actually wrote about the above *Rhythm Study No. 1* excerpt in his article on "The Rhythmic Basis of American Music".[120] Carter had been so influenced by

Elliott Carter, "The Rhythmic Basis of American Music," in *The Writings of Elliott Carter*, eds. Else Stone and Kurt Stone (Bloomington: Indiana University Press, 1977), 165-166.
[119] See Carter, *The Writings of Elliott Carter*, 48-51, 98-102, 160-166, 258-269, 331-343.
[120] Key, "Pan-Rational," 222; Carter, *The Writings of Elliott Carter*, 165-166.

these two composers that he paid homage to Ives' Sonata No. 1 for Violin and Piano and Nancarrow's *Rhythm Study No. 1* by quoting both pieces in his String Quartet No. 1.[121]

Example 1.19: Elliott Carter, String Quartet No. 1, mvt. I "Fantasia" (bars 13-23).[122]

In this work, Carter was preoccupied with the '"stratification" of musical elements [i.e. rhythmic procedures and different tempos] by metrical and other means', as well as the 'speeding up [and] slowing down of themes'.[123] In order to achieve these effects, he used and pushed the limits of metric modulation to achieve a climax of 'tempo

[121] Carter, *The Writings of Elliott Carter*, 277.
[122] Elliott Carter, String Quartet No. 1 (New York: Associated Music Publishers, 1951), 4.
[123] Carter, *The Writings of Elliott Carter*, 245.

and character change'.[124] He describes metric modulation as 'a procedure in which the tempo or "beat" speeds up in an ordered manner between measures' and analogises the technique to 'changes of key in a piece of tonal music'.[125]

Example 1.19 shows four instances of metric modulation notation near the beginning of the first movement of String Quartet No. 1. The metric modulation from bars 14 to 15 features a consistent beat: the ♩ beat of ***4/4*** at MM = 72 becomes the ♪‿♪. beat of ***10/16***. The 𝅘𝅥𝅯 pulses of ***10/16*** are pre-empted by the ⁵𝅘𝅥𝅯 figures in bar 14 of the cello, which both equate to MM = 360. (If ♩ = 72 in ***4/4***, then 𝅘𝅥𝅯 = 288. Therefore, ⁵𝅘𝅥𝅯 in ***4/4*** or 𝅘𝅥𝅯 in ***10/16*** = 288 × 5/4 = 360.)

Since ***5/16*** is half the bar duration of ***10/16***, the 𝅘𝅥𝅯 = 𝅘𝅥𝅯 metric modulation between bars 15 and 16 is expected. However, for there to be another 𝅘𝅥𝅯 = 𝅘𝅥𝅯 metric modulation between bars 16 and 17, where the *pulse* is kept consistent, that changes the tempo of the beat (hence the beat is ♪. = 120 in ***6/16***).

Similar to the cello's ⁵𝅘𝅥𝅯 figures that were used in bar 14 to pre-empt the new pulse speed, so too at the end of bar 18 does the cello play two 𝅘𝅥𝅯. *pulses* which become the new *beats* in the ***3/***𝅘𝅥𝅯. bar. This is a truly remarkable instance of time signature notation where Carter uses noteheads in the denominator instead of integer numerals (which will be revisited later with Example 1.27).

The word "beats" is used to describe the 𝅘𝅥𝅯. durations in the ***3/***𝅘𝅥𝅯. bar because they are specifically used in the denominator, and the previous ♪. beats from the ***6/16*** and ***9/16*** bars do not entirely fit in a ***3/***𝅘𝅥𝅯. bar. Only 1.5 ♪. durations are contained within a ***3/***𝅘𝅥𝅯. bar. However, going from ***3/***𝅘𝅥𝅯. to ***4/***𝅘𝅥𝅯., Carter reaffirms the ♪. beat before undertaking another beat-to-beat metric modulation in bars 21-22 where the beat of ♪. = 120 becomes the beat of ♩ = 120 in ***4/4***.

This whole process is very similar to Birtwistle's *Silbury Air* but instead of switching metric modulation types by keeping a slower or faster pulse speed consistent, this is instead switching between keeping the *beat* consistent and keeping the *pulse*

[124] Carter, *The Writings of Elliott Carter*, 246.
[125] Carter, *The Writings of Elliott Carter*, 245.

consistent. In this way, Carter is able to transition from a 4/4 with a ♩ = 72 tempo to a 4/4 with ♩ = 120 by the end of the excerpt.

Example 1.19 also showcases the other developments explored thus far: rhythmic displacements in bars 13-14 and 22-23 (especially over the bar lines); differing note groupings when the five-note groups transition into three-note groups in bars 15-18; and different subdivisions of the 𝅝 as seen with the quintuplet usage in bar 14. Carter has expressed his desire to write music that is 'direct' and 'easily understood', and that extends to his precision with notation.[126]

Ives, Nancarrow, and Carter employed 'extreme use of tuplets, the extreme and continuous stratification of indivisible rhythmic proportions, and a renewed perspective on time signature and tempo and their relation to rhythmic design'.[127] Yet despite all of these developments, their complex rhythmic ideas continued to persist. Key attributes this to the fact that these composers were still working within the Western notational system they inherited and they were 'reasonably clear' in their notational practices.[128] Therefore, efficacy is at the heart of any notational innovation moving forward, and this is certainly the case with OFTSs.

The Final Stage: Odd-Factored Time Signatures

Even from the earliest instances of intra-sectional metric transformations, the time signature changes within a movement or section were used as perturbations on the surface of a regular metric structure.[129] In Richard Wagner's *Tristan und Isolde*, Act III Scene 2 (see Example 1.20), the note groupings—and thus, the musical motive—are compressed, and therefore the time signatures and bar lines are notated to indicate this compression. The time signatures transition from 5/4, to 4/4, 3/4, and 2/4. This metric fluidity and fluctuation is associated with Tristan's emergent insanity.[130]

[126] Carter, *The Writings of Elliott Carter*, 247, 276.
[127] Key, "Pan-Rational," 238.
[128] Ibid.
[129] Carter, *The Writings of Elliott Carter*, 161.
[130] Compare this to the lopsided metre in *Totentanz* portraying the dance of death (see Example 1.28), or the unsettled metre in the *Rite of Spring* encapsulating the horror of the human sacrifice (see Example 1.7).

Example 1.20: Richard Wagner, *Tristan und Isolde*, Act III Scene 2 (pages 389-391), vocal and strings lines.[131]

Another early and prominent example of intra-sectional changing metres is found in the first movement of *Pictures at an Exhibition* by Modest Mussorgsky. In Example 1.21, the theme is written in alternating bars of ***5/4*** and ***6/4*** to paint a sonic picture of an ambling walk:

Example 1.21: Modest Mussorgsky, *Pictures at an Exhibition*, mvt. I "Promenade" (bars 1-4).[132]

These perturbations of the rhythmic surface were progressively allowed to disrupt and distort the metric structure itself, and over time the exceptional became steadily accepted.[133] This gave rise to the idea that notational devices, such as time

[131] Richard Wagner, *Tristan und Isolde* (Leipzig: Breitkopf & Härtel, 1859), 389-391.
[132] Modest Mussorgsky, *Pictures at an Exhibition* (St Petersburg: V. Bessel & Co., 1874), 1.
[133] Carter, *The Writings of Elliott Carter*, 161. I use the term 'metric distortion' to mean distortions of the metrical grid of a piece of music, and I refer to this idea throughout the project. Note that metric distortion is different from 'metric/temporal dissonance' where two or more independent, unrelated, and unaligned layers of metre or tempo coexist in the same passage of music. On metric/temporal dissonance, see Alistair M. Riddell and Conlon Nancarrow, "Tempus Perfectum: A Conversation with Conlon Nancarrow," *Meanjin* 47, no. 2 (1988): 272; Eric Austin Drott, "Conlon Nancarrow and the Technological Sublime," *American Music* 22, no. 4 (2004): 540; Margaret Elida Thomas, *Conlon Nancarrow's "Temporal Dissonance": Rhythmic and Textural Stratification in the Studies for Player Piano* (Ann Arbor: UMI, 1997), 4; all cited in Key, "Pan-Rational," 210, 213, 215; see also Mark Gotham and Megan Lavengood, "Metrical Dissonance," Open Music Theory, accessed March 27, 2025,

signatures, can reflect the groupings of multiple musical parameters, because the structures that used to exist (where exceptions could occur) were no longer nearly as delineable as they once were in tonal music. Therefore, we reach the final stage of the evolution: the invention and introduction of OFTSs.

If a piece is entirely in one conventional time signature, such as ***4/4***, and contains only one bar of an OFTS, such as ***2/6***, several procedures and effects will occur simultaneously. The subsequent ***4/4*** accent placements after the ***2/6*** bar will be displaced by $^{3}\!\!\downarrow$ $^{3}\!\!\downarrow$. The note grouping will change from groups of ♩ ♩ ♩ ♩ (or 2 × ♫, or 4 × 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 etc.) in ***4/4*** to $^{3}\!\!\downarrow$ $^{3}\!\!\downarrow$ (or 2 × ♫ , or 4 × ♬ etc.) in the ***2/6*** bar.

The pulse speeds will transition from conventional ♩/♪/𝅘𝅥𝅯 to $^{3}\!\!\downarrow$/ $^{3}\!\!\downarrow$/ $^{3}\!\!\downarrow$ due to the fundamental 𝅝 unit being divided into 6 instead of 4 (as per the time signature denominators); i.e. the tempo will accelerate and the bar duration will shorten, both at a 2:3 ratio, when the ***2/6*** bar is played. OFTSs are thus the combination of all three procedures mentioned throughout this chapter, affecting accent placement, note grouping, pulse speed, bar duration, and tempo.

The concept of ratios is important when understanding OFTSs as proportionality is at the heart of the notational device. A proportion, as a general definition, is the number, amount, or level of one thing when compared to another.[134] However, in the context of musical time, the notion of proportionality will be employed in a more specifically mathematical framing where ratios of durations and tempi will be considered.[135]

Pierre Boulez attempted a time signature notation similar to that of OFTSs, except instead of using integer denominators, he employed fractional *numerators* as a means of expressing the pulse speed and bar duration (i.e. in Examples 1.22-1.25, these fractional numerators are a fraction of the conventional 𝅗𝅥 or ♩ beats). In the third movement of *Le Marteau sans maître*, he notates two different time signatures (compare Examples 1.22

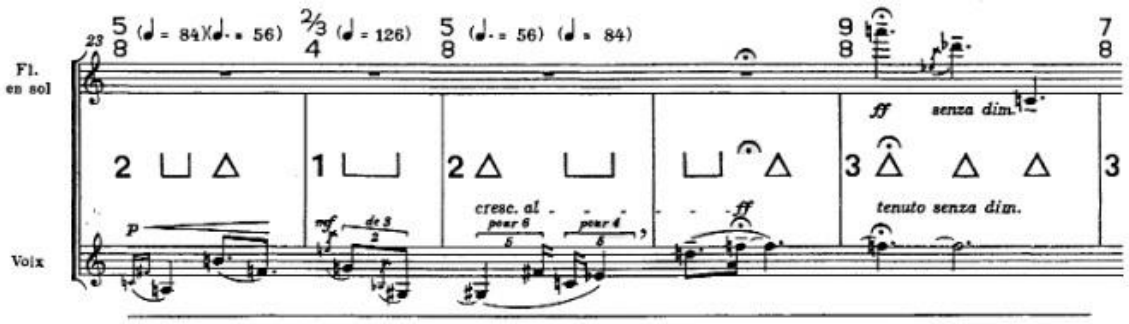
https://viva.pressbooks.pub/openmusictheory/chapter/metrical-dissonance/; Krebs, *Fantasy Pieces*, 7.

[134] Cambridge Dictionary, "Proportion," Cambridge Dictionary, accessed March 20, 2025, https://dictionary.cambridge.org/dictionary/english/proportion.

[135] The Editors of Encyclopaedia Britannica, "Proportionality," Encyclopedia Britannica, modified March 10, 2025, https://www.britannica.com/science/proportionality.

and 1.23 with Example 1.25). The first which will be discussed is "$^{2}/_{3}$ / $\mathbf{4}$", as seen in Examples 1.22 and 1.23.[136]

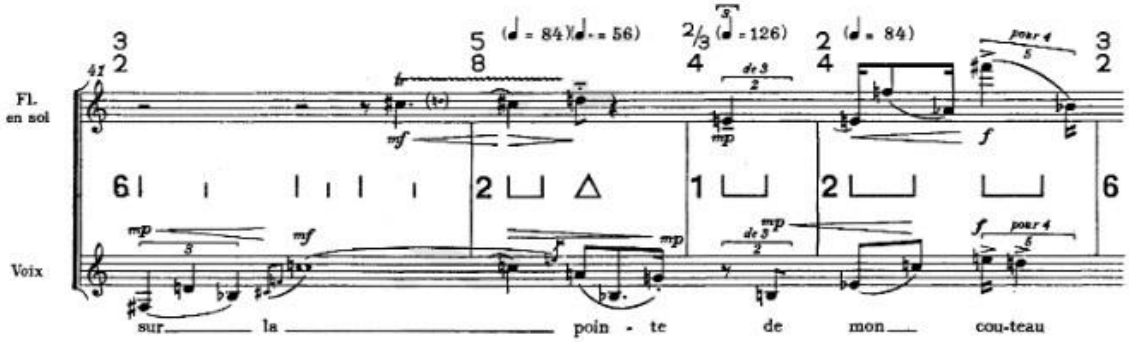
Example 1.22: Pierre Boulez, *Le Marteau sans maître*, mvt. III "l'artisanat furieux" (bars 23-27).[137]



OFTSs have the unique notational function of specifying incomplete tuplets.[138] However, examining Example 1.22, the way Boulez has notated the time signature makes the reader approach OFTSs in a different way than previously discussed. The numerator's "$^{2}/_{3}$" fraction explicitly speaks to the *absolute duration of the bar* (which hearkens back to the subdivision of the bar as a structural unit).

Compare this use to the numerator's normal function of indicating the number of beats within the bar. So, in this instance, two-thirds of a ♩ would find its notational equivalence in ^{3}♪ ^{3}♪ (in Cowell's notation, the appropriate OFTS would be "**2/12**", which can be gleaned mathematically in Boulez's notation by understanding that $^{2}/_{3}$ / $\mathbf{4}$ = $^{2}/_{3}$ × 1/4 = **2/12**).

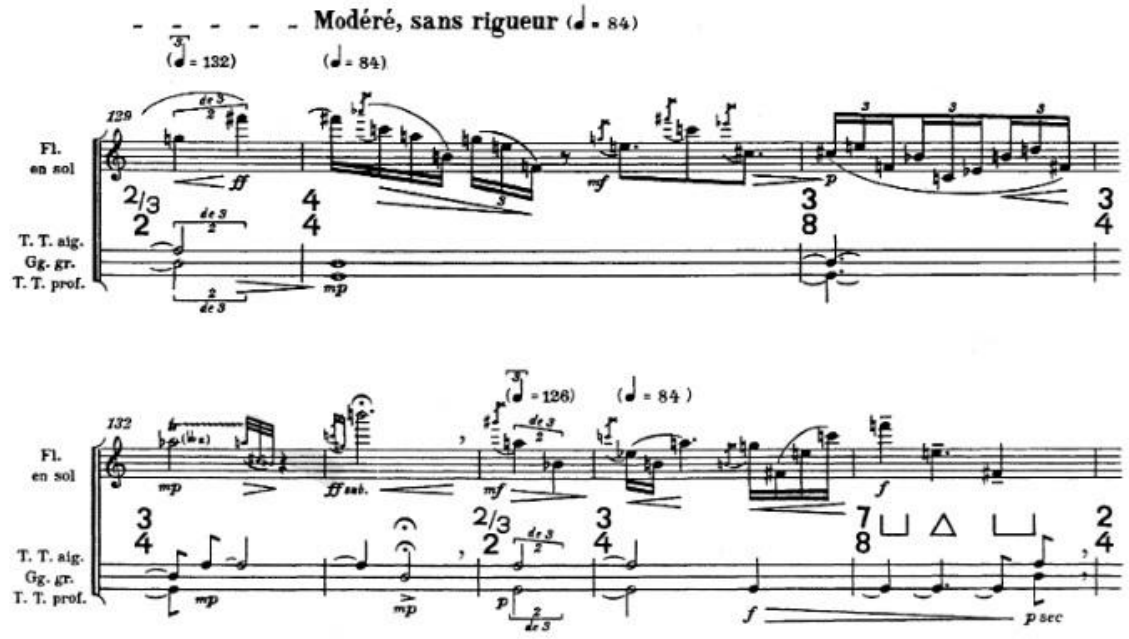
Example 1.23: Boulez, *Le Marteau sans maître*, mvt. III "l'artisanat furieux" (bars 41-44).[139]



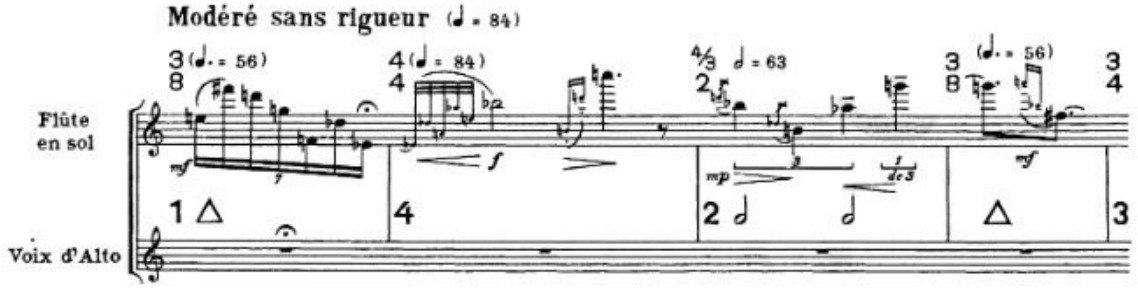
[136] Note that there is an error in Example 1.22: the metronome mark above bar 24 should be written as ^{3}♩ = 126, like bar 43 in Example 1.23.
[137] Pierre Boulez, *Le Marteau sans maître* (London: Universal Edition, 1953/1955), 19.
[138] Key, "Pan-Rational," 300.
[139] Boulez, *Le Marteau sans maître*, 20.

It is interesting, then, when Boulez uses the "$^{2}/_{3}$" tuplet bracket over a ♩ in Example 1.23 to achieve the same overall duration, which introduces some rhythmic notational ambiguity (to be discussed later with Example 1.25). In movement IX of the same work, "$^{2}/_{3}$ / **2**" is used (see Example 1.24). The same principle of notational equivalence applies here: two-thirds of a 𝅗𝅥 would equate to ^{3}♩ ^{3}♩ (which would be "**2/6**" in normal OFTSs; i.e. $^{2}/_{3}$ / **2** = $^{2}/_{3}$ × 1/2 = **2/6**).

Example 1.24: Boulez, *Le Marteau sans maître*, mvt. IX "»bel edifice et les pressentiments« double" (bars 129-136).[140]



Example 1.25: Boulez, *Le Marteau sans maître*, mvt. III "l'artisanat furieux" (bars 1-4).[141]



The third movement differs slightly from the other examples in that the numerator indicates the bar duration is *more* than a whole of the denominator beat value: $^{4}/_{3}$ / **2** = $1^{1}/_{3}$ 𝅗𝅥 (see Example 1.25). Therefore, Boulez has notated the rhythms as a full

[140] Boulez, *Le Marteau sans maître*, 91.
[141] Boulez, *Le Marteau sans maître*, 18.

triplet crotchet figure (i.e. ♩♩♩), and then a ♩ with the "***1/3***" tuplet bracket to indicate it is a third of a triplet, and thus a third of a 𝅗𝅥 duration.

4/3 / 2 may not be as elegant a solution as its OFTS counterpart "***4/6***", especially given the fact that Boulez needed to add metric modulation notation and 𝅗𝅥 notes underneath the flute staff to convey his meaning. Furthermore, the "***4/3***" numerator is more ambiguous as it does not necessitate the notation of ^{3}♩ ^{3}♩ ^{3}♩ ^{3}♩ (cf. "***4/6***", which would more readily imply the rhythm of four ^{3}♩ notes). Instead, the rhythm in the ***4/3 / 2*** bar could have been notated in a variety of ways (e.g. ^{3}♩ 𝅗𝅥 or ♩ ^{3}♩ ♩).

Cowell first explained OFTSs in his book *New Musical Resources* (although Carlos Chávez was possibly the first composer to ever use an OFTS in his *Piano Sonata No. 3* (1928) which predates Cowell's book by two years).[142] Cowell did not coin the term "odd-factored time signatures" when describing the convention in *New Musical Resources*.[143]

The notational custom is more commonly named "irrational time signatures", possibly derived from the description of tuplet figures as being "irrational" in Gardner Read's book, *Modern Rhythmic Notation*.[144] However, the more widespread term "irrational time signature" will not be used in this project as it is a misnomer. Odd-factored time signatures and tuplet rhythms do not adhere to the mathematical description of "irrational".

Key uses the term "dyadic" and "non-dyadic" time signatures to describe conventional and OFTSs respectively. His reasoning is that

> In mathematics, a ***dyadic rational*** *[sic]* is a rational number in the form of a/b whose denominator is a power of two when the ratio is in coprime or minimal terms. Simply demonstrated, a dyadic rational is a number in the form of $a/2^b$ where *a* is an integer and $b > 0$ and is a natural number.[145]

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[142] For the explanation of OFTSs, see Cowell, *New Musical Resources*, 49-66. In my honours dissertation, I claimed that Dieter Schnebel was possibly the first composer to use the notational device: see Wheatley, "Irrational Time Signatures," 16. However, this is incorrect, as Key illuminates in his thesis: see Key, "Pan-Rational," 283-284.
[143] The term "odd-factored time signature(s)" was suggested by my supervisor Richard Kurth.
[144] For 'irrational note groups', see Gardner Read, *Modern Rhythmic Notation* (Bloomington: Indiana University Press, 1978), 22 and throughout the remainder of the book.
[145] Key, "Pan-Rational," 26.

I will not be using these terms because, although that is a sound mathematical definition, the term "dyadic time signature" seems as though the "dyad" is referring to the numerator and denominator, instead of referring to a shortened version of the term "dyadic *rational*". In order to avoid the confusion, I use the terms conventional and OFTSs (though there is a solid argument to be made for alternative terms such as "dyadic rational time signature(s) (DRTS(s))" and "non-dyadic rational time signature(s) (NDRTS(s))" given the mathematical consistency of the terms).

Key cited Paul Creston's book, *Rational Metric Notation*, as '[t]he first to theoretically attempt to codify' OFTSs, and although Creston does indeed attempt to define what an OFD might look like, Key's claim is not entirely accurate.[146] True to the title, Creston's focus is on notational devices which illuminate the metric structure of a piece, including beat subdivisions and note groupings.

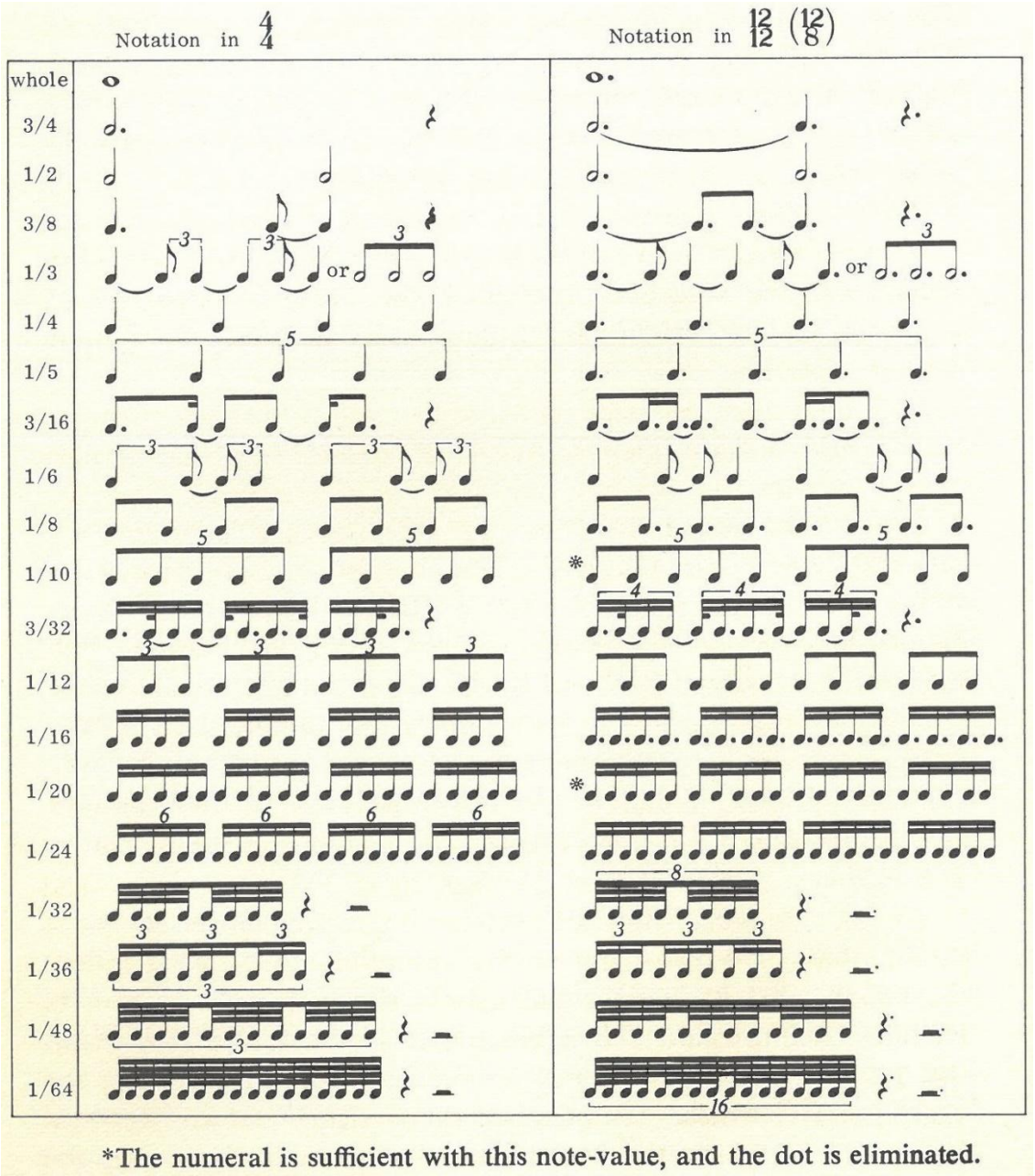
With regard to specifying the metre of a piece, Creston specifically points back to the Medieval system of subdividing the beat into two and three pulses[147] (i.e. prolation imperfect and prolation perfect[148] gradually transforming into our modern simple and compound times).[149] He raises the inconsistency of compound time signatures: where the denominator of simple time signatures indicate the value of the *beat*, compound time signature denominators indicate the value of the *pulse* (e.g. the ***4*** of ***2/4*** indicates the ♩ beat; the ***8*** of ***6/8*** indicates the ♪ pulse, not the ♩. beat of the compound time signature).[150]

Creston proposes a revised system of rhythmic note values, thus also revising the system of time signature denominators (see Example 1.26).[151] However, his method is convoluted and based on inaccurate assumptions. He provides a 'revised Table of Common Note-Values' where a ***12/12*** bar (which is supposed to be the revised version of a ***12/8*** bar) is equivalent to a ***4/4*** bar. He arrives at the ***12***-denominator by claiming

[146] Key, "Pan-Rational," 284.
[147] Creston, *Rational Metric Notation*, 23. N.B. Creston labels beats as 'pulses' and the subdivisions as 'units'. He only uses the term 'beats' for sounded, rhythmic beats. Due to this confusion of terminology, I have decided against using his labels and I have instead engaged in discussion around his book using my terminology alone, as defined under this chapter's subsection "Preliminary Definitions and the Common-Practice Conceptualisation of Time Signatures and Metre".
[148] Creston, *Rational Metric Notation*, 37.
[149] Creston, *Rational Metric Notation*, 23.
[150] Creston, *Rational Metric Notation*, 37.
[151] Creston, *Rational Metric Notation*, 41.

that each traditional ***12/8*** bar is equivalent to a 𝅝 in duration,[152] and since there are 12 ♪ in a ***12/8*** bar, those ♪ are really 1/12th the duration of a 𝅝, thus making them 1/12-notes.

Example 1.26: Creston's revised table of common note-values.[153]



However, the issue with this is assuming that the *bar durations* of ***4/4*** and the traditional ***12/8*** are equivalent, and for that to be true, a ♩ = ♩. metric modulation must also be assumed. But, as previously discussed in the "3. Metric Modulation" subsection, this type of metric modulation is not necessarily a given. ***12/8*** could just as easily be equivalent to 𝅝. in total bar duration if a ♪ = ♪ metric modulation was used instead. The

[152] Creston, *Rational Metric Notation*, 38.
[153] Creston, *Rational Metric Notation*, 42.

actual OFTS ***12/12*** is truly equivalent to ***4/4*** in total bar duration, but not necessarily how Creston is using it.

Furthermore, OFTSs are not useful in a purely regular metrical context as there are simpler ways to notate rhythms in those contexts. Instead, OFTSs are useful precisely in contexts where different time-related musical parameters are juxtaposed (e.g. different beat speeds, different durational spans), where the different notations are not easily commensurable within a regular metrical framework.[154]

However, Creston specifically denounces such metric irregularities, especially when there are consistently changing time signatures or where perturbations of single bars with "***1***" in the numerator are concerned.[155] This is because he is particularly opposed to the notion of time signatures indicating duration, instead of implying metre as a '*measurement* of that duration'.[156]

Creston comes from a very particular angle that dismisses much recent metrical practice and he does not consider the sorts of rhythmic and metric irregularities that composers who use OFTSs utilise. The fact that Creston explores the notion of non-standard denominators is interesting but he does not follow through on these conceptualisations, and certainly not in the way we now understand OFTSs. Therefore, *Rational Metric Notation* does not truly attempt to codify OFTSs as he is not really grappling with OFTSs to begin with.

Similar to Creston, Carl Orff also communicated dissatisfaction with the inconsistency and restraints of compound time signatures to express the accurate 𝅗𝅥. beat value. He notated *Carmina Burana* with time signatures that featured noteheads instead of integers as denominators:[157]

This way, Orff makes it clear that the beat value of the first four bars is a 𝅝 beat, and the beat value for bars 5-6 is a 𝅗𝅥 beat. The inconsistency of standard notation (especially with relation to compound time signatures) mirrors what OFTSs are attempting to address and correct.

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[154] Roeder, "Co-operating Continuities," 134.
[155] Creston, *Rational Metric Notation*, 71-72.
[156] Creston, *Rational Metric Notation*, 71.
[157] See also the discussion around Émile Jacques-Dalcroze in Sachs, *Rhythm and Tempo*, 361; Creston, *Rational Metric Notation*, 76.

Example 1.27: Carl Orff, *Carmina Burana*, mvt. I "O Fortuna" (bars 1-6), flute lines.[158]

A Detailed Example of Odd-Factored Time Signature Use

To avoid the ambiguity found in the fractional numerators of *Le Marteau sans maître*, let us return instead to OFDs. An expansion of the introductory chapter's Example A, now placed in its original musical context, will be used to illustrate how OFTSs as a notational device symbolise the synthesis of multiple musical parameters to encapsulate a diverse range of proportional relationships in new music.

Example 1.28: Adès, *Totentanz* (bars 137-139), string lines with additional analytical staff.[159]

[158] Carl Orff, *Carmina Burana* (Mainz: Schott Musik International, 1935-1936; reprinted Mainz: B. Schott's Söhne, 1965), 1.
[159] Adès, *Totentanz*, 10-11.

Example 1.28 is an excerpt of all the string lines taken from an orchestral work by Adès entitled *Totentanz*, and an additional analytical staff detailing the pulse values and pulse speeds has been inserted at the top of the excerpt for reference. Example 1.28 provides the preceding three bars that were excised from Example A. The rhythms employed are of particular note, as Adès intended to musically encapsulate the dance of death.[160]

There are several rhythmic features that impact the performer's understanding and sensation of the metre in this passage. In the first bar, the ***4/4*** metre of ♩ ♩ ♩ ♩ is not projected due to the disruption of the $\overset{3}{\overline{\text{♫}}}$ figure in the middle of the bar. The triplets are subdividing a ♩ note, which is offset against the ♩ beats of the notated metre, thereby metrically displacing the subsequent rhythms of the bar.

There are three specific rhythmic groupings at different tempi that are clearly projected: initially a group of subdivided ♫, then a group of $\overset{3}{\overline{\text{♫}}}$, then another group of subdivided ♫ (refer to the top analytical staff for a clear breakdown). These groups of three are delineated by the accent placements, phrase marks, dynamics, and the viola onsets.

The $\overset{3}{\text{♪}}$ pulse is 1.5 times faster than the ♪ pulse of the first and third phrases (i.e. ♪ = 240 is at a 2:3 ratio with $\overset{3}{\text{♪}}$ = 360). However, the 𝅘𝅥𝅯 notes are $1^1/_3$ times faster than the $\overset{3}{\text{♪}}$ pulse (i.e. $\overset{3}{\text{♪}}$ = 360 is at a 3:4 ratio with 𝅘𝅥𝅯 = 480). These proportions reappear throughout the rest of the passage.

The first bar is notated as ***4/4***, but the time signatures that may more accurately represent the rhythms would subdivide the first bar into ***3/8***, ***3/12***, and ***3/8***. However, Adès elects not to pursue this form of notation for at least two discernible reasons: 1. He is using bar lines to demarcate changes in timbre and instrumentation; and 2. For the most part, he only uses OFTSs when there is not a convenient conventional time signature solution.

With regard to demarcating instrumentation changes, the melody is played by: the violins in the first bar; the celli in the second bar (in ***2/4***); violin 2 and celli in the

[160] AllmuthAndorsch, "Thomas Adès: Totentanz," YouTube, August 10, 2013, video, 37:45, https://youtu.be/BpFh-Z_GYfE?si=NsQXYfm43XPAWWlg.

third bar (***3/8***); violin 1 in the fourth bar (***2/4***); violin 2 and viola in the fifth bar (***5/12***); and back to violin 1 in the sixth bar (***5/8***). Adès is using the time signatures to dictate the absolute bar durations in order to draw the performer's attention to changes in timbre throughout the passage.

As will be seen in chapters 3-5, Adès generally uses OFTSs when there is not a more convenient and conventional time signature alternative. He usually opts for clear and common time signatures. The exception to this is his use of the OFTS ***6/6***—the durational equivalent of ***4/4***—later in the piece (see Example 1.29). In this instance, the ***6/6*** bar ensures the conductor is assisting the orchestra in navigating the $\overset{3}{\text{♩.}}$ pulse speed due to the added complication of the overlaid *ritenuto*.[161]

Example 1.29: Adès, *Totentanz* (bars 161-167), selected parts.[162]

Returning to the ***4/4*** bar in Example 1.28, there are several ways it could have been notated. The time signature of ***8/8*** could have been used (a less common but nonetheless conventional time signature), or the bar could have been split into ***3/8*** and ***5/8*** (this would have pre-empted bars 3 and 6, which are separated ***3/8*** and ***5/8*** bars). The use of the ***3/8***, ***3/12***, ***3/8*** trisection of the bar could have drawn out the

[161] Compare this to Stravinsky's use of time signatures for the 'purpose of easier reading and [conductor] beating' in *The Little Concert* in *L'Histoire du Soldat*: see Sachs, *Rhythm and Tempo*, 372.
[162] Adès, *Totentanz*, 13.

proportionality in bars 5 and 6 (***5/12*** and ***5/8***), as they share the same pulse speeds, just different note groupings.

However, for the sake of notational simplicity, and for ease of reading and coordination, Adès uses the ***4/4*** time signature to establish stability in the ♩ beat tempo through the conductor, thereby helping the orchestra to discern and perform any other note duration, tuplet or otherwise. He also maintains momentum throughout the passage, so that the only disruption prior to the ***5/12*** bar is the ***3/8*** bar. Ultimately, he is considering the bar as a structural unit, and he therefore uses time signatures to inform and reflect the structural organisation of the music.

In the second and third bars of Example 1.28, the featured rhythm is short-long-short with a 1:2:1 ratio. In the ***2/4*** bar, it is the ♪♩ ♪ figure in the upper cello line (within the blue box annotation). In the ***3/8*** bar, it is the ^{4}♪ ^{4}♪ ^{4}♪ figure in the upper violin 2 and cello lines (within the pink boxes). Additionally, the lower violin 2 line in the third bar has the same short-long-short figure (within the solid red box) but with an extra ♪ at the beginning of the bar (annotated by the dotted red box) to elongate the rhythmic figure. These short-long-short rhythms form a compound rhythm with the lower cello line in both bars to create a hocket (as elucidated in the top analytical staff).

This canonic imitation by diminution is at a 4:3 ratio (seen previously in the first bar of the passage) where, in this instance, the ***3/8*** rhythm is $1^{1}/_{3}$ times faster than the ***2/4*** rhythm, due to the respective ^{4}♪ = 320 and ♪ = 240 pulse speeds. If the lower violin 2 line in the solid red box is also taken into account (♪ = 480), the upper cello figure in the blue box is at a 1:2 tempo ratio with it. Canonic distortions and the reproportioning of the same musical material at different tempi will be explored later in greater detail in the chapter 8 case study of *Mort Subite*.

When considering the proportions between the pulse speed of the ***3/8*** bar compared to the ♪ of the following ***2/4*** and ***5/12*** bars, there are fascinating ratio relationships exploited here as well. If the ***3/8*** ^{4}♪ = 320 is compared to ^{3}♪ = 360, there is an 8:9 ratio relationship (i.e. a compounded triplet ratio in the form of $8:9 = 2^{3}:3^{2} = 2\times2\times2 : 3\times3$). Alternatively, if the ***3/8*** ♪. = 160 is pitted against ^{3}♪ (= 360), there is another compounded triplet ratio of 4:9 (= 2:3 × 2:3).

Note also that the rhythms of the violin 2 and cello lines counteract the ***3/8*** time signature (i.e. all the attacks divide the bar by one (i.e. 𝅗𝅥.), two (i.e. ♪. ♪.), or four (i.e. 𝅘𝅥𝅯 𝅘𝅥𝅯 𝅘𝅥𝅯 𝅘𝅥𝅯), not three as is written in the numerator). Therefore, the relationship between the time signature and beat speed does not enjoy a straightforward correlation.

Despite what the ***8*** denominator would normally imply, these rhythms do not employ the same ♪ pulse durations like those found in the second bar, made evident by the fact that the only note to fall on the ♪ pulse (apart from the first notes of the bar) is the middle C–harmonic F 𝅘𝅥𝅯 dyad played by the lower line of violin 2 (as indicated by the red arrow annotation). The pattern of rhythms counteracting or being played against the notated metre will also be expounded later with the *Mort Subite* case study.

Although the time signature of the fourth bar in Example 1.28 is ***2/4***, the rhythm consists entirely of ³♪ rhythms, which is the same pulse speed as the ***5/12*** bar. (Despite the fact that the ***12***-denominator would technically make the triplet notation redundant, ultimately the preservation of the pulse speed across bars is made clearer by the consistent use of the triplet bracket notation.)[163] The consistency of the pulse speed naturally leads to the question of why Adès decided to notate the fourth bar as ***2/4*** instead of ***6/12***.

The odd-factoring of pulse durations is not novel, as they are already implicated by conventional tuplet notation. What is introduced in the passage with the ***5/12*** bar is his use of the OFD (which in turn allows for simpler rhythmic notation of an incomplete triplet figure). He uses triplet figures in the ***2/4*** bar as a didactic tool to smooth over the transition from conventional time signatures (especially the ***3/8*** bar and the rhythms notated within) to the ***5/12*** OFTS, and then back to another conventional time signature of ***5/8***.

He thereby shows the performer that a point of major difference between a ***2/4*** bar and a ***5/12*** bar, when both bars contain the same ♪ rhythms, is the absolute bar duration (i.e. a ***5/12*** bar is a ♪ shorter than a ***2/4*** bar). Thus, in terms of absolute bar

[163] Note that Adès does not always use the tuplet brackets in OFTS bars, as is the case with the case study of *Piano Quintet* in chapter 5. For further discussion around Adès' inconsistency with his notation of tuplet rhythms in OFTS bars, see chapter 3, 126-129.

length, there is a 6:5 proportional durational relationship between the ***2/4*** and ***5/12*** bars (as the ***5/12*** bar is five-sixths the length of the ***2/4*** bar).

Moreover, as shown with the annotated green boxes, the oscillating melodic contour of the violin 1 in the fourth bar elides with the upper violin 2 line with a similar melodic contour in the fifth bar. The ***5/12*** bar initially seems to be a truncation of the ***2/4*** bar, but it actually highlights the elision (as indicated by the green arrow) when the first note of the violin 2 melody overlaps with the final $^{3}\!\!\!

To look at an example where the proportional relationship of pulse speeds between conventional and OFTSs is explicated, Example 1.30 shows the flute lines taken from *In Seven Days*, another orchestral work by Adès. This is the only instance of an OFTS throughout the whole piece, so the score elucidates that the ***4/4*** and ***2/4*** bars are measured by ♩ = 77, then specifies ^{3}♩ = 115.5. The denominators of ***4*** and ***6*** are at a 2:3 ratio, and so that proportional relationship is also imposed on the metronome marking.

Example 1.30: Thomas Adès, *In Seven Days* (bars 107-110), flute lines.[164]

Note that, similar to Example 1.28 where the ***12***-denominator equates to a twelfth of a 𝅝 (i.e. a ^{3}♪), the ***6***-denominator here clarifies that the ^{3}♩ is a sixth of a 𝅝, and so the ***2/6*** bar maintains the triplet notation from the preceding bars. This is a further example of how the preceding pulse speed can be maintained while being grouped differently in the ***2/6*** bar in terms of a new, related, slower pulse speed. Example 1.30 also shows how OFTSs indicate a change of absolute bar duration.

Examples 1.28 and 1.30 demonstrate how OFTSs introduce layers of complexity to the considerations in a performer's interpretation of the score. Instead of treating the time signature as a purely metric concern, an OFTS asks the performer to further contemplate the rhythmic implications, inferred pulse speeds, underlying tempi, accent placements, bar and phrase lengths, and the fundamental proportional relationships between some, if not all, of these time-related parameters.

[164] Thomas Adès, *In Seven Days* (London: Faber Music, 2008), 14.

A New Conception of Metre?

Both Examples 1.28 and 1.30 illuminate the value of time signatures in generating proportional understandings of pulse speed and other musical relationships, as the time signatures are fundamental theoretical and notational keys to understanding the rhythms and tempi in these passages. Yet, they do not principally deal with metre in the conventional sense, because Lerdahl and Jackendoff's conception of metre is not present. This then calls into question the validity of the MWFRs as they pertain to non-tonal music. To review, the MWFRs are listed below:

> MWFR 1: Every attack point must be associated with a beat at the smallest metrical level present at that point in the piece.
> MWFR 2: Every beat at a given level must also be a beat at all smaller levels present at that point in the piece.
> MWFR 3: At each metrical level, strong beats are spaced either two or three beats apart.
> MWFR 4: The tactus and immediately larger metrical levels must consist of beats equally spaced throughout the piece. At subtactus metrical levels, weak beats must be equally spaced between the surrounding strong beats.

It is important to understand that these rules were written with the intent of applying to common-practice tonal music. Even so, Kramer has questioned MWFR 4 if 'equally spaced throughout the piece' would mean 'separated by the same clock-time interval or by the same number of primary-level beats'.[165]

On this point, consider instances of metric modulation or pieces that change time signatures throughout. For example, hearkening back to Example 1.6 (included below for easy reference), this excerpt from *America* is a very clear violation of MWFR 4, as each alternating bar experiences differently spaced beats (i.e. 𝅗𝅥. and 𝅗𝅥 beats), yet the sensation of metre is still present.

[165] Kramer, *The Time of Music*, 108.

Example 1.6: Bernstein, *America* (rehearsal mark 46), string lines.[166]

The other rules are also worth scrutinising in the context of non-tonal music to demonstrate why these rules should only be applied to common-practice tonal music. To refer back to Example 1.28, looking at the first bar in ***4/4*** time, it is not clear what the 'smallest metrical level' is. It could be the 𝅘𝅥𝅯 unit, but if that was the case, the ♫ figure in the middle of the bar does not adhere to it. A smaller subdivision would have to be employed to ensure there is a shared smallest metrical level. However, since the metronome mark at the beginning of the piece is ♩ = c. 120 BPM, any smaller subdivision would be too difficult to perceive, as the tempo is too fast, particularly when this smallest metrical level is not being articulated by the rhythmic surface.

Ultimately, the ***4/4*** bar of Example 1.28 does not project the metre implied by the time signature. Indeed, this is a good example of a time signature that is not projected as a metre because the rhythms in the bar do not allow for it. However, the time signature does allow for those particular non-periodic, non-metrical rhythms to be notated clearly.

Similar to the point made about MWFR 1, the second rule also does not fit in the context of the ***4/4*** bar in Example 1.28; the ^{3}𝅘𝅥𝅯 beat is inconsistent with the 𝅘𝅥𝅯 level. The third rule should also be scrutinised when OFTSs are concerned; numerous instances of OFTSs have bars that only have one strong beat at the beginning of the bar and where the strong beats are separated by four, five, six, or a greater number of beats.

[166] Bernstein, *America*, 175-176.

Example 1.31: Adès, *Piano Quintet* (rehearsal mark 2).[167]

As annotated in the red box of Example 1.31, the ***7/10*** bar contains only one strong beat, which is separated from the next strong beat by six weak beats. Other examples of this exception will be examined later, particularly in the case studies of chapters 5 and 8. Lerdahl and Jackendoff's MWFRs are valuable when considering a wide slew of tonal music, but unfortunately they are too prescriptive and limiting, especially when considering the metric and rhythmic complexities of the 20th century and beyond.

The modern understanding of metre is being challenged by pieces featuring sections of music that can be momentarily entrained to, but do not conform to the conventional conception of a metre sustained on a prolonged basis. Furthermore, some of these pieces illustrate that metre is not nearly as important to the musical structure as it was in the common-practice tonal context. OFTSs reveal the blurred distinctions between metre, rhythm, tempo, and other time-related musical parameters, as they interact in a much deeper way when it comes to informing the structure of the music.

[167] Thomas Adès, *Piano Quintet* (London: Faber Music, 2000), 3.

Chapter 2: The Notational and Interpretational Ambiguities of Odd-Factored Time Signatures

Before introducing each composer and analysing their selected works, we must first thoroughly examine the notational implications of OFTSs. This is because ambiguities arise from the interpretation of the notation, and these must be elucidated before we can proceed.

OFDs imply tuplet rhythms, and tuplets, by their very nature, involve ratios and proportional relationships. Indeed, even the standardised subdivisions of the 𝅝 involve the most fundamental ratio of all: 2:1. The 𝅝 is twice the length of a 𝅗𝅥 note, the 𝅗𝅥 is twice the duration of a ♩ note, and so on.

Tuplets are normally conceptualised within a similar idiom: triplets are three notes in the time of two (i.e. 3:2), quintuplets are five notes in the time of four (i.e. 5:4), and so on. There are exceptions to this generalised rule, and they will be addressed, especially in chapters 6-8 as Ferneyhough frequently uses non-standard tuplets in his works. However, for the sake of establishing general principles, let us assume for the time being that tuplets are conceptualised within a similar idiom to that of duple subdivision where more notes are being added in the space of less.

The note values of each duration (as implied by each OFD) are tabulated in the abridged Table 2.1 in the following page. The highlighted rows correspond to conventional time signature denominators. The final column indicates if there is an alternative interpretation of an OFTS, and those alternative interpretations are detailed in Table 2.2. A fuller version of Table 2.1 is provided in Appendix A.[168]

The time signatures selected to appear in Table 2.1 all fit into one of three categories: 1. They are commonly used, which encompasses conventional time signatures as well as frequently used OFTSs in Adès' and Ferneyhough's works; 2. They are rare and require explanation, especially when they involve contradictions,

[168] No prime-numbered denominators above 7 will be considered in the abridged table because it is the largest single-digit prime number. No prime-numbered denominators above 19 will be considered in the full table provided in Appendix A to streamline the table. The composers examined in this project do not base their OFDs on any prime number above 11, but for completion's sake, I included prime-numbered denominators up to 20.

inconsistencies, notational errors, or ambiguities in interpretation; or 3. They have not yet been used by Adès and Ferneyhough, but explication would provide a helpful resource for future use by composers and performers alike.

In Table 2.2, the labels of "Direct note value" and "Indirect note value" in the columns, as well as "Interpretation 1", "Interpretation 2", and "Interpretation 3" in certain rows, will be explained as they arise in the upcoming discussion. Finally, Table 2.3 details all the OFDs used by Adès and Ferneyhough throughout their oeuvre. The labels of "Common" and "Uncommon" are associated with the subheadings of this chapter. Any unique OFTSs only found in one work are specified in their respective composer's column.

The factors in the "Denominator factorisation" columns of Tables 2.1-2.3 are arranged in increasing orders of magnitude as there is an implicit understanding that the order of the factors could be different in some conceptual sense. For example, ***x/30*** could be factorised as 2 × 3 × 5 or 3 × 5 × 2 or 5 × 2 × 3. The order of factorisation speaks to a matter of note grouping, and until a composer specifies their intent in the notation, it is conceptually open-ended. Therefore, for the sake of simplicity and consistency, the factors are all presented from smallest to largest in the tables below.

Table 2.1: Abridged table of direct note values of each duration, as implied by select time signature denominators up to *x/64*.

Time Sig.	Denominator Factorisation	Direct Note Value	Ratio[169]	Notation	Alternative Interpretation Available?
x/1	1	Semibreve		𝅝	
x/2	2	Minim		𝅗𝅥	
x/3	3	Triplet minim	3:2		
x/4	2 × 2	Crotchet		♩	
x/5	5	Quintuplet crotchet	5:4		
x/6	2 × 3	Triplet crotchet	6:4 (2 × 3:2)		
x/7	7	Septuplet crotchet	7:4		
x/8	2 × 2 × 2	Quaver		♪	
x/9	3 × 3	Nonuplet quaver	9:8		Yes
x/10	2 × 5	Quintuplet quaver	10:8 (2 × 5:4)		
x/12	2 × 2 × 3	Triplet quaver	12:8 (4 × 3:2)		

[169] All ratios are expressed $x{:}y$ where $x > y$.

Time Sig.	Denominator Factorisation	Direct Note Value	Ratio	Notation	Alternative Interpretation Available?
***x*/14**	2 × 7	Septuplet quaver	14:8 (2 × 7:4)		
***x*/15**	3 × 5	***15***-tuplet quaver	15:8		Yes
***x*/16**	2 × 2 × 2 × 2	Semiquaver			
***x*/18**	2 × 3 × 3	Nonuplet semiquaver	18:16 (2 × 9:8)		Yes
***x*/20**	2 × 2 × 5	Quintuplet semiquaver	20:16 (4 × 5:4)		
***x*/21**	3 × 7	***21***-tuplet semiquaver	21:16		Yes
***x*/22**	2 × 11	***11***-tuplet semiquaver	22:16 (2 × 11:8)		
***x*/24**	2 × 2 × 2 × 3	Triplet semiquaver	24:16 (8 × 3:2)		
***x*/27**	3 × 3 × 3	***27***-tuplet semiquaver	27:16		Yes
***x*/28**	2 × 2 × 7	Septuplet semiquaver	28:16 (4 × 7:4)		
***x*/30**	2 × 3 × 5	***30***-tuplet semiquaver	30:16		Yes
***x*/32**	2 × 2 × 2 × 2 × 2	Demisemiquaver			
***x*/33**	3 × 11	***33***-tuplet demisemiquaver	33:32		Yes
***x*/36**	2 × 2 × 3 × 3	Nonuplet demisemiquaver	36:32 (4 × 9:8)		Yes
***x*/39**	3 × 13	***39***-tuplet demisemiquaver	39:32		Yes
***x*/40**	2 × 2 × 2 × 5	Quintuplet demisemiquaver	40:32 (8 × 5:4)		
***x*/42**	2 × 3 × 7	***42***-tuplet demisemiquaver	42:32 (2 × 21:16)		Yes
***x*/45**	3 × 3 × 5	***45***-tuplet demisemiquaver	45:32		Yes
***x*/48**	2 × 2 × 2 × 2 × 3	Triplet demisemiquaver	48:32 (16 × 3:2)		
***x*/49**	7 × 7	***49***-tuplet demisemiquaver	49:32		Yes
***x*/56**	2 × 2 × 2 × 7	Septuplet demisemiquaver	56:32 (8 × 7:4)		
***x*/63**	3 × 3 × 7	***63***-tuplet demisemiquaver	63:32		Yes
***x*/64**	2 × 2 × 2 × 2 × 2 × 2	Hemidemi-semiquaver			

Table 2.2: Abridged table of direct and indirect note values of all time signatures in Table 2.1 that have an alternative interpretation.

Time Sig.	Denominator Factorisation	Direct Note Value	Ratio	Notation	Indirect Note Value	Ratio	Notation
***x*/9**	3 × 3	Nonuplet quaver	9:8		Triplet minim with nested triplet crotchet	9:4 (3:2 × 3:2)	
***x*/15**	3 × 5	***15*-tuplet quaver**	15:8		Interpretation 1: Triplet minim with nested quintuplet quaver Interpretation 2: Quintuplet crotchet with nested triplet quaver	15:8 (3:2 × 5:4) Or 15:8 (5:4 × 3:2)	
***x*/18**	2 × 3 × 3	Nonuplet semiquaver	18:16 (2 × 9:8)		Triplet crotchet with nested triplet quaver	18:8 (2 × 9:4)	
***x*/21**	3 × 7	***21*-tuplet semiquaver**	21:16		Interpretation 1: Triplet minim with nested septuplet quaver Interpretation 2: Septuplet crotchet with nested triplet quaver	21:8 (3:2 × 7:4) Or 21:8 (7:4 × 3:2)	
***x*/27**	3 × 3 × 3	***27*-tuplet semiquaver**	27:16		Nested triplet minim with nested triplet crotchet with nested triplet quaver	27:8 (3:2 × 3:2 × 3:2)	

Time Sig.	Denominator Factorisation	Direct Note Value	Ratio	Notation	Indirect Note Value	Ratio	Notation
x/30	2 × 3 × 5	***30***-tuplet semiquaver	30:16		Interpretation 1: Triplet crotchet with nested quintuplet semiquaver Or Interpretation 2: Quintuplet quaver with nested triplet semiquaver	30:16 (2 × 3:2 × 5:4) 30:16 (2 × 5:4 × 3:2)	
x/33	3 × 11	***33***-tuplet demisemiquaver	33:32		Interpretation 1: Triplet minim with nested ***11***-tuplet semiquaver Or Interpretation 2: ***11***-tuplet quaver with nested triplet semiquaver	33:16 (3:2 × 11:8) 33:16 (11:8 × 3:2)	
x/36	2 × 2 × 3 × 3	Nonuplet demisemiquaver	36:32 (4 × 9:8)		Triplet quaver with nested triplet semiquaver	36:16 (4 × 9:4)	
x/39	3 × 13	***39***-tuplet demisemiquaver	39:32		Interpretation 1: Triplet minim with nested ***13***-tuplet semiquaver Or Interpretation 2: ***13***-tuplet quaver with nested triplet semiquaver	39:16 (3:2 × 13:8) 39:16 (13:8 × 3:2)	

Time Sig.	Denominator Factorisation	Direct Note Value	Ratio	Notation	Indirect Note Value	Ratio	Notation
***x*/42**	2 × 3 × 7	***42***-tuplet demisemiquaver	42:32 (2 × 21:16)		Interpretation 1: Triplet crotchet with nested septuplet semiquaver Or Interpretation 2: Septuplet quaver with nested triplet semiquaver	42:16 (2 × 3:2 × 7:4) 21:16 (2 × 7:4 × 3:2)	
***x*/45**	3 × 3 × 5	***45***-tuplet demisemiquaver	45:32		Interpretation 1: Triplet minim with nested triplet crotchet with nested quintuplet semiquaver Or Interpretation 2: Triplet minim with nested quintuplet quaver with nested triplet semiquaver Or Interpretation 3: Quintuplet crotchet with nested triplet quaver with nested triplet semiquaver	45:16 (3:2 × 3:2 × 5:4) 45:16 (3:2 × 5:4 × 3:2) 45:16 (5:4 × 3:2 × 3:2)	
***x*/49**	7 × 7	***49***-tuplet demisemiquaver	49:32		Septuplet crotchet with nested septuplet semiquaver	49:16 (7:4 × 7:4)	

Time Sig.	Denominator Factorisation	Direct Note Value	Ratio	Notation	Indirect Note Value	Ratio	Notation
***x*/63**	3 × 3 × 7	***63*-tuplet demisemiquaver	63:32		Interpretation 1: Triplet minim with nested triplet crotchet with nested septuplet semiquaver Or Interpretation 2: Triplet minim with nested septuplet quaver with nested triplet semiquaver Or Interpretation 3: Septuplet crotchet with nested triplet quaver with nested triplet semiquaver	63:16 (3:2 × 3:2 × 7:4) 63:16 (3:2 × 7:4 × 3:2) 63:16 (7:4 × 3:2 × 3:2)	

Table 2.3: All OFTSs found in Adès' and Ferneyhough's oeuvres.

Time Sig.	Denominator Factorisation	Number of Factors	Thomas Adès	Brian Ferneyhough
***x*/3**	3	1	*Tevot*	
***x*/5**	5	1	Uncommon	
***x*/6**	2 × 3	2	Common	
***x*/7**	7	1	*Piano Quintet*	String Quartet No. 6
***x*/9**	3 × 3	2		Uncommon
***x*/10**	2 × 5	2	Common	Common
***x*/12**	2 × 2 × 3	3	Common	Common
***x*/14**	2 × 7	2	Uncommon	Uncommon
***x*/15**	3 × 5	2		Uncommon
***x*/18**	2 × 3 × 3	3		String Quartet No. 6
***x*/20**	2 × 2 × 5	3	Uncommon	Common
***x*/22**	2 × 11	2		String Quartet No. 6
***x*/24**	2 × 2 × 2 × 3	4	Uncommon	Common
***x*/28**	2 × 2 × 7	3		String Quartet No. 6
***x*/36**	2 × 2 × 3 × 3	4		String Quartet No. 6
***x*/40**	2 × 2 × 2 × 5	4		Common
***x*/48**	2 × 2 × 2 × 2 × 3	5		Common
***x*/56**	2 × 2 × 2 × 7	4		Uncommon

1. Commonly Used Odd-Factored Denominators by Adès and Ferneyhough

The time signatures in Table 2.1 that fit into the first category of "commonly used" are self-explanatory and require little elucidation. As can be seen in Table 2.3, of the common OFDs, both Adès and Ferneyhough include ***12***-denominators in almost all their works featuring OFTSs, and Adès is also particularly fond of ***6***-denominators. Therefore, no examples of these denominators are included in this chapter, as they will inevitably arise in later chapters. However, the ***6***-denominator is important to expound upon with relation to understanding OFDs based on ***5***.

Both ***6*** and ***12*** imply triplet rhythms, the most common form of tuplets implied by OFTSs in Adès' and Ferneyhough's oeuvres. However, the primary/base triplet denominator is ***3***, which indicates triplet minim durations. A ***6***-denominator indicates sextuplet crotchets, but it can also be reinterpreted to mean *triplet* crotchets, as the notation conventions of both sextuplet and triplet in this context correlate to the same duration (i.e. sextuplets have a 6:4 ratio, which can be simplified to 3:2, the ratio of a triplet).

Therefore, although the language used to express the beat values of ***x/5*** and ***x/6*** may seem to insinuate that the "quintuplet crotchet" is faster than the "triplet crotchet", the triplet crotchet of ***x/6*** is in fact shorter in duration and therefore faster. This pattern also applies to the quintuplet quaver of ***x/10*** vs the triplet quaver of ***x/12***, the quintuplet semiquaver of ***x/20*** vs the triplet semiquaver of ***x/24***, the quintuplet demisemiquaver of ***x/40*** vs the triplet demisemiquaver of ***x/48***, and any further OFDs with the prime factorisation of base-2 multiplied by only one factor of ***5*** or ***6***.[170]

Furthermore, no OFD apart from ***3*** implies a tuplet 𝅗𝅥 note duration. This is because any other number placed in a ratio against 2 would provide a proportion steeper than 2:1, breaking normal tuplet conventions.[171] For example, if a ^{5}𝅗𝅥 were attempted, the ratio would be 5:2 (i.e. 2.5:1), yet normal tuplet conventions require the closest standard power-of-two note value (i.e. 𝅝 , 𝅗𝅥 , ♩ , ♪ , 𝅘𝅥𝅯 , 𝅘𝅥𝅰 , etc.). Quintuplets are not conventionally conceptualised as "five in the time of two" (i.e. 5:2); rather, they are traditionally conceived as "five in the time of four" (i.e. 5:4), because this does not contravene the standardised 2:1 subdivisions of the fundamental 𝅝 unit.

This is made clearer with a more extreme example: one would not assume a ***31***-tuplet implies a 31:2 ratio, i.e. 31 𝅗𝅥 in the space of 2 to make up the length of a 𝅝 duration. This would be absurd—impossible, in fact—to conceive and to perform. Therefore, the "Direct note value" columns of Tables 2.1 and 2.2 indicate the note value that adheres to *both* normal tuplet conventions: 1. A tuplet in the time of the closest conventional note value (i.e. 𝅝 , 𝅗𝅥 , ♩ , ♪ , etc.); and 2. The tuplet must fit *more* notes, not less, in the specified duration.

For example, although 7 is much closer to 8, ***x/7*** refers to a 7:4 ratio, because the normal tuplet convention refers to squeezing more attacks into a timespan and not less.[172] There are, of course, exceptions to this rule, with a duplet being the most common example. Ferneyhough often breaks this convention as well, using tuplets that fit less attacks into a timespan (see Example 2.1, where a ***6:7*** universal tuplet is used). Despite

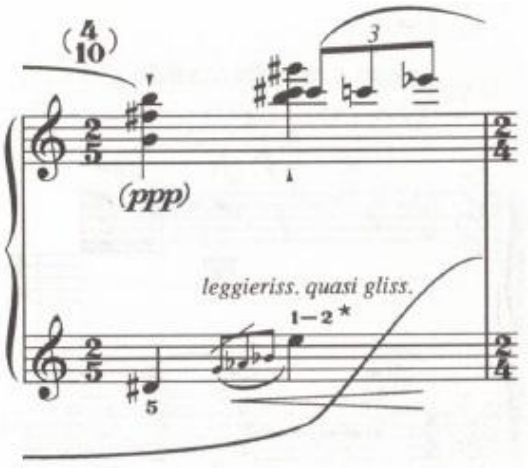
[170] I have used the full terminology of note durations in this paragraph and the previous to elucidate the difference between sextuplet and triplet. From this point onward, I will be using actual noteheads for ease of reading. The exceptions will be when referring to hemidemisemiquavers, as the tails are difficult to decipher, and rest notations.
[171] Read, *Modern Rhythmic Notation*, 22.
[172] Gardner Read, "Some Problems of Rhythmic Notation," in *Journal of Music Theory,* Vol. 9, No. 1 (1965), 259; as cited by Key, "Pan-Rational," 232-233.

these exceptions, for the sake of clarity and consistency, the "Direct note value" label refers to a duration that adheres to the convention that the tuplet must fit more notes, not less, in the specified timespan.

Example 2.1: Brian Ferneyhough, *Etudes Transcendantales*, mvt. I (bar 7).[173]

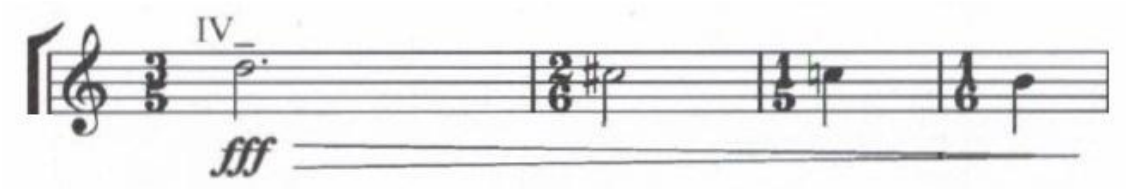
So, when looking at ***x/5***, the only examples between the two featured composers' oeuvre can be located in Adès' works. In the second movement of *Traced Overhead*, there is a clear example of a ***2/5*** bar articulated by two accented $^{5}\!\!\downarrow$ (see Example 2.2). In *Piano Quintet*, he explores the close proportional relationship between ***x/5*** and ***x/6*** by placing them adjacent to each other and alternating between them (see Example 2.3).

Example 2.2: Thomas Adès, *Traced Overhead*, mvt. II (bar 86).[174]



[173] Ferneyhough, *Etudes Transcendantales*, 9.
[174] Thomas Adès, *Traced Overhead* (London: Faber Music, 1995-1996), 9.

Example 2.3: Adès, *Piano Quintet* (page 6), violin 1 line.[175]



In Example 2.3, notice how the noteheads are not distinguishable between bars with different time signature denominators. The denominators are the only indication of their respective tuplet values; to wit, the "tupletness" of any note in an OFTS bar is subsumed into the denominator. The reliance on the time signature to inflect the note value is inconsistent with general notational practice; however, it has a historical precedent in Medieval notational practice, where mensuration inflected duration.

With mensuration conventions, there was not an absolute/objective duration attributed to a specific notehead. Cowell, in *New Musical Resources*, proposed a new system of different noteheads to indicate different note values.[176] However, this has not been widely adopted, likely due to lack of efficacy.[177]

Also, Adès is not consistent with how he notates tuplet rhythms in OFTS bars in his works (which will be discussed in more detail in the next chapter).[178] However, for the purposes of this chapter, the generally established norm for notating rhythms within OFTS bars is the use of normal, unadorned noteheads, and any tuplet brackets imposed on them would imply nested tuplets (which will be discussed with Example 2.6, as well as in later chapters, particularly with Ferneyhough's persistent use of nested tuplets throughout his output). This established norm of unadorned noteheads in OFTS bars is adopted in Adès' later works (such as *Piano Quintet*) and throughout Ferneyhough's oeuvre.

The only exception in Ferneyhough's works where the use of tuplet brackets imposed on rhythms in OFTS bars does *not* imply nested tuplets is found in a particularly complex passage of *Finis Terrae*. This will be discussed in more detail in chapter 6 with Example 6.10(b). However, it will be briefly flagged here:

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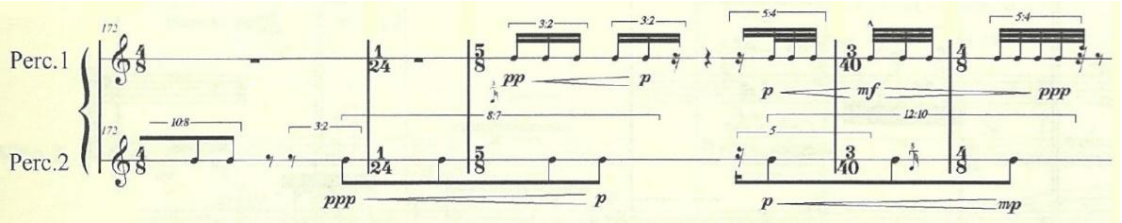
[175] Adès, *Piano Quintet*, 6.
[176] Cowell, *New Musical Resources*, 59.
[177] Read, *Source Book*, 272–279; Read, *Modern Rhythmic Notation*, 102.
[178] For more information, regarding the notational inconsistency of Adès' works, see Wheatley, "Irrational Time Signatures," 23-26; as well as in chapter 3 of this thesis, 126-129.

Example 2.4: Brian Ferneyhough, *Finis Terrae* (bars 172-176a), percussion lines.[179]



Ferneyhough's use of OFTSs in the percussion 2 line in Example 2.4 only serves to delineate bar duration. The tuplet value of the ♪ notes in both the ***1/24*** and ***3/40*** bars are explicated by the tuplet brackets spanning across bar lines, as he has grouped notes in both conventional and OFTS bars. So, in the first instance, in bars 172-174 of the percussion 2 line, there is an ***8:7*** ^{3}♪ tuplet bracket over the ♩♩♩ figure, which means the rhythm is eight ^{3}♪ or four ^{3}♪ notes in the time of seven ^{3}♪ notes. The ♪ in the ***1/24*** bar is not a nested ^{3}♪ note. Similarly, in bars 174-176 of the percussion 2 line, there is a ***12:10*** ^{5}♬ tuplet bracket over the ♩♩♩ figure, which means the rhythm is 12 ^{5}♬ or six ^{5}♪ or three ^{5}♩ notes in the time of 10 ^{5}♬ (quintuplet demisemiquavers). The ♪ in the ***3/40*** bar is not a nested ^{5}♩ note.

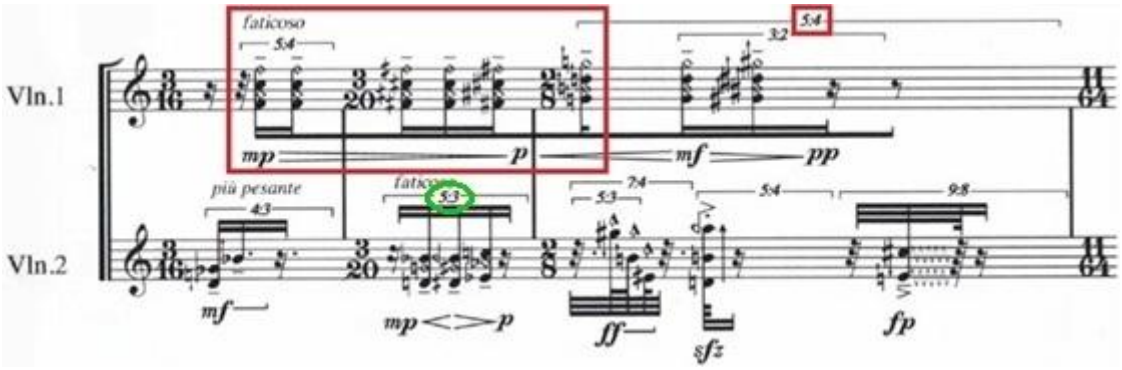
Example 2.5: Adès, *Piano Quintet* (rehearsal mark 10).[180]

[179] Brian Ferneyhough, *Finis Terrae* (London: Edition Peters, 2012), 35.
[180] Adès, *Piano Quintet*, 14.

Following the pattern of quintuplet rhythms, ***x/10*** is the next OFTS based on a ***5***-denominator, and it is commonly used by both composers. Adès makes the beat value explicit in *Piano Quintet* when he reinterprets a ***2/4*** bar as a ***5/10*** bar with $\overset{5}{\text{♪}}$ notes (see Example 2.5).

As ***x/10*** is almost as common as ***x/12***, many more examples will be encountered in later chapters, particularly in *Mort Subite*, as ***10*** and ***12*** are the only two OFDs used in the case study piece. The other ***5***-based denominator that commonly occurs is ***x/20***, though it is used more frequently by Ferneyhough than Adès. Ferneyhough elucidates the implied $\overset{5}{\text{♪}}$ note value in the ***3/20*** bar in his String Quartet No. 6 by preceding and following the bar with the same note durations notated with explicit ***5:4*** tuplet brackets in conventional time signature bars (see the red box annotations):

Example 2.6: Brian Ferneyhough, String Quartet No. 6 (bars 340-342), violin 1 and 2 lines.[181]

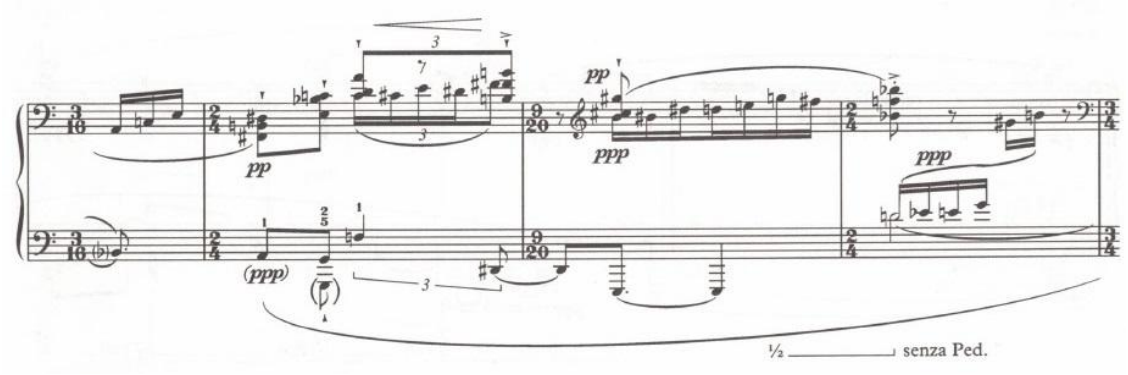


As seen in the violin 2 line above, the ***5:3*** tuplet bracket—circled in green—imposed on the semiquavers of the ***3/20*** bar indicates a nested tuplet (i.e. a ***5:3*** tuplet is nested within the universal ***5:4*** quintuplet implied by the ***20***-denominator).

As another example of a ***20*** denominator, Adès uses a ***9/20*** bar in *Traced Overhead* and notates the implied $\overset{5}{\text{♪}}$ in the same way:

[181] Brian Ferneyhough, String Quartet No. 6 (London: Edition Peters, 2010), 33.

Example 2.7: Adès, *Traced Overhead*, mvt. II (bars 63-66).[182]



2. Uncommon Odd-Factored Denominators Used by Adès and Ferneyhough

The uncommon or rare OFDs of the second category are based on the next two prime numbers: 7 and 11. Starting with 7-based denominators, there is only one work in each of Adès' and Ferneyhough's outputs that contain ***x*/7** time signatures: *Piano Quintet* and String Quartet No. 6 respectively. This is unsurprising, as both these pieces feature the most adventurous and rare uses of OFTSs by their corresponding composers. Expanding Example 2.3 a little further, the below excerpt from *Piano Quintet* includes the piano part and five preceding bars:

Example 2.8: Adès, *Piano Quintet* (page 6), violin 1 and piano lines.[183]

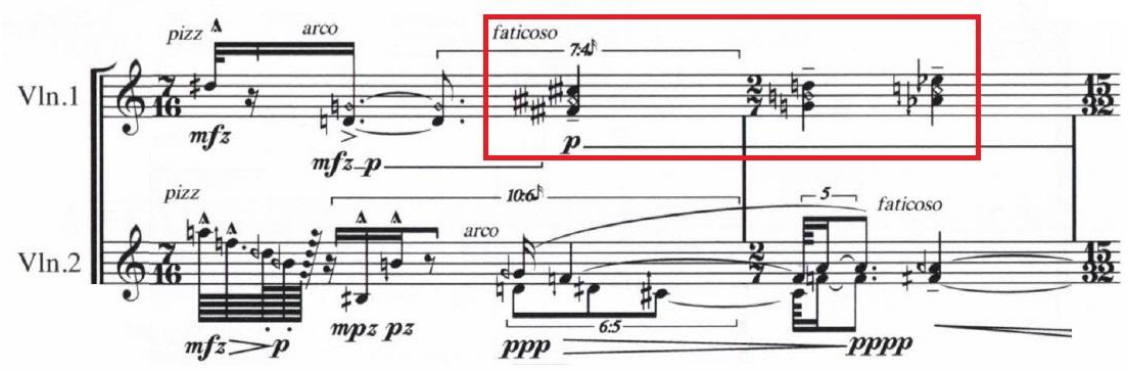
The red box in Example 2.8 highlights the **7**-denominator bar for ease of reference. The green box features the use of the same ♩ notation across the ***1*/5**, ***1*/6**, and ***1*/7** bars, implying a sequence of 5:4, 6:4, and 7:4 ratio note durations (i.e. a successive shortening of durations facilitating an artificial acceleration). This will be discussed in more detail in the *Piano Quintet* case study chapter, under the subsection "2b. Rhythmic

[182] Adès, *Traced Overhead*, 7.
[183] Adès, *Piano Quintet*, 6.

Ornamentation: Artificial Tempo Change". Again, it is important to recognise that the unadorned 𝅗𝅥 notehead is used throughout these different bars; only the denominator can confirm the note's actual duration.

Similar to Example 2.6, Ferneyhough explicates the 7𝅗𝅥 durations of the ***2/7*** bar in his String Quartet No. 6 by preceding the bar with a ***7:4*** 𝅘𝅥𝅯 tuplet in a conventional time signature (see Example 2.9). This pattern of preceding and/or following OFTS bars with the same tuplet beats in adjacent bars will reappear in all future examples from String Quartet No. 6.

Example 2.9: Ferneyhough, String Quartet No. 6 (bars 329-330), violin 1 and 2 lines.[184]

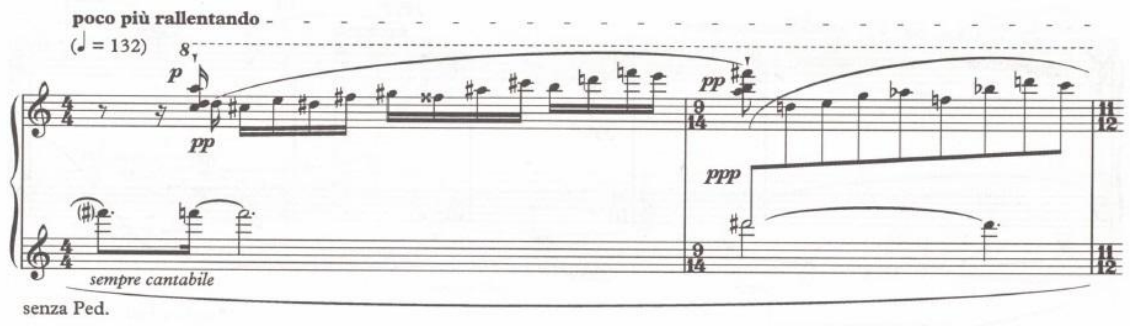


The time signature ***x/14*** seems slightly more common than ***x/7***; it appears a little more frequently in Adès' and Ferneyhough's pieces, likely because it is the septuplet equivalent of the common *x*/***10*** and *x*/***12*** OFTSs. There is a similar pattern with the quintuplet- and triplet-implying denominators where ***x/10*** and ***x/12*** are more common than ***x/5*** and ***x/6*** respectively.

The use of the *x*/***14*** time signature is demonstrated most clearly in Adès' *Traced Overhead* (see Example 2.10) and Ferneyhough's *Carceri d'Invenzione III* and *Silentium* (excerpts from these pieces are not provided in this chapter as these works are examined in chapter 6 under their respective subsections). ***x/14*** implies 7𝅘𝅥𝅯 notes, similar to how ***x/10*** and ***x/12*** imply their corresponding tuplet 𝅘𝅥𝅯 durations.

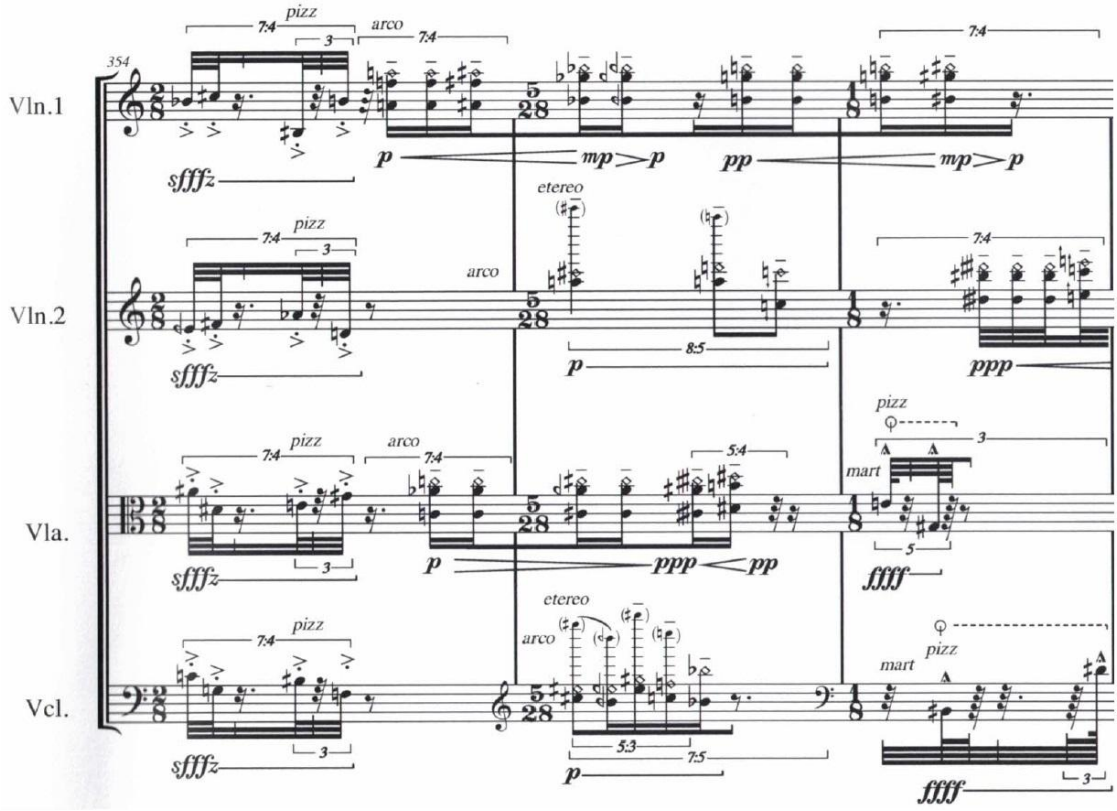
[184] Ferneyhough, String Quartet No. 6, 32.

Example 2.10: Adès, *Traced Overhead*, mvt. II (bars 98-99).[185]



The OFD ***x/28*** only appears once in either composer's output, and it is found in Ferneyhough's String Quartet No. 6. The same is also true of the only 11-based denominator: ***x/22***. String Quartet No. 6 will be examined in greater detail in chapter 6, during the discussion of Ferneyhough's works. Examples 2.11 and 2.12 below are only provided here to show the respective 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 and 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 note durations, which are implied by the OFDs of ***28*** and ***22***.

Example 2.11: Ferneyhough, String Quartet No. 6 (bars 354-356).[186]



[185] Adès, *Traced Overhead*, 10.
[186] Ferneyhough, String Quartet No. 6, 35.

Example 2.12: Ferneyhough, String Quartet No. 6 (bars 344-346), violin 2 line.[187]

As previously mentioned, triplet-implying OFDs are the most common, so ***x/24*** is seen more often than ***x/28*** or ***x/22***. Adès incorporates ***1/24*** into a composite time signature at the end of *Piano Quintet*:

Example 2.13: Adès, *Piano Quintet* (page 39), cello and piano lines.[188]

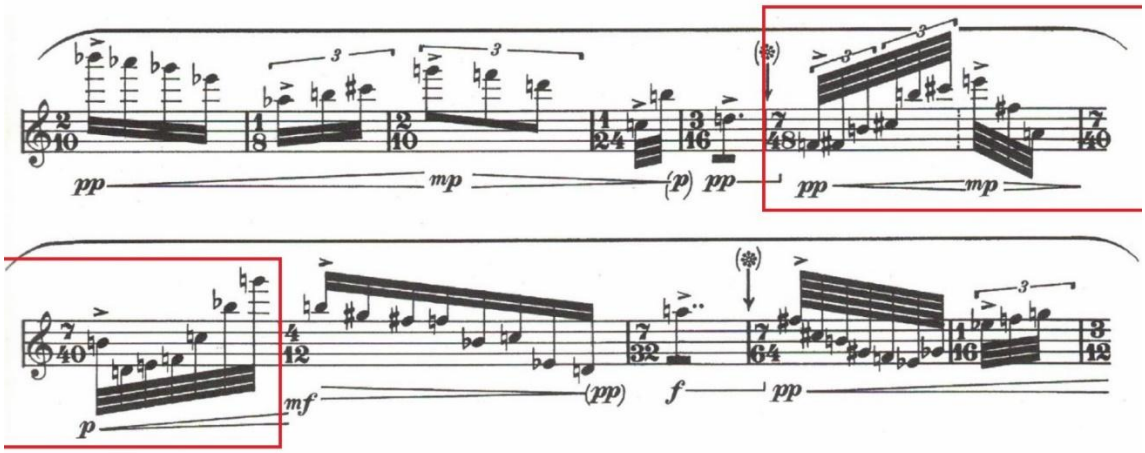
As it applies to a tied note, the composite time signature in Example 2.13 (annotated in the red box) serves to indicate the bar duration as well as specific note durations. The way Adès has notated the bar aligns with the composite time signature and provides an effective breakdown of the note value each OFD implies. For the ***2/7***, the note length would be a 𝅗𝅥 , as two ♩ would notationally form a 𝅗𝅥 duration, and therefore two 𝅗𝅥 would equate to a 𝅗𝅥 (i.e. 2 × 7:4). As previously established, the ***1/10*** indicates a 𝅘𝅥𝅯 (i.e. 10:8). At the end of the bar, ***1/24*** is shown in the 𝅘𝅥𝅰 (i.e. 24:16).

[187] Ferneyhough, String Quartet No. 6, 34.
[188] Adès, *Piano Quintet*, 39.

This is a fascinating example, because reading the notated rhythm in isolation without the time signature context would not provide the performer an accurate understanding of the different proportional relationships exploited in this one bar. Furthermore, it would not be an accurate representation of the actual duration of the tied note and absolute bar length.

So far, the examples have dealt with tuplet ♩, ♪, and ♪ note values. Ferneyhough has a propensity to use much shorter note durations, not only with rhythms in OFTS bars, but generally as well. In his pieces, there are a few examples of OFTSs that indicate tuplet ♪ (demisemiquaver) note durations such as ***x/40***, ***x/48***, and even ***x/56*** (with the ***40***- and ***48***-denominators occurring more commonly than ***56***, as the latter is 7-based which is less common). In *Superscriptio*, he provides a convenient point of comparison between a ***7/48*** bar and a ***7/40*** bar by placing them side by side; the two bars share the same numerator, even though they do not share the same number of attacks:

Example 2.14: Brian Ferneyhough, *Superscriptio* (bars 46-56).[189]



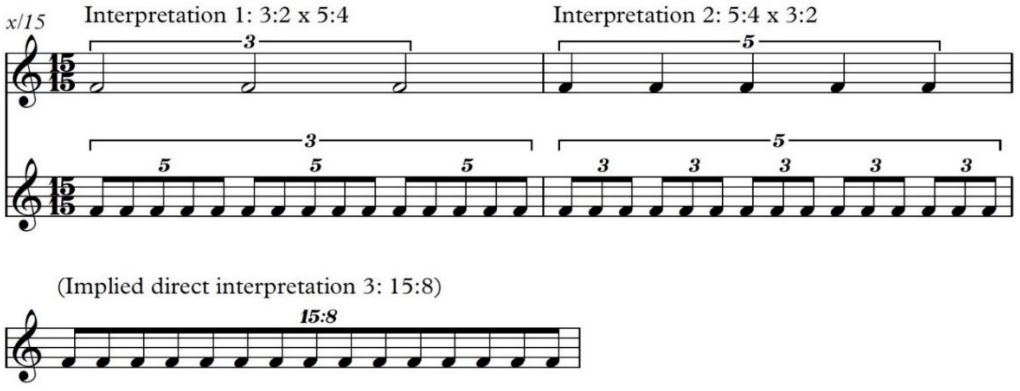
The OFD of ***56*** occurs in two of Ferneyhough's pieces: String Quartet No. 6 and *Carceri d'Invenzione III*. The more illuminating example is found in String Quartet No. 6: here, the ***11/56*** bar is preceded by rhythms with explicit septuplet brackets in the violin 2 line, which prepare for the upcoming 𝅘𝅥𝅯 (septuplet demisemiquaver) durations:

[189] Brian Ferneyhough, *Superscriptio* (London: Edition Peters, 1982), 2.

Example 2.15: Ferneyhough, String Quartet No. 6 (bars 356-357), violins 1 and 2, and viola lines.[190]

All the OFDs discussed thus far have featured only one odd number in their prime factorisation. However, the interpretation of OFTS notation becomes more complex when there is more than one odd number in the factorisation of the denominator. One such instance is ***x/15***, which can be interpreted at least two different ways: firstly, 3 × 5 where the 𝅝 is split into 𝅗𝅥 containing nested ^{5}♪ (i.e. 3:2 × 5:4); or secondly, 5 × 3 where the 𝅝 is divided into ^{5}𝅗𝅥 containing nested ^{3}♪ (5:4 × 3:2).

Example 2.16: Comparison of different interpretations of note values belonging to *x/15* time signature with explicated tuplet notation.



Regardless, a 15:8 ratio is derived from either interpretation, making up an implied direct third interpretation of simply 15:8 ♪ durations (i.e. ^{15}♪ notes) with no nesting tuplet procedure involved. The "Interpretation 1", "Interpretation 2", and

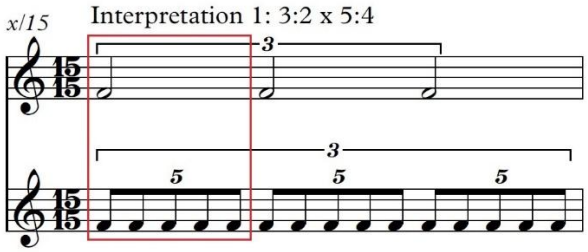
[190] Ferneyhough, String Quartet No. 6, 35.

"Interpretation 3" labels found in some rows of Table 2.2 are attributed to OFDs that feature this sort of interpretive ambiguity.

Example 2.17: Ferneyhough, String Quartet No. 6 (bars 348-350).[191]

Of the two composers, only Ferneyhough has used ***15***-denominators. In String Quartet No. 6, the ***5/15*** bar correlates to interpretation 1, because the absolute bar duration of ***5/15*** can be simplified to ***1/3*** (i.e. the bar is the length of a 𝅗𝅥 duration). Therefore, the ♪ durations notated in the bar are implied to be nested ^{5}♪ (see Example 2.17). It follows that a ***x/15*** time signature of either ***5/15*** or ***10/15*** would indicate interpretation 1, as the absolute bar durations would imply umbrella ^{3}𝅗𝅥 bar lengths, subdivided into nested ^{5}♪ pulses.

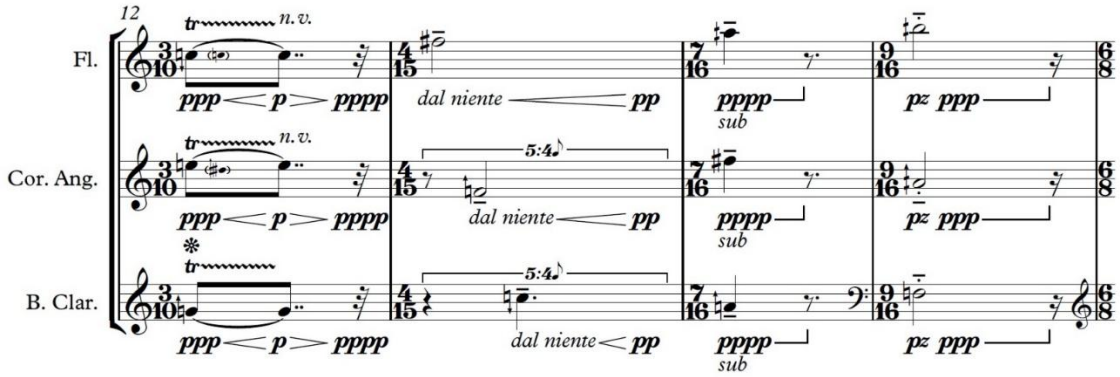
Example 2.18: How bar 350 of Ferneyhough's String Quartet No. 6 fits into interpretation 1.



Conversely, a ***x/15*** time signature expressed as ***3/15***, ***6/15***, ***9/15***, or ***12/15*** would infer interpretation 2, as the absolute bar durations would indicate umbrella ^{5}♩ bar lengths subdivided into nested ^{3}♪ pulses. However, in *In Nomine a 12*, the implied direct interpretation 3 is utilised instead, as the absolute bar duration of ***4/15*** does not equate to either a ^{3}𝅗𝅥 ***5/15*** or a ^{5}♩ ***3/15*** bar length.

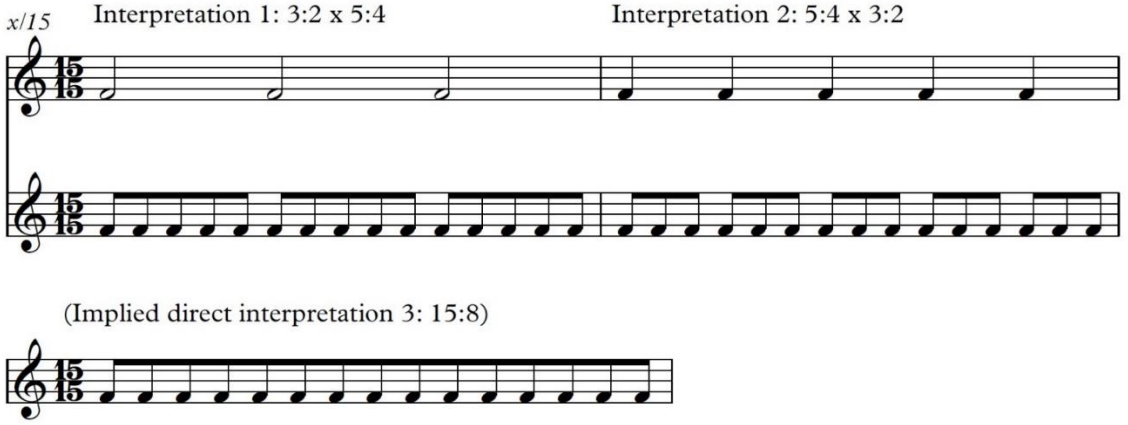
[191] Ferneyhough, String Quartet No. 6, 34.

Example 2.19: Brian Ferneyhough, *In Nomine a 12* (bars 12-15).[192]



The ***4/15*** indicates four $^{15}\!\!\!

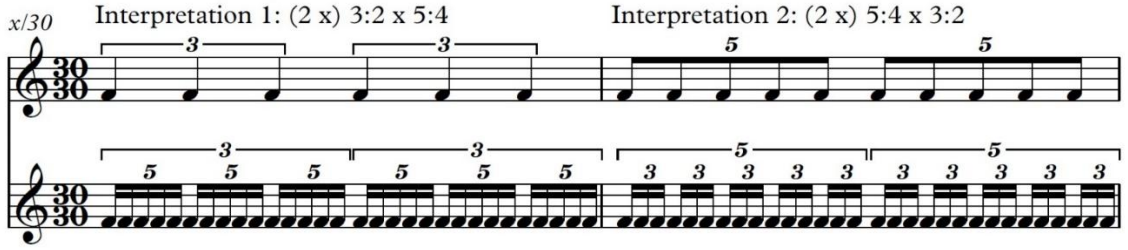
Example 2.21: Comparison of different interpretations of note values belonging to *x/15* time signature without tuplet notation (note values are implied by the OFD alone).



For the remainder of this chapter, it will be assumed that any examples that explicitly show the tuplet brackets (such as Example 2.16) only include these to clarify any ambiguous tuplet interpretations. They do not reflect the generally established notation practice of either composer.

Although ***x/30*** is derived from ***x/15***, it is not found in either composer's works. For the sake of clarity, similar to ***x/15***, a comparison is provided below of the different interpretations of ***x/30***:

Example 2.22: Comparison of different interpretations of note values belonging to *x/30* time signature with explicated tuplet notation.

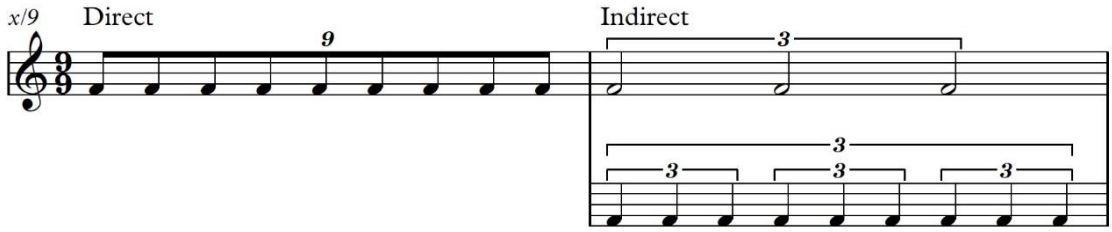


There is one other branch of ambiguity that has not yet been addressed. As previously mentioned, the "Direct note value[s]", and therefore direct interpretations, refer to tuplets that adhere to *both* normal tuplet conventions: 1. Note values corresponding to the closest conventional note value; and 2. Fitting more notes—not less—in the specified duration. However, multiplying or compounding ratios obscure interpretation and introduce ambiguities in a way that may not be immediately apparent.

To illustrate, let us first focus on ***x/9***, a denominator with two odd-numbered factors, like ***x/15***. However, unlike ***x/15***, which is made up of two *different* odd factors, ***x/9*** is made up of the *same* two numbers: 3 × 3. The direct interpretation of ***x/9*** would be 9:8, implying $^{9}\!\!\blacksquare$ durations. This would satisfy both rules according to normal tuplet conventions. However, if the relevant ratios were compounded, it would actually result in 3:2 × 3:2 = 9:4. The "4" would indicate tuplet ♩ durations (not ♪ notes).

The problem with this latter interpretation is that it does not adhere to the first rule of normal tuplet conventions: a $^{9}\!\!\blacksquare$ does not engage with the closest conventional note value of a ♪ note. Also, 9:4 would contravene the standardised 2:1 subdivisions of the fundamental 𝅝 unit, as it is a ratio steeper than 2:1 (i.e. 9:4 = 2.25:1). Therefore, this interpretation has been deemed as the "Indirect note value" (as referred to in Table 2.2); the notational proportion is calculated indirectly via its factors' ratios. (Incidentally, the reason the term "direct" is used for the "Direct note value" columns is because it is a terminological antonym for "indirect".) For the indirect interpretation of ***x/9***, 3:2 × 3:2 would indicate $^{3}\!\!\blacksquare$ consisting of nested $^{3}\!\!\blacksquare$ notes:

Example 2.23: Comparison of different interpretations of note values belonging to *x/9* time signature with explicated tuplet notation.



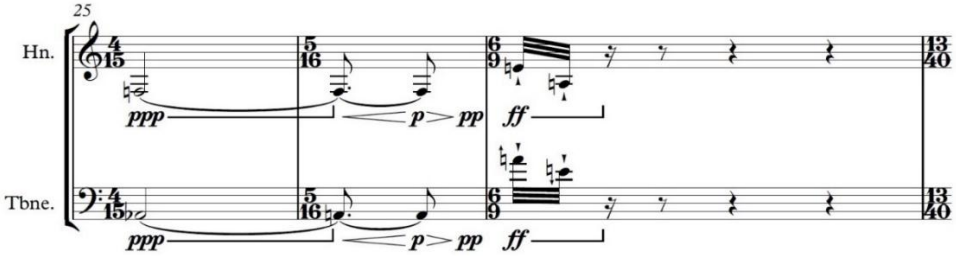
Adès uses the indirect note value in *Piano Quintet* (see Example 2.24), but there are even further notational ambiguities to the rhythms and noteheads employed. As the indirect interpretation of ***x/9*** involves umbrella/universal $^{3}\!\!\blacksquare$ durations, the reading of the 𝅗𝅥 notes in the ***3/9*** bars could be mistaken for straightforward $^{3}\!\!\blacksquare$ notes. However, these 𝅗𝅥 are actually the result of the combination of two nested $^{3}\!\!\blacksquare$ notes, made apparent by the fact that there is a nested triplet crotchet rest at the end of each ***3/9*** bar. It could be argued that if Adès wanted to notate a duration spanning the full ***3/9*** bar, he could have written either a 𝅗𝅥 notehead (as that would have indicated the umbrella $^{3}\!\!\blacksquare$ value) or a 𝅗𝅥. note (as that would have indicated the combination of three nested $^{3}\!\!\blacksquare$ notes).

Example 2.24: Adès, *Piano Quintet* (rehearsal mark 15).[193]

This is the issue with the current rhythmic notation system: it is unclear whether a tuplet 𝅗𝅥 indicates the umbrella tuplet or it is the combined duration of two nested ♩ notes. This is the same problem for tuplet ♩ notes as umbrella tuplets or the combination of two nested ♪ notes, tuplet ♪ as umbrella tuplets or two nested 𝅘𝅥𝅯 notes, and so on.

The benefit of Example 2.24 is that it demonstrates Adès' notational consistency, at least within this passage: in the piano part, the 𝅗𝅥 in the ***3/7*** bars clearly indicates a duration equal to that of two ^{7}♩ notes. The 𝅗𝅥 notes in Example 2.24 are the result of two tuplet ♩ regardless of the time signature; they are not pure units of tuplet 𝅗𝅥 but rather indicate an aggregate duration.

Example 2.25: Ferneyhough, *In Nomine a 12* (bars 25-27).[194]

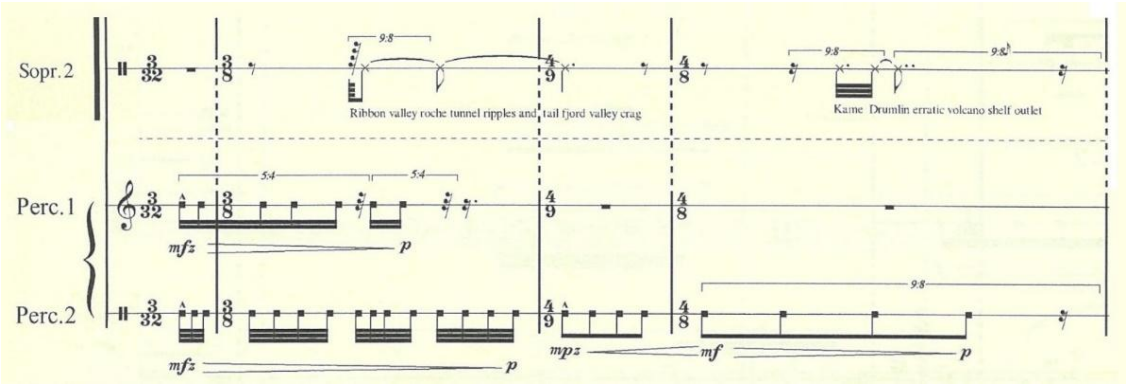


Ferneyhough, on the other hand, always employs the direct interpretation when it comes to ***x/9*** time signatures. In *In Nomine a 12*, he notates six ^{9}♪ in a ***6/9*** bar (instead

[193] Adès, *Piano Quintet*, 20.
[194] Ferneyhough, *In Nomine a 12*, 8.

of the indirect interpretation of six nested $^{3}\!\!\downarrow$ notes; see Example 2.25). In *Finis Terrae*, a $^{9}\!\!\downarrow$. in the soprano 2 line is used to symbolise an aggregate duration of three direct $^{9}\!\!\downarrow$ in the ***4/9*** bar (made clear in the percussion 2 line):

Example 2.26: Ferneyhough, *Finis Terrae* (bars 190-193).[195]



Etudes Transcendantales contains a sequence of ***x/9*** bars (see Example 2.27). However, there is a notational error in the excerpt below. The cello plays a progression of ***2/9***, ***3/9***, and ***4/9*** bars while the soprano and harpsichord perform two bars of ***2/8***, but those durations are not equivalent: ***2/9*** + ***3/9*** + ***4/9*** = ***9/9*** (i.e. one $\mathbb{o}$ in duration) while ***2/8*** × 2 = ***4/8*** (i.e. one $\mathbb{d}$ in length).

Example 2.27: Ferneyhough, *Etudes Transcendantales*, mvt. III (bars 27-29).[196]

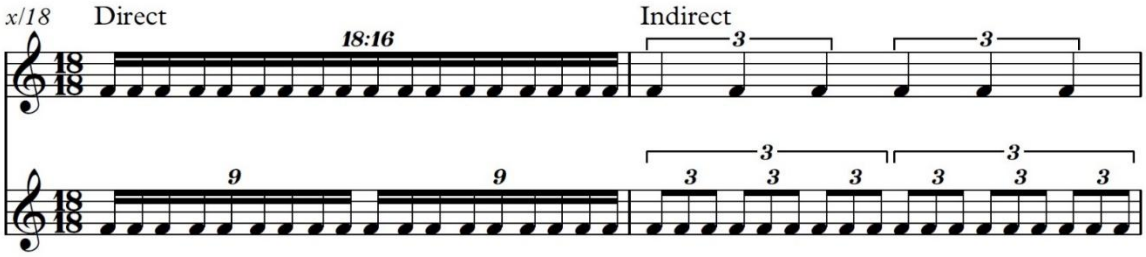
To rectify this notational error, Ferneyhough would need to either change the soprano and harpsichord time signatures to be two bars of ***2/4*** and double all their rhythms, or halve the rhythms in the cello and make the ***x/9*** time signatures into ***x/18*** time signatures with the same numerators (i.e. ***2/18***, ***3/18***, and ***4/18***). It is likely easier to

[195] Ferneyhough, *Finis Terrae*, 37.
[196] Ferneyhough, *Etudes Transcendantales*, 21.

enact the latter option, as only one instrument with a relatively simple part would have to be altered, but it is uncertain which version Ferneyhough intended, as this notational error affects the absolute/overall duration of these bars.

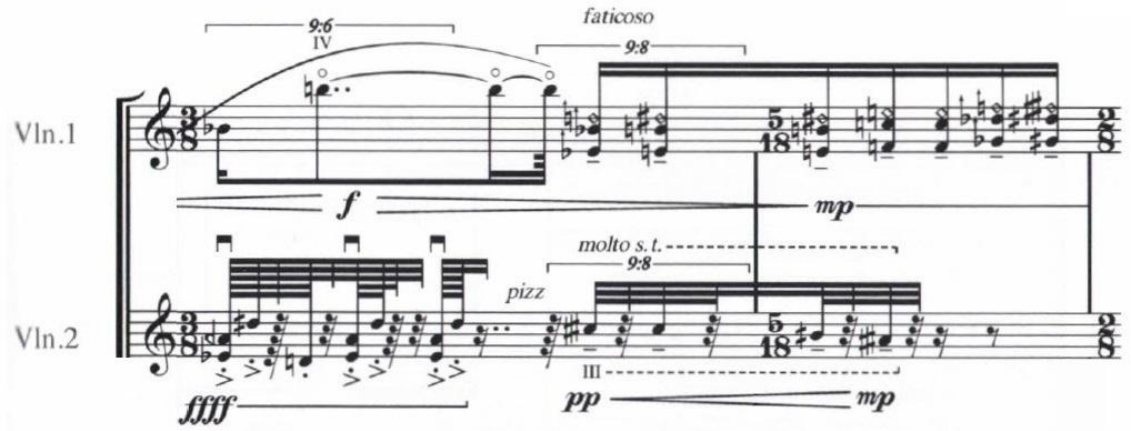
On the topic of ***x/18*** time signatures, as these are derived from ***x/9***, they experience the same issues with the direct and indirect interpretations:

Example 2.28: Comparison of different interpretations of note values belonging to *x/18* time signature with explicated tuplet notation.



As Ferneyhough is the only one to include ***x/18*** in his works, and since he favours the direct interpretation, the excerpt from String Quartet No. 6 below features direct ***18:16***-tuplet semiquavers:

Example 2.29: Ferneyhough, String Quartet No. 6 (bars 333-334), violin lines.[197]



However, the direct interpretation of Example 2.29 contradicts the ***x/36*** bar a few bars later, another OFD based on ***x/9*** (see Example 2.30). There are a few issues with the excerpt below. While all the other OFDs in String Quartet No. 6 are notated with the direct interpretation, the ***7/36*** bar is the only one notated with the indirect note value. In this instance, the indirect note value of ***x/36*** is nested $^{3}\!\!\diagup\!\!\!\diagdown$ notes. For a comparison of

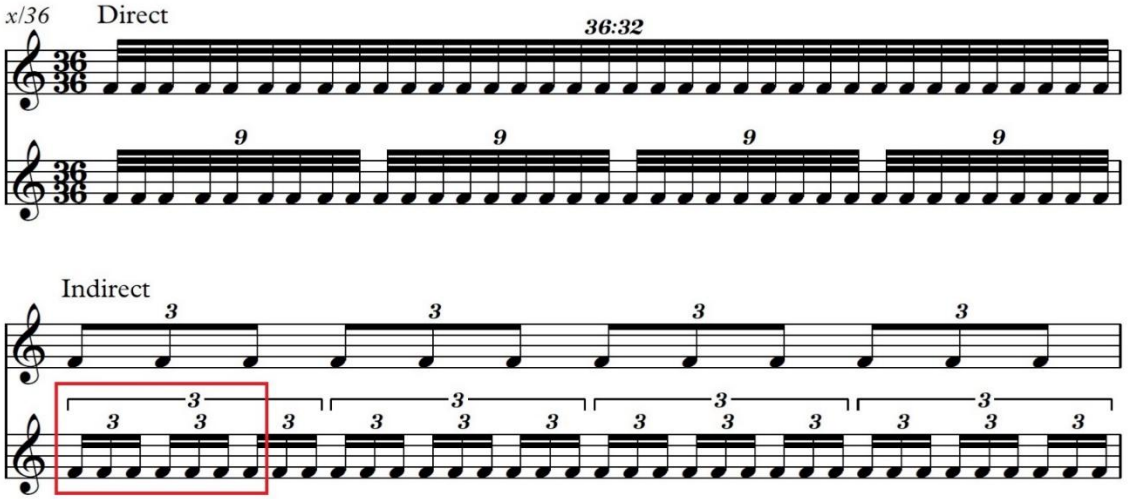
[197] Ferneyhough, String Quartet No. 6, 33.

direct vs indirect interpretations of ***x/36***, see Example 2.31, which has a red box annotation indicating the nested ^{3}𝅘𝅥𝅯 durations of the ***7/36*** bar of Example 2.30.

Example 2.30: Ferneyhough, String Quartet No. 6 (bars 345-349).[198]

[198] Ferneyhough, String Quartet No. 6, 34.

Example 2.31: Comparison of different interpretations of note values belonging to *x/36* time signature with explicated tuplet notation.

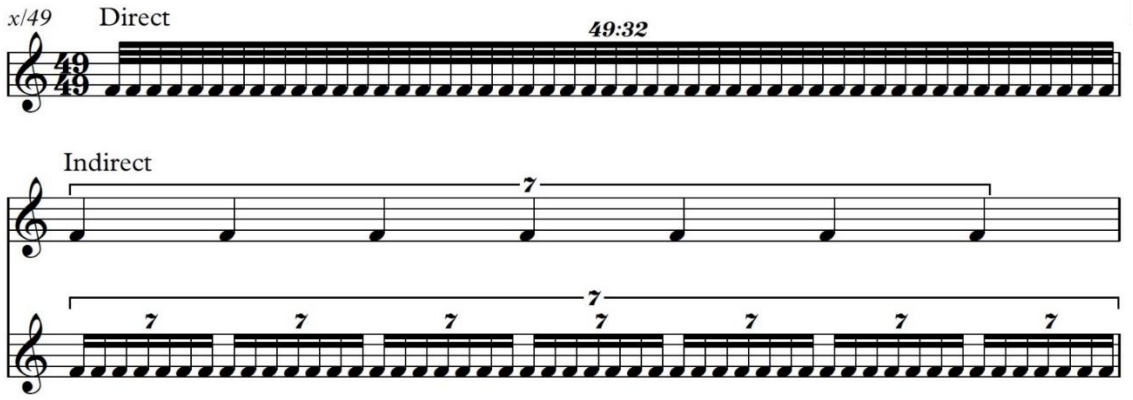


Furthermore, there are other complications and related notational errors.[199] In the previous excerpts from String Quartet No. 6, such as Examples 2.6, 2.9, and 2.11, Ferneyhough establishes a pattern of preceding and/or following bars of OFTSs with the same tuplet beats with explicit corresponding tuplet brackets. This can even be seen with a different time signature in Example 2.30, when he does this with the $^{11}\!\!\!

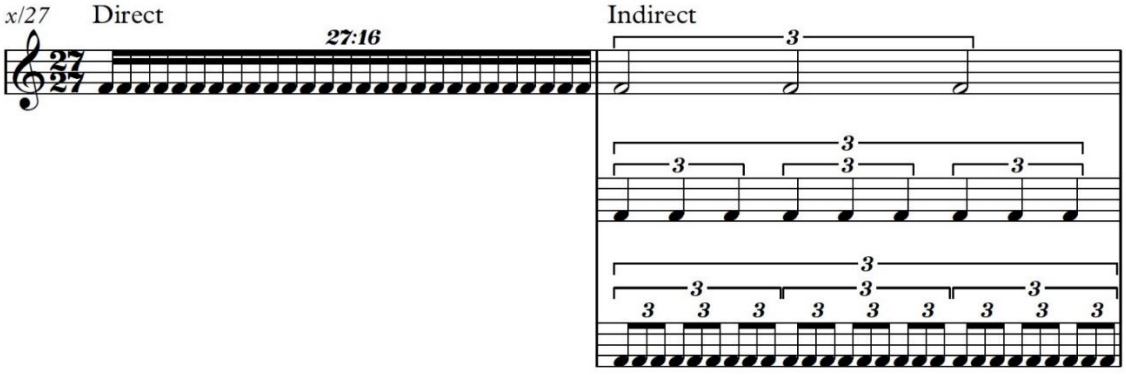
3. Odd-Factored Denominators Not Used by Adès or Ferneyhough

The remainder of this chapter will briefly explore the time signatures belonging to the third category: a few select ambiguous OFTSs that are not yet found in the works of Adès or Ferneyhough but deserve to be analysed—or at least demonstrated—for posterity. Just as ***x/9*** is the result of two of the same odd-numbered factors (i.e. 3 × 3 or 3^2), so too is ***x/49*** factorised as two identical odd-numbered factors (i.e. 7 × 7 or 7^2). However, *x*/***49*** has fewer complications than ***x/9***.

Example 2.32: Comparison of different interpretations of note values belonging to *x*/*49* time signature with explicated tuplet notation.



Example 2.33: Comparison of different interpretations of note values belonging to *x*/*27* time signature with explicated tuplet notation.

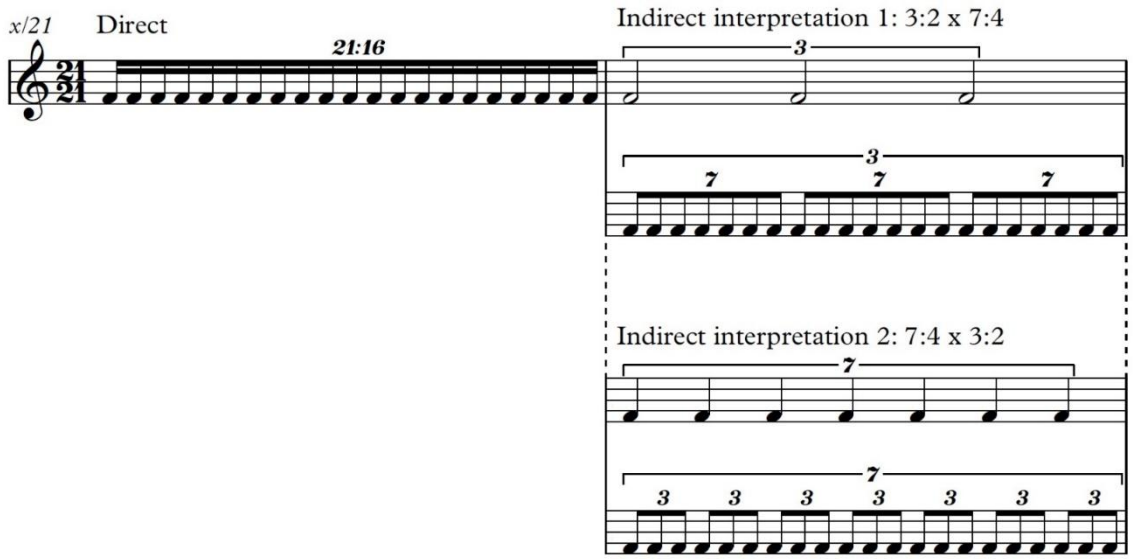


The OFD ***x/27*** has even more layers in the indirect interpretation, as it contains *three* of the same odd-numbered factor: 3 × 3 × 3 or 3^3 (as seen above). Time signatures involving multiple indirect interpretations are the result of denominators with at least two different odd-numbered factors.

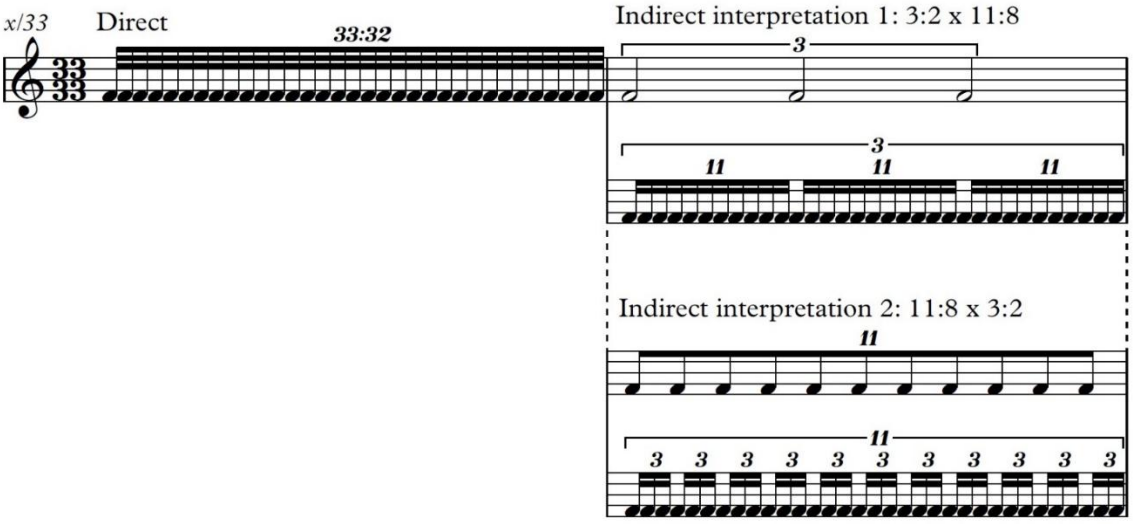
While ***x/21*** can be interpreted directly as 21:16, as in ^{21}𝅘𝅥𝅯 notes, since the factorisation of 21 is 3 × 7, and by extension the ratios would be 3:2 × 7:4 = 21:8 (which

is a steeper proportion than 2:1), there are two different indirect interpretations (see Example 2.34). A similar commentary may be applied to ***x/33***, ***x/39***, and ***x/42***, demonstrated in Examples 2.35, 2.36, and 2.37 respectively.

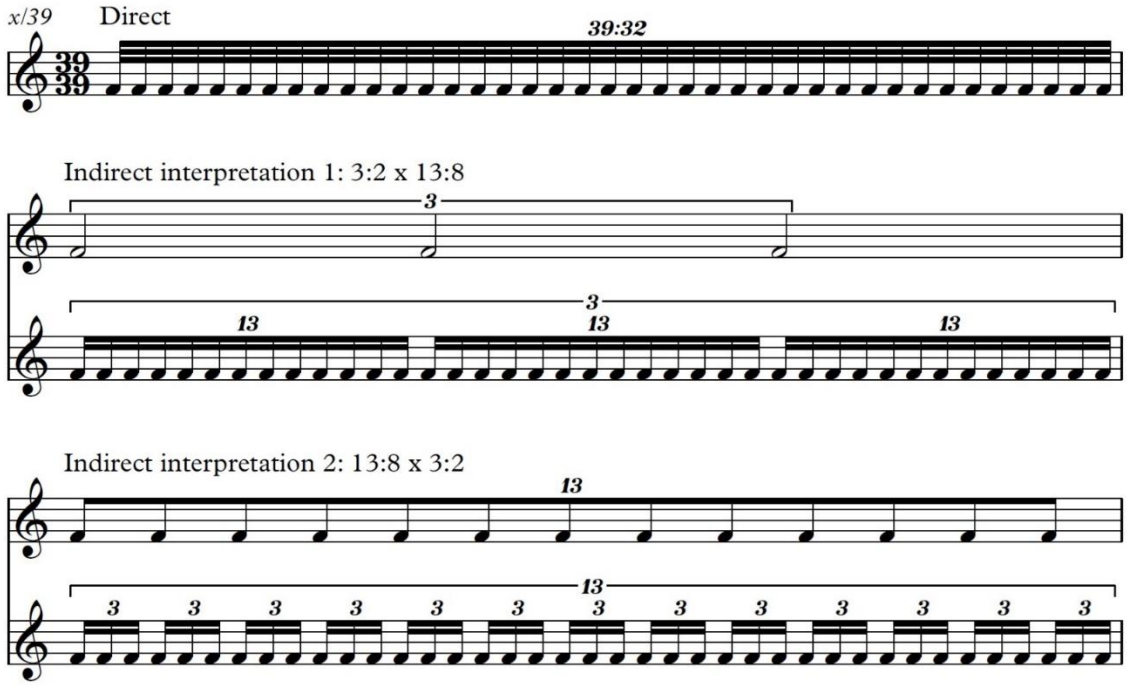
Example 2.34: Comparison of different interpretations of note values belonging to *x/21* time signature with explicated tuplet notation.



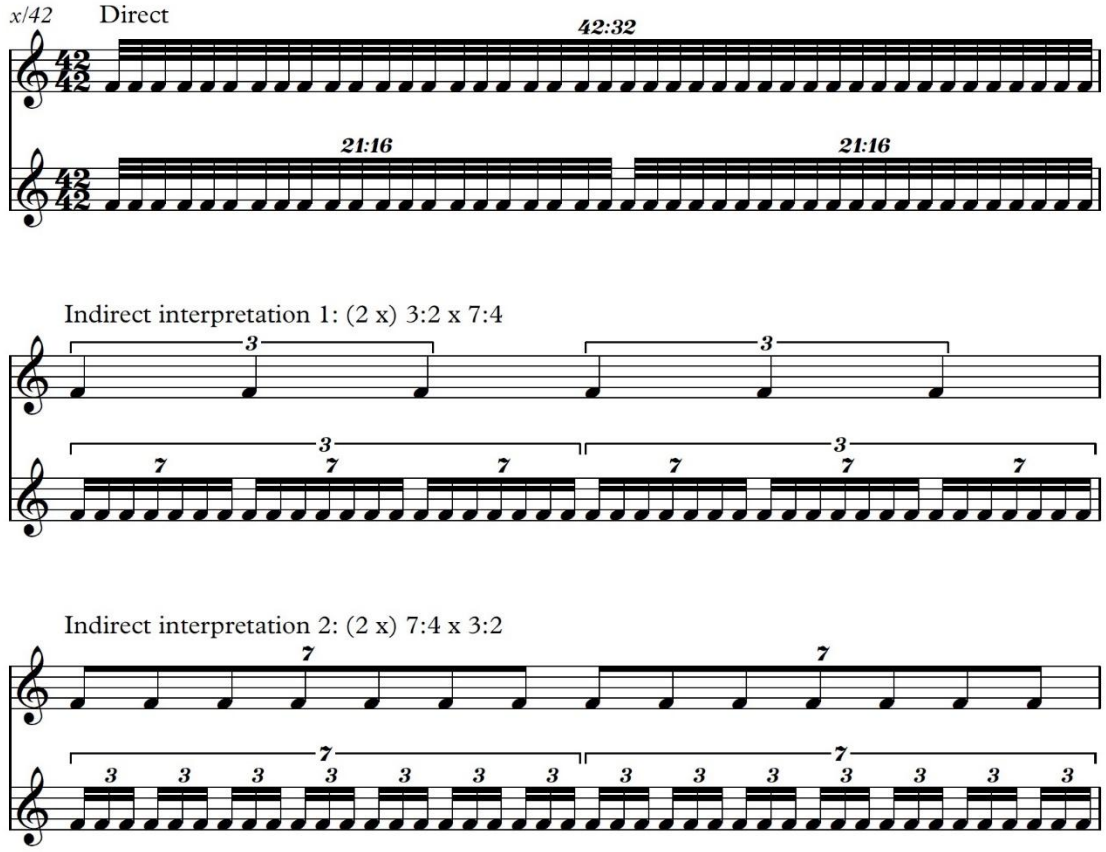
Example 2.35: Comparison of different interpretations of note values belonging to *x/33* time signature with explicated tuplet notation.



Example 2.36: Comparison of different interpretations of note values belonging to *x/39* time signature with explicated tuplet notation.



Example 2.37: Comparison of different interpretations of note values belonging to *x/42* time signature with explicated tuplet notation.



The final two time signatures to be addressed are ***x/45*** and ***x/63***. They are similar to ***x/27*** in the sense that the denominators involve three odd-numbered factors, but with ***x/45*** and ***x/63*** at least one number is different in the factorisation. So, for ***x/45***, its direct interpretation would be 45:32, i.e. $^{45}\!\!\!

With ***x/63***, the multiplication of the constituent ratios would provide an even steeper proportion, as 3:2 × 3:2 × 7:4 = 63:16 would equate to 3.9375:1. This is to be expected, as the ***63***-denominator is only one integer away from the next conventional denominator of ***64***.

Example 2.39: Comparison of different interpretations of note values belonging to *x/63* time signature with explicated tuplet notation.

Looking back towards the beginning of this chapter, it is evident from Table 2.3 that both composers have used ***10***- and ***12***-denominators frequently, which indicates their propensity to engage with quintuplet and triplet rhythms. However, Adès seems to use smaller denominators more frequently than Ferneyhough and, between the two of them, is the only one to use ***x/3***, the simplest OFD possible.

Ferneyhough, on the other hand, has a propensity to use very short note values in his pieces, and this allows him to utilise note beaming as another means of notating phrases and musical gestures. Therefore, all his OFDs indicate a variety of small tuplet values, especially compounded tuplet values (e.g. ***24***- and ***48***-denominators, as compounded denominators of ***x/12***, are commonly used). It is important to bear all these notational and interpretational ambiguities in mind as we now move on to discuss the particularities of Adès' and Ferneyhough's uses of OFTSs.

Chapter 3: Composer Introduction of Thomas Adès

Adès has stated in his interview with Tom Service that he approaches composition with the intention, the musical idea, first, and the form and design follow on from that: 'The impulse comes first, the method second. ... It was desire that generated the design. … I think the duty should be first to the desire of the material, second to the formal plan'.[200] From this, we can deduce that he generally uses notational devices in service of communicating his compositional conceptions, and this is true of his uses of OFTSs.

An overview of OFTSs in Adès' compositional output appears in my honours dissertation, which chronologises all of his works up until 2019 and details the frequency of the notational device throughout his oeuvre.[201] To update the overview of his works, according to both Faber Music, his publisher, and his own website, he has a total of 89 compositions to date, 31 of which are arrangements, reorchestrations, or alternate versions.[202] Of the remaining 58 works, the following eight scores were not accessible at the time of writing this thesis: *Aubade* (1990), *Thrift* (2011), *Reveilles* (2011), the ballet *Dante* (2019-2020), *Gyöker (Root)* (2020), *Forgotten Dances* (2023), *Aquifer* (2024), and *Wreath* (2024).

My previous honours dissertation included arrangements and reorchestrations in the statistical overview, and inaccessible scores were assumed to not contain OFTSs. For the sake of clarity, this thesis does not include arrangements, reorchestrations, and inaccessible works in the statistical overview.

This leaves 50 of Adès' compositions to consider. OFTSs are only found in 15 of these works (see Table 3.1). Seven of his works have minimal (i.e. less than 1% of the piece) to infrequent (i.e. 1-2%) use of OFTSs; four are moderately frequent (i.e. 2-15%); three have very frequent use (i.e. more than 15%); and one, *Mazurkas*, is a unique

[200] Adès and Service, *Full of Noises*, 7-8.
[201] Wheatley, "Irrational Time Signatures," 21-23.
[202] Faber Music, "Thomas Adès | Works," Faber Music, accessed July 27, 2024, https://www.fabermusic.com/we-represent/thomas-ad%C3%A8s/works; Thomas Adès, "Compositions," Thomas Adès' composer website, accessed July 27, 2024, http://thomasades.com/compositions/.

instance.[203] These are all detailed in Table 3.2. The frequency categories are based on the number of bars containing OFTSs proportional to the total number of bars in each work.

Table 3.1: The total number of Adès' unique works to date in chronological order (excluding arrangements, reorchestrations, and inaccessible scores).

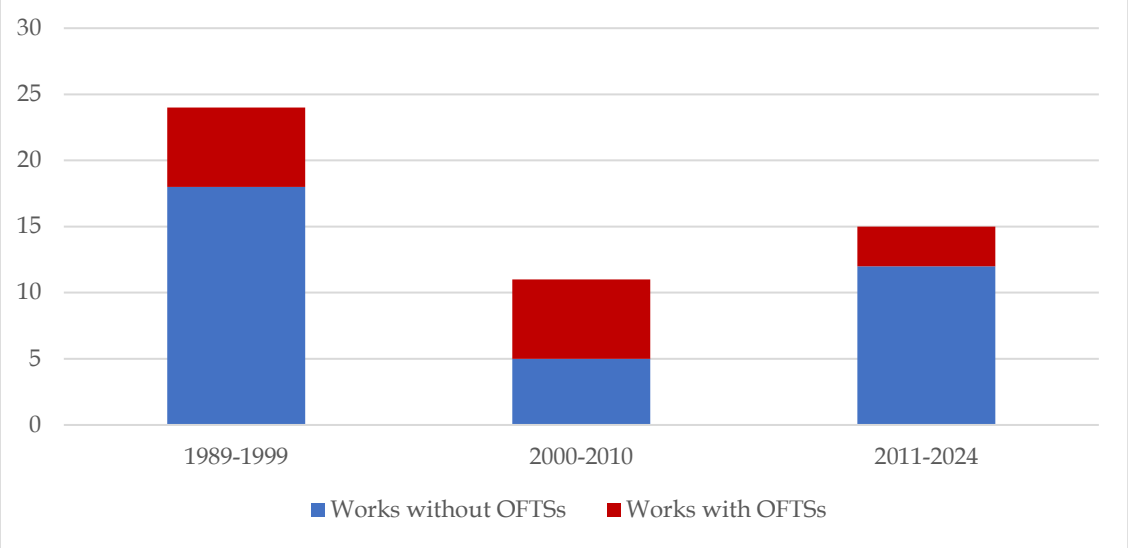


Table 3.2: The frequency of OFTS bars in all pieces with OFTSs (excluding arrangements, reorchestrations, and inaccessible scores).

Work	OFTS Bars	Total Bars/Pages	Percentage	Frequency
Catch (1991)	6	342 bars	1.75%	Infrequent
Living Toys (1993)	7	555 bars	1.26%	Infrequent
Arcadiana (1994)	2	259 bars	<1%	Minimal
Powder Her Face (1995)	10	3,045 bars	<1%	Minimal
Traced Overhead (1996)	19	185 bars	10.27%	Moderate
Asyla (1997)	32	567 bars	5.64%	Moderate
Piano Quintet (2000)	390	1,001 bars	38.96%	Frequent
The Tempest (2003)	1	247 pages	<1%	Minimal
Tevot (2007)	3	444 bars	<1%	Minimal
In Seven Days (2008)	1	119 pages	<1%	Minimal
Mazurkas (2009)	0 (97)	232 bars	0% (41.81%)	Unique
The Four Quarters (2010)	32	307 bars	10.42%	Moderate
Totentanz (2013)	156	924 bars	16.88%	Frequent
The Exterminating Angel (2016)	120	2,880 bars	4.17%	Moderate
Concerto for Piano and Orchestra (2018)	100	502 bars	19.92%	Frequent

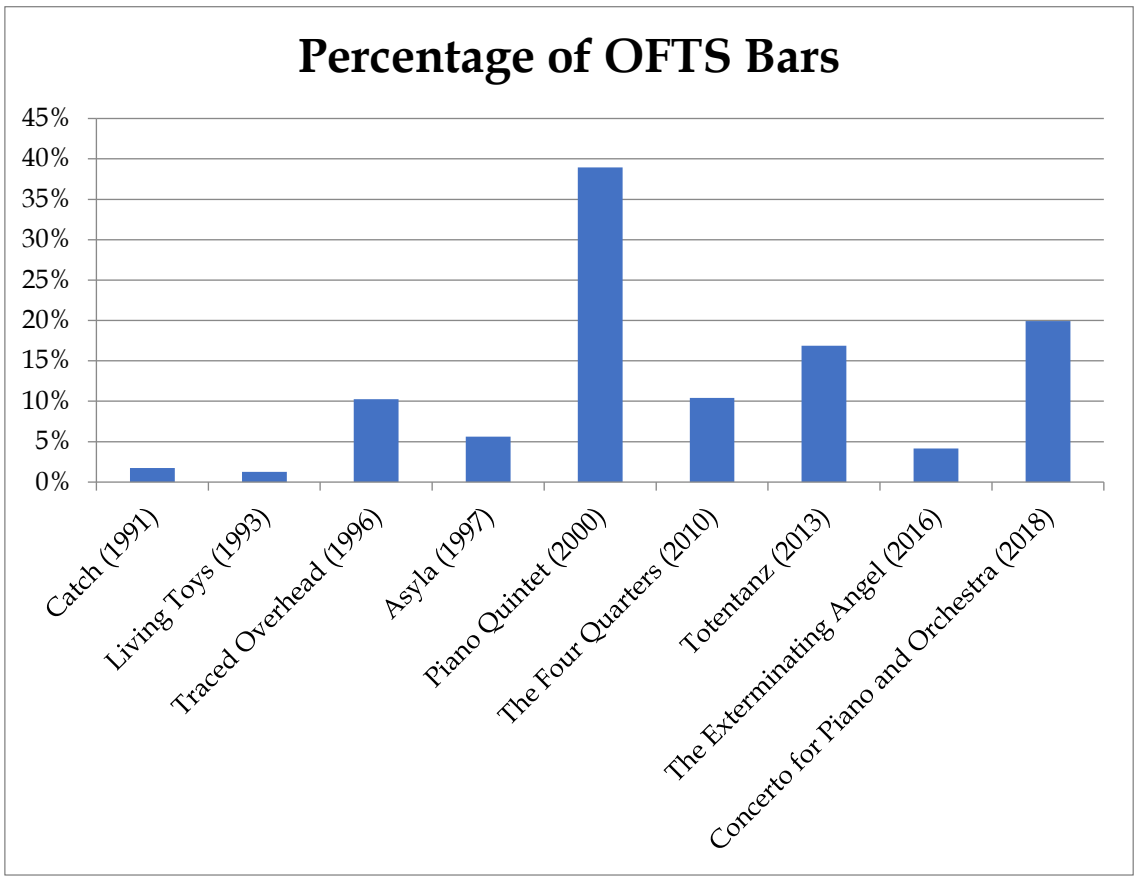
In Table 3.2, *Mazurkas* is classified as a "unique" case as it does not technically contain any OFTSs. Adès instead uses the OFTS parenthetically to communicate performance intention to the pianist: the whole of the second movement has an

[203] For a more detailed discussion of the uniqueness of *Mazurkas*, see Wheatley, "Irrational Time Signatures," 44-45.

alternative 'hear this' staff above the main score which is notated in ***5/12*** to convey the five note groupings and triplet feel of the right hand compared to the straightforward ♩ beats of the left hand (see Example 3.1). As initially asserted at the beginning of this chapter, Adès uses OFTSs as one of the many notational devices at his disposal to communicate particular rhythmic ideas, and we will continue to see this pattern throughout the next few chapters.

Example 3.1: Thomas Adès, *Mazurkas*, Second Mazurka (bars 1-5).[204]

Table 3.3: The percentage of OFTS bars in all of Adès' works containing more than 1% of OFTSs.



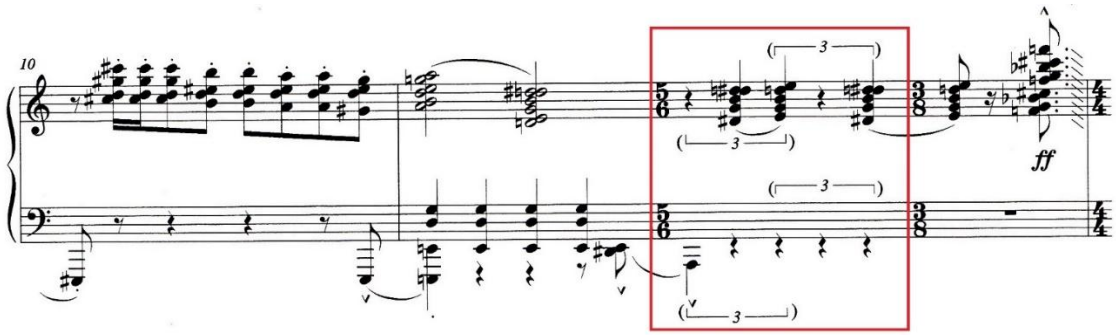
[204] Thomas Adès, *Mazurkas for Piano* (London: Faber Music, 2009), 4.

Table 3.3 reveals that *Piano Quintet*, *Totentanz*, and *Concerto for Piano and Orchestra* contain the most OFTS bars proportional to the total number of bars in each work. *Concerto for Piano and Orchestra* is a relatively recent work, and so its materials were not publicly available until the latter stages of this project. The *Concerto* seems to be a conceptual successor of *Piano Quintet* and therefore deserves a fuller investigation, but a detailed examination will require further research since it is beyond the scope of this project.

The following was briefly mentioned in chapter 2, but it is worth expounding upon in greater detail here: Adès is not consistent with his notation of tuplet rhythms in OFTS bars. Six of his 15 OFTS works use the normal notation of omitting tuplet brackets and only relying on the OFD to imply the tuplet pulse value. However, the rest of his OFTS works feature inconsistent tuplet rhythmic notation in the OFTS bars. This inconsistency is between piece to piece, generally not within the same work.

One peculiar example is found in the "first amended impression" of the vocal score of *Powder Her Face*. Faber has since released a "second amended impression" in 2016, which uses more consistent notation of OFTS tuplets/rhythms. In the first amended impression, the tuplet notation in OFTS bars is represented in at least five different ways, which is odd since they are all found within the one score. These are seen below in Examples 3.2-3.6.

Example 3.2: Thomas Adès, *Powder Her Face*, Act I Overture (bars 10-13), vocal score.[205]



The overlapping tuplet notation of Example 3.2 was introduced in Adès' first two OFTS pieces, *Catch*—which will be discussed in more detail later in this chapter—and *Living Toys*. It maintains the presentation of full triplets as would be expected in conventional tuplet notation. However, when the OFTS bar length does not allow for

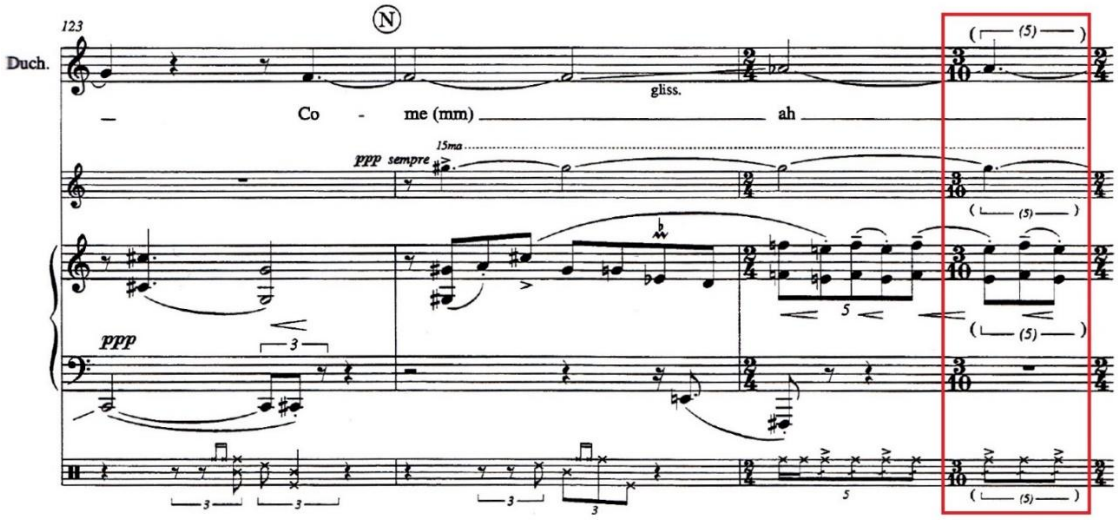
[205] Thomas Adès, *Powder Her Face* (London: Faber Music, 1995), Vocal Score first amended impression (February 1999), 1.

full tuplets, he has used an incomplete tuplet bracket (which can also be seen in *Arcadiana* and *Asyla*):

Example 3.3: Adès, *Powder Her Face*, Act I Overture (bars 19-22), vocal score.[206]

The remaining three examples are unique to *Powder Her Face*: the parenthesised tuplet value and tuplet bracket, as seen in Example 3.4; the tuplet bracket with only the tuplet value parenthesised, as seen in Example 3.5; and a fraction used instead of an integer to represent the tuplet value, as seen in Example 3.6. The use of a fraction to represent the tuplet value is reminiscent of Examples 1.22–1.25 in chapter 1, where Boulez used "***2/3***" and "***4/3***" time signature numerators in *Le Marteau sans maître* to convey the idea of the tuplets being a fraction of the conventional rhythmic and bar durations.

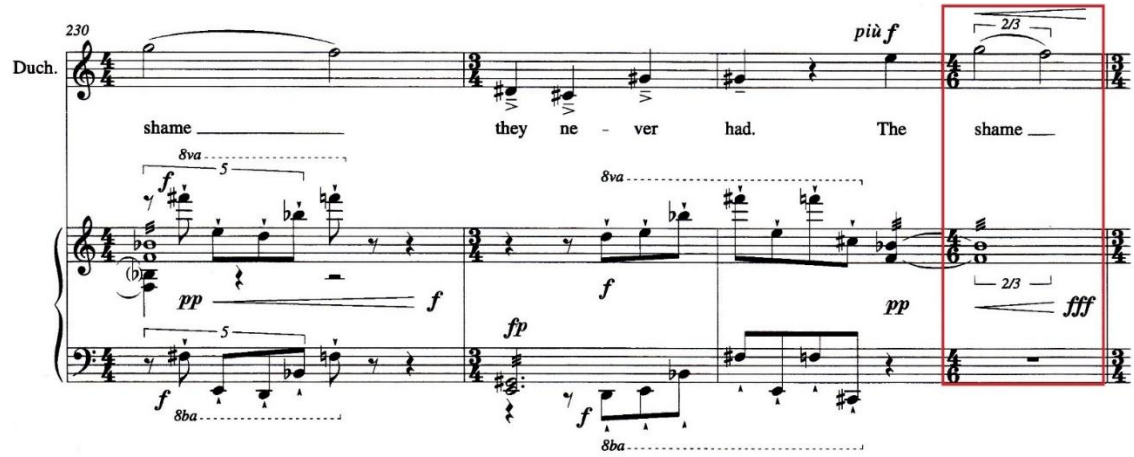
Example 3.4: Adès, *Powder Her Face*, Act I Scene 4 (bars 123-126), vocal score.[207]



[206] Adès, *Powder Her Face*, Vocal Score, 2.
[207] Adès, *Powder Her Face*, Vocal Score, 93.

Example 3.5: Adès, *Powder Her Face*, Act I Scene 4 (bars 127-130), vocal score.[208]

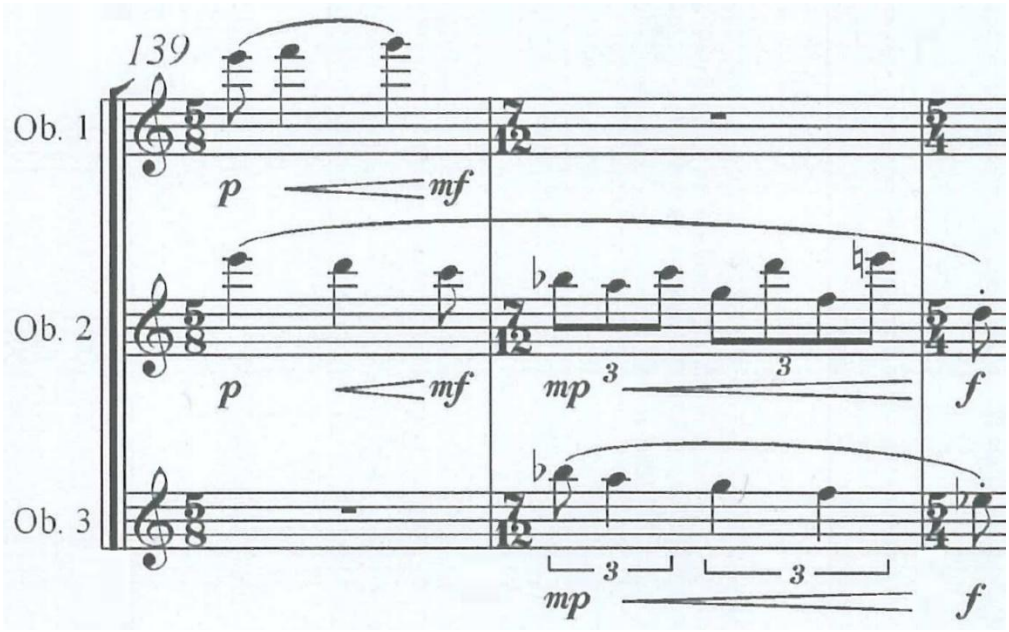
Example 3.6: Adès, *Powder Her Face*, Act II Scene 7 (bars 230-233), vocal score.[209]



The other common way Adès notates tuplet rhythms in the rest of his OFTS works is to use full tuplet brackets regardless of whether or not there is a full tuplet present, like in *Totentanz* (see Example 3.7). He also does this in *In Seven Days*, *The Four Quarters*, and his opera *The Exterminating Angel*. It is important to note that this wide range of tuplet notation throughout his oeuvre is likely used to better elucidate the rhythms in the context of each piece. Works where OFTSs are used frequently, such as *Piano Quintet* and *Concerto for Piano and Orchestra*, tend to use the unadorned notes where no explicit tuplet notation is used for the sake of decluttering the score.

[208] Ibid.
[209] Adès, *Powder Her Face*, Vocal Score, 212.

Example 3.7: Adès, *Totentanz* (bars 139-140), oboe lines.[210]



My honours dissertation also catalogued the common uses of OFTSs and gave isolated examples in multiple works (as well as detailed examples in the case study piece *Totentanz*). These common uses include:

- Ease of reading of complex rhythms and proportional tempo changes;
- Accommodating incomplete tuplets (i.e. rhythms that are not easily rationalised in conventional notation);
- Heightening the effect of tumultuous passages; and
- Rhythmic ornamentation in the context of:
  - Effecting rhythmic distortions;
  - Elongating and truncating phrase lengths; and
  - Enacting artificial tempo changes with proportional precision.

Uncommon uses included:

- Notating a rhythmic feeling;
- Providing the means for a conductor to conduct clearly and thereby achieve orchestral unity; and
- Explicating multiple proportional relationships in the musical notation.

The current analysis of chapters 3-5 does not stop at identifying these uses in isolation. What is of more interest is how Adès synthesises *multiple* techniques to create rhythmic and metric complexity throughout numerous musical layers. This chapter will

[210] Adès, *Totentanz*, 11.

provide a brief summary of some of the common uses of OFTSs in Adès' works, as exemplified in one passage of *Arcadiana* before focusing on Adès' overall rhythmic and metric practices.

Generally, Adès' use of any notational convention seems to be for the purpose of communicating and elucidating his musical ideas as clearly as possible.[211] He tends to look for the most succinct ways to capture what he wants to express.[212]

Consider Example 3.8 which shows bar 60 of *Arcadiana*, mvt. V: he uses a composite time signature of ***2/4+2/12*** to communicate a bar of eight $^{3}\!\!\!

Example 3.9: Two renotations of Adès, *Arcadiana*, mvt. V (bars 60-61), violin 2 and viola lines.

Initially, it seems as though, the final viola triplet in bar 60 *is* completed: the onset of the E♭ 𝅘𝅥𝅯 lands when the final ^{3}𝅘𝅥𝅯 should fall (as highlighted by the red boxes in Example 3.9), thus completing the pitch pattern of the previous C♭-B♭-E♭ figures. However, there is a rhythmic elision that occurs where the E♭ could be interpreted as both the end of bar 60 (as seen in Example 3.9(a)) and the return to the uneven 𝅘𝅥𝅯 𝅘𝅥𝅯 pattern at the beginning of bar 61 (as seen in the "original" system of Example 3.9).

Note that the term "straight" is used to describe a note duration that is a base-2 note duration: a note that is purely a whole, half (1/2), quarter (1/4), eighth (1/8), sixteenth (1/16), thirty-second (1/32), and so on of a 𝅝 duration. "Straight" note durations are used in contrast to odd-factored/tuplet note durations (which have at least one odd number in their factorisation). The descriptor of "straight" connotes non-tuplet note durations where the factorisation of the note value is purely even-factored (i.e. a power of two) or additions of those specific note values. Therefore, "straight" note

durations also include their dotted and tied counterparts; for example, a 𝅗𝅥. would be a straight dotted crotchet, as that would equate to a straight 𝅗𝅥 tied to a straight 𝅘𝅥𝅮 note.

A straight rhythm would involve *only* base-2 durations, whereas an odd-factored *rhythm* would involve at least one odd-factored/tuplet duration. So, the viola rhythm of Example 3.9(b) in the first bar would ultimately be an odd-factored rhythm, because it consists of multiple ^{3}𝅘𝅥𝅮 notes and one straight 𝅘𝅥𝅮 note.

This elision gives the impression of rhythmic distortion where there are two simultaneous interpretations of the rhythm in bar 61 arriving both too late and too early. The bar 60 phrase is durationally elongated with the straight 𝅘𝅥𝅮 instead of the expected ^{3}𝅘𝅥𝅮 note, but the 𝅘𝅥𝅮 𝅘𝅥𝅯 rhythm in bar 61 retroactively interrupts the triplets of bar 60.

On top of this, the tied A notes in the violin 2 line in Example 3.9 make the placement of the downbeat of bar 61 even more ambiguous. It sounds as though the first E♭ in the violin 2 line is an upbeat as renotated in Example 3.9(b), which complicates the perception of the metric framework even further, as this interpretation means the A downbeat of the ***2/4*** bar in violin 2 does not align with any attack in the viola.

Ultimately, these sorts of rhythmic or grouping elisions tend to have a disruptive quality as they 'frustrat[e] one's projections… thereby maximising discontinuity at the relevant metric level'.[214] In the following chapters, it will be evident that Adès often incorporates OFTSs in these places of grouping elisions.

Bar 60 could not be possible with conventional tuplet notation, as conventional tuplets must be complete. It could be renotated so that the triplet rhythms became straight rhythms instead. However, the renotation would involve far more complex notation of the previously conventional time signatures and rhythms, particularly in bar 62 with the ***27/32*** time signature (see Example 3.10). By using the composite time signature of ***2/4***+***2/12***, Adès can keep the surrounding common time signatures while simply notating the rhythms, thus making the score much easier to read for the performer.

[214] Roeder, "Co-operating Continuities," 133.

Example 3.10: Renotation of Adès, *Arcadiana*, mvt. V (bars 58-62) into conventional time signatures.

More broadly, Adès' general rhythmic and metric practices are exemplified in two concentrated example pieces: *Catch* and *Traced Overhead*. These works have been chosen for multiple reasons. *Catch* is Adès' first work containing OFTSs and therefore gives insight into the composer's early practices with the notational device. Furthermore, it has very few OFTS bars, making it distinct from *Totentanz* and *Piano Quintet*, the case study pieces of my honours dissertation and this thesis respectively, which both feature frequent use of OFTSs.

However, *Catch* is a chamber ensemble work, similar in size to *Piano Quintet*. So, to provide a different textural context, *Traced Overhead* has also been selected for analysis in the next chapter. *Traced Overhead* is a solo work; indeed, it is the first solo piece analysed as part of this project. Therefore, it seems an appropriate inclusion, as it will provide the opportunity to discuss and focus on the intra-instrumental proportions instead of the inter-instrumental relationships of non-solo works.

Catch

Catch is the first work in Adès' oeuvre to feature OFTSs. It is a single-movement piece, and amongst its 342 bars, only six feature OFTSs. These are only found within one section in the middle of the piece at rehearsal mark I. Therefore, the rhythmic and thematic context prior to this section, as well as the composer's intent, must be explored to understand the significance of the OFTS use. As explained by Adès in the programme notes:

> *Catch* structures itself around various combinations of the four instruments [clarinet, violin, cello, and piano]. There are several games going on: at the start, the clarinet is the outsider, the other three are the unit, then, after a decoy entry, the clarinet takes the initiative. All four then play jovial 'pig-in-the-middle' with each other. The clarinet is then phased out leaving a sullen piano and cello, with interjections based on the clarinet's original tune. This slower passage gradually mutates back into fast music, and this time the game is in earnest: the piano is squeezed out, only to lure the clarinet finally into the snare of its own music.[215]

Thus, the title of the work alludes to the catching of the clarinet, and the most significant shift occurs when the clarinet enters in earnest and interacts with the other three instruments to 'play jovial 'pig-in-the-middle' with each other'.[216] OFTSs are used in this section to inject playfulness while also drawing attention to the different proportional and inter-instrumental relationships in this pivotal section.

OFTSs are comparative in nature, and so this analysis of local rhythms, tempi, pulse speeds, and proportions uses the following framework questions:

- What is set up in the preceding bars?
- What is the direct comparison of pulses?
- Is the OFTS pulse speed anticipated directly or not?
- How and when is the conventional pulse speed re-established?

The answers to the above questions dictate much of the analytical discussion to follow in this chapter and throughout the rest of this thesis.

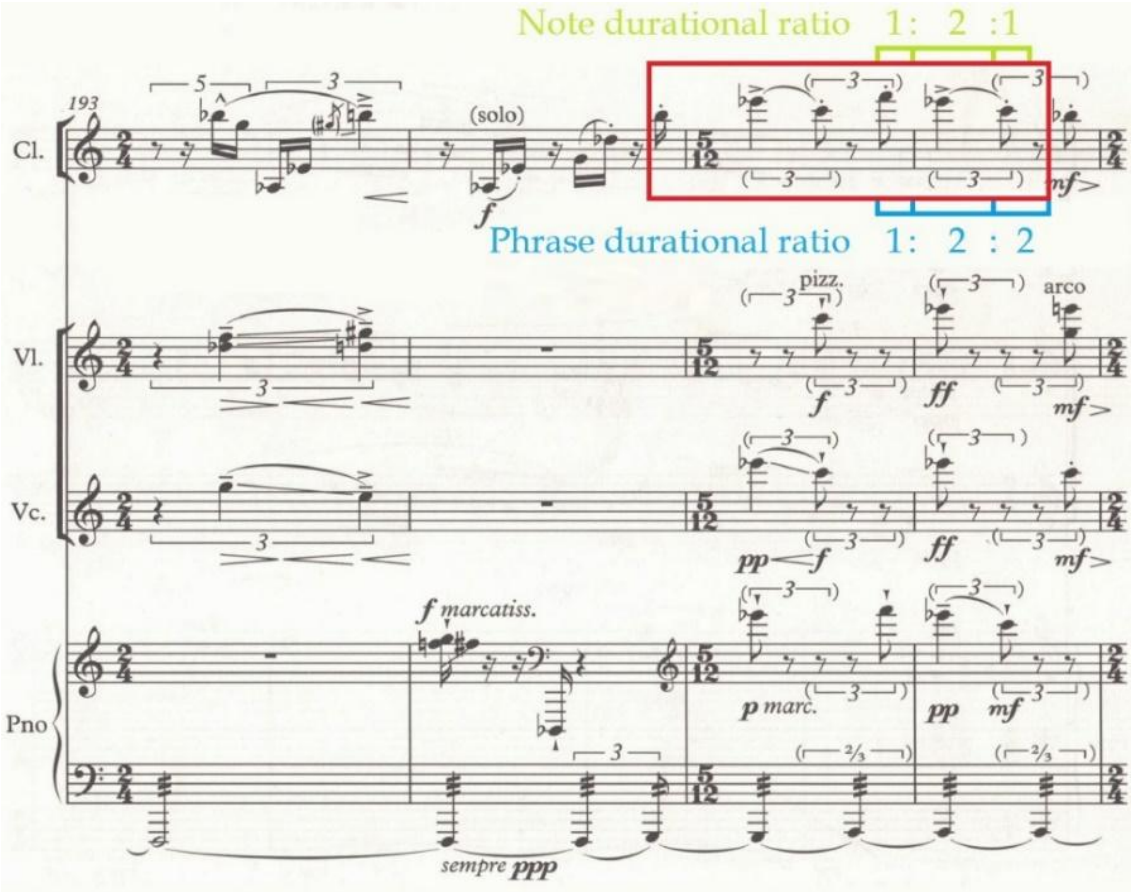
The first time the 'pig-in-the-middle' theme is introduced is with OFTS bars (see Example 3.11). It is based on a popularised schoolyard tune (see Example 3.12, where the melody is given in the same key and register as Example 3.11 for ease of comparison).

In the popularised version, there is a regular ***6/8*** metre and the long 𝅗𝅥. note is three times the duration of the other shorter 𝅘𝅥𝅮 notes (i.e. a 1 : 3 : 1 durational proportion is established between the notes of the 𝅘𝅥𝅮 𝅗𝅥. 𝅘𝅥𝅮 phrase, as seen in the green bracket annotation of Example 3.12). Comparatively, the 'pig-in-the-middle' motif in *Catch* contains note durations at a 1 : 2 : 1 ratio instead: a ^{3}𝅘𝅥𝅮 ^{3}𝅗𝅥 ^{3}𝅘𝅥𝅮 phrase, as seen in the green

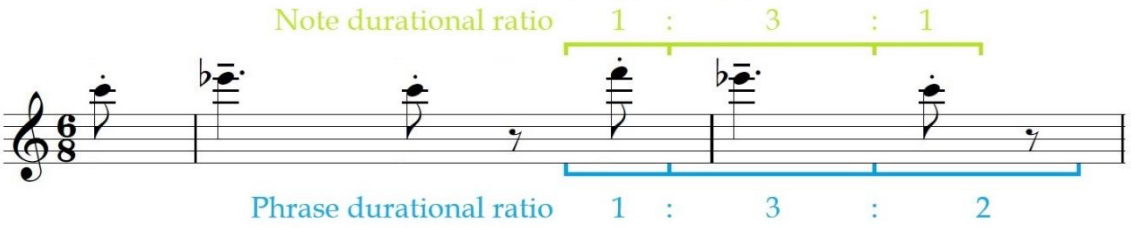
[215] Thomas Adès, "Catch," Faber Music, accessed July 18, 2024, https://www.fabermusic.com/music/catch-2052.
[216] Ibid.

annotation of Example 3.11. In any case, both the schoolyard tune and the motif are characterised by phrases of a short-long-short rhythm, and they typically appear as two phrases: the first with an alternating melodic contour, and the second with a descending contour.

Example 3.11: Thomas Adès, *Catch* (bars 193-196).[217]



Example 3.12: Original popularised pig-in-the-middle schoolyard tune.



There is a caveat attached to the durational ratios listed in the previous paragraph: the first and last note of each phrase has staccato articulation, so the ratios are not entirely accurate. If we consider the *elapsed time* between each onset, the total duration of the blue annotated phrase in Example 3.12 would have a 1 : 3 : 2 ratio,

[217] Thomas Adès, *Catch* (London: Faber Music, 1991), 20.

whereas the blue phrase of Example 3.11 is at a 1 : 2 : 2 proportion, taking up the whole ***5/12*** bar duration.

Taking this into account, the durational proportion between the ***2/4*** and ***5/12*** bars in Example 3.11 is 6:5. The majority of *Catch* up until this point has been in ***2/4***, and 18 of the 26 bars of rehearsal mark I continue this trend. As such, this proportional truncation of the bar length from ***2/4*** to ***5/12*** leads to a shortening of the rhythm, particularly the proportional truncation of the middle long note (i.e. where in the popularised version, the long note was three times as long as the short notes, now in *Catch*, it is only twice as long). Therefore, this gives the motif a sense of rushing compared to the original popularised tune, and it reinforces the idea that the clarinet is being chased.

However, there is also a sense that the motif is simultaneously slowing down as well. Consider Example 3.11 with different annotations:

Example 3.13: Reannotation of the clarinet line from Example 3.11.

Although it is not the same rhythm as the motif, the green box annotation demarcates two groups of slurred 𝅘𝅥𝅯𝅘𝅥𝅯 gestures, which are played in preparation of the 'pig-in-the-middle' motif. These gestures have a total duration of a 𝅘𝅥𝅯. each and can be broken down into two components: the first component is the initial slurred 𝅘𝅥𝅯 note, and the second component is the combined duration of the staccato 𝅘𝅥𝅯 and semiquaver rest (which equals a 𝅘𝅥𝅯 in length). Therefore, there is an overall 1:2 durational ratio within each gesture in bar 194.

The 'pig-in-the-middle' motif then presents an interesting development in the red box of Example 3.13: there are two different interpretations, which are indicated by the blue brackets above and below the staff. Observing the upper blue bracket first: initially, the staccato 𝅘𝅥𝅯 B sounds as if it would be a continuation of the green box gestures (i.e. the staccato 𝅘𝅥𝅯 B could be interpreted as taking on the function of the first component of the green box gestures).

It would follow, then, that the accented 3♩ E♭ note would take on the function of the second component of the green box gestures. Yet, if the upper blue bracket interpretation is accurate, then the 3♩ duration would present a durational elongation compared to the length of the second component of the green box gestures (i.e. the combined ♪ duration in the latter part of each green box elongates to 3♩ here).

Conversely, if the lower blue bracket is considered instead, the accented 3♩ E♭ note corresponds to the first component of the green box gestures, and the staccato 3♪ C corresponds to the second component. This interpretation is corroborated by the slurring and articulation. In terms of the proportions in this excerpt, instead of an overall 1:2 durational ratio (which was seen with each gesture in bar 194), the lower blue bracket indicates an overall 1:1 durational ratio (to be consistent, the triplet quaver rest was included in the ratio). As such, the 3♩ represents a proportional durational elongation of the first component according to this second interpretation.

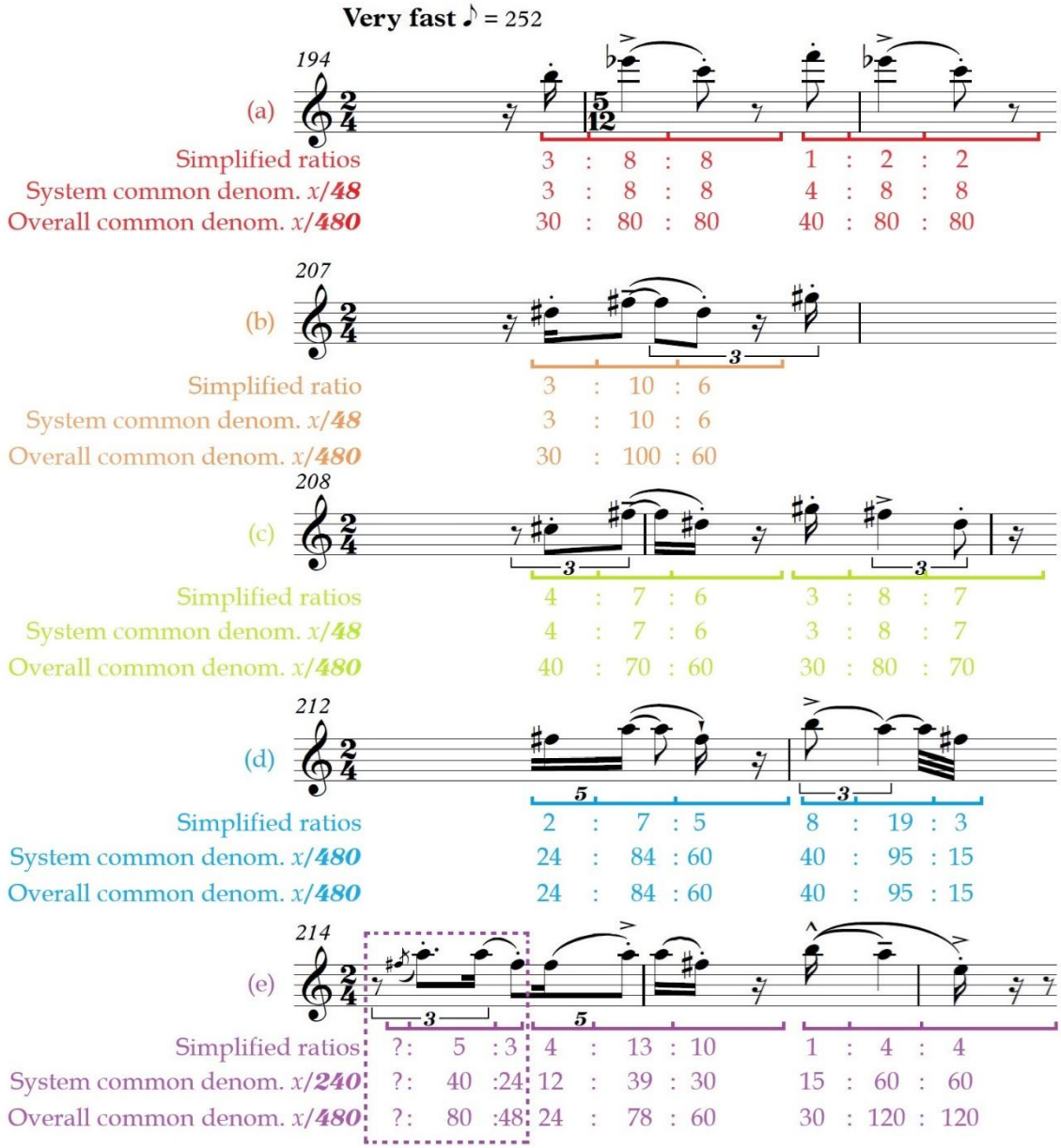
Ultimately, an elongation of note durations occurs when the 'pig-in-the-middle' motif enters, and this is because there is an added note; instead of the two-note gestures in the green box of Example 3.13, the motif is made up of three-note gestures in the red box. Furthermore, when comparing both pulse speed and phrase duration, the rhythms slow down from bar 194 to 195. Where there was a ♪ pulse speed in bar 194, it slows to a 3♪ pulse speed in bar 195; where there was an overall phrase duration of 3/16 (i.e. ♪.) before, it becomes ***5/12*** in length (as indicated by the OFTS). There is an interpretational ambiguity in this passage, which results in rhythmic and metric ambiguity.

Although the other instruments play motivic fragments in unison with the clarinet, it is only the clarinet that plays the motif in full throughout this section. The 'pig-in-the-middle' motif recurs a few bars after bar 196 but each subsequent instance occurs within conventional time signature bars (see Example 3.14). For convenience, Example 3.15 provides a comparison of all the 'pig-in-the-middle' motifs.

Example 3.14: Adès, *Catch* (bars 206-217), clarinet and piano lines.[218]

[218] Adès, *Catch*, 21-22.

Example 3.15: Comparison of all the 'pig-in-the-middle' motifs.



Example 3.15 demonstrates that the 'pig-in-the-middle' motif is comprised of two phrases: the first calling (characterised by the alternating melodic contour), and the second responding (characterised by the descending contour). There are three levels of ratios within each system of the above example. The first row of ratios is labelled "Simplified ratio(s)", as the ratios are reduced to their simplest form. The second row is labelled "System common denom. *x*/…", which allows the phrases within a single system to be compared according to the lowest common denominator specified.

For example, in Example 3.15(a), the lowest system common denominator between both the first- and second-phrase ratios is ***48***, so the durations of the second phrase are expressed in the ratio of 4/48 : 8/48 : 8/48. This allows the ratio of the second phrase to be comparable to the proportion of the first phrase in the (a) system.

Note the difference in the system common denominators in systems (d) and (e). Up until the (d) system, the system common denominator was ***48***, but then in (d), due to the quintuplet rhythms in bar 212 and 𝅘𝅥𝅯 notes in bar 213 heightening the proportional complexity, the lowest common denominator across the system is ***480***. System (e) is similarly complex, as it also contains quintuplet rhythms, making the system common denominator ***240***. Also, the grace note occupies an indeterminate amount of time, so it could not be significantly considered in the initial ratio of the (e) system (hence the question marks).

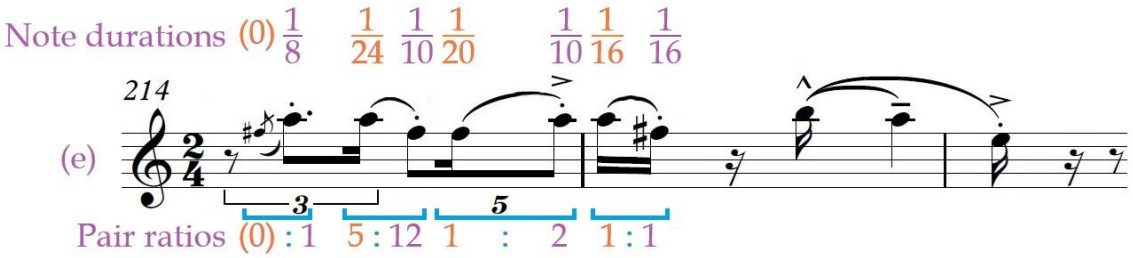
There are two other peculiarities about the (e) system. Firstly, the pairs of adjacent repeated A notes in bar 214 and across the 214-215 bar line are regarded as combined durations, as they act similarly to the tied A notes in both bars of the (d) system. The repeated A notes in the (e) system merely omit the ties of the (d) system (i.e. they continue to fulfil the function of the long notes of the 'pig-in-the-middle' motif). Secondly, the purple dotted box delineates a false start, where the first phrase of the motif is given without being answered by a second phrase. This is similar to system (b), where there is the beginning of the second phrase (seen in the G♯ note) but the second phrase does not complete. System (b) is the only instance to not contain the second answering phrase, and system (e) is the only instance to repeat the first phrase.

The third row of ratios in Example 3.15 is labelled "Common denom. *x*/***480***", and it allows all the durations throughout the entire example to be comparable via the common ***480***-denominator. For example, all lone 𝅘𝅥𝅯 durations throughout Example 3.15 have the duration of 30/480. All the durations in the above example are based on elapsed time between onsets, not just the note durations, so the rests are also taken into account. Therefore, although the final note in the (e) system is a 𝅘𝅥𝅯 note, the reason its proportional duration is 120/480 is because that segment also includes the semiquaver and quaver rests after the note.

The brackets below each staff indicate the grouping of durations throughout each phrase corresponding to the relevant short-long-short segments of each phrase of the motif. As the motif progresses, the truncations and elongations of elapsed durations become more extreme. The third row of ratios shows that the proportions become more asymmetrical and less rationalisable, and this heightens the playfulness and frenetic energy of the chase.

Looking closer at the proportions in Example 3.15(e), the first eight notes make four pairs of slurred minor thirds: two ascending and two descending (see the blue brackets in Example 3.16). Each pair ends on a staccato note, and each pair's first note becomes progressively longer. So, the first pair's note is the grace note F♯ (of indeterminate duration), which then becomes the ^{3}♪ A in the next pair (i.e. 1/24 duration), which elongates to the ^{5}♪ F♯ (i.e. 1/20 duration), which finally lengthens to the straight ♪ A (i.e. 1/16 duration) at the beginning of bar 215. These first note durations are in orange text in Example 3.16.

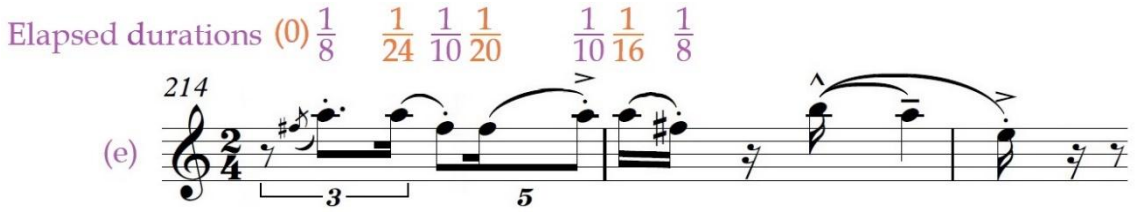
Example 3.16: Analysis of Example 3.15(e) system with note durations.



The second note of each pair (annotated in purple text) would theoretically shorten in duration if not for the staccato articulations: the first pair's ^{3}♪. A note (i.e. 1/8 duration) truncates to the ^{5}♪ F and A notes of the second and third pairs respectively (i.e. 1/10 duration each), and finally shortens to the straight ♪ F♯ (i.e. 1/16 duration). These simultaneous, nested processes of elongation (of the first notes) and truncation (of the second notes) end up landing on the final ♬ pair, so the proportions in each pair of notes become generally more symmetrical if the second notes were not staccato (see the "Pair ratios" under the staff in Example 3.16).

As it is currently notated with the staccato articulation of each second note, there is effectively an elongation of the first note durations, which would therefore result in a deceleration of pulse speed. Meanwhile, due to the staccatos, the elapsed durations should be taken into account instead, in which case the second duration of each pair does not truncate but rather maintains either a ♪ or ^{5}♪ length (see the purple text in Example 3.17).

Example 3.17: Analysis of Example 3.15(e) system with elapsed durations.



Ultimately, Examples 3.14-3.17 reveal two levels of rhythmic elaboration involved with the motif and its development. One level is concerned with the simple proportions within a given pulse speed, such as in the second phrase of Example 3.15(a) or the final phrase in system (e).

These proportions are rendered more complex in places where the surface pulse speed switches at the change of beat, such as in the middle phrase of system (e) where the "long" duration incorporates both 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 and straight 𝅘𝅥𝅯 pulse speeds (although the final note of bar 214 is a 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯, the pulse speed is that of 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯). These rhythmic elaborations become particularly complex in Example 3.15(d) where triplets, quintuplets, and 𝅘𝅥𝅯 notes are all involved in the rhythms.

Examples 3.14-3.17 illuminate the fundamental use of OFTSs to draw attention to proportional relationships. Adès is interested in rhythmic shifting, tempo/pulse speed elasticity, and minute but calculable geometrical variations of rhythm. He accomplishes his intended rhythmic fluctuations through a variety of different techniques: sometimes with the use of conventional tuplet notation in conventional time signature bars; and at other times he achieves them by utilising OFTSs, which, in turn, enhance these changes on the bar and metrical level.

The process of motivic development whereby Adès truncates/elongates rhythms is originally introduced earlier in the piece. This occurs before the clarinet enters in earnest, during a section of music that does not contain any OFTSs (see Example 3.18).

Not only do the note durations change, but Adès also includes additional notes to elongate the motif so that the phrase lengths are affected as well (see bars 117-121). Example 3.18 seems to be ametrical, because the different iterations of the motif do not conform to the ***2/4*** metric grid, leading to an ever-shifting downbeat for the start of each phrase, many rhythmically displaced notes, and awkward notated durations (such as

the tied notes spanning across bars 115-116 in the violin and cello parts: tenuto ♪♩♪).

Example 3.18: Adès, *Catch* (bars 110-123).[219]

Thus far, only two of the six OFTS bars in *Catch* have been accounted for. The next two are encountered at bars 192 and 199 (see Examples 3.19(a) and (b)). From a side-by-side comparison, it is clear that Adès is employing another elongation technique: the ^{3}♪ figure in the ***4/12*** bar (which has the rhythmic proportion of 1:2:1) becomes 1:3:1 in the ***5/12*** bar. The change of the numerators indicates that the bar length has increased from four ^{3}♪ to five.

[219] Adès, *Catch*, 12-13.

Example 3.19(a): Adès, *Catch* (bars 189-192).[220]

Example 3.19(b): Adès, *Catch* (bars 197-200).[221]

However, the other proportion of interest in Example 3.19 is that of the bar duration. As previously mentioned with Example 3.11, there is a 6:5 ratio between a ***2/4*** and ***5/12*** bar, and this ratio is present again in Example 3.19(b). In Example 3.19(a), however, there is a closer ratio of 9:8 between the ***3/8*** and ***4/12*** bars. The OFTS overall

[220] Adès, *Catch*, 19.
[221] Adès, *Catch*, 20.

bar durations are actually truncations when compared to the conventional time signatures that surround them. However, the $^{3}\!\!\!

It may seem strange to offset bars 204-205 by a $\overset{3}{\text{♪}}$ duration when it seems as though almost all of the notes in those two bars adhere to a $\overset{3}{\text{♪}}$ metric grid. So, why does Adès not notate conventional time signature bars with triplet rhythms? It is because of the clarinet's accented, staccato 𝅘𝅥𝅯 D at the end of bar 204, which is the only note in the two bars to not adhere to the $\overset{3}{\text{♪}}$ metric grid (see the red box in Example 3.20).

Example 3.21 demonstrates the difficulties associated with renotating Example 3.20 into conventional time signatures. It is clear that OFTSs of Example 3.20 provide a far simpler, less cluttered means of notating the same rhythmic idea. The problematic D note played by the clarinet has also been annotated in the red box in Example 3.21 for ease of comparison.

Example 3.21: Renotation of Example 3.20.

This passage also involves a layering process with the rhythms, and this appears contrapuntal in nature (see the blue box in Example 3.20). Here the ♩ beat has been subdivided in two different ways: according to either the $\overset{3}{\text{♪}}$ or the 𝅘𝅥𝅯 pulse. Effectively, this passage contains constant shifts of pulse speed where one half of the bar is generally pitted against the other half of the bar but the different pulse speeds are dispersed across multiple musical lines (i.e. between the clarinet and both hands of the piano). Example 3.22 below separates all these different rhythms into three staves of straight rhythms and three staves of tuplet rhythms.

Example 3.22: Separation of the straight and tuplet rhythms of Example 3.20.

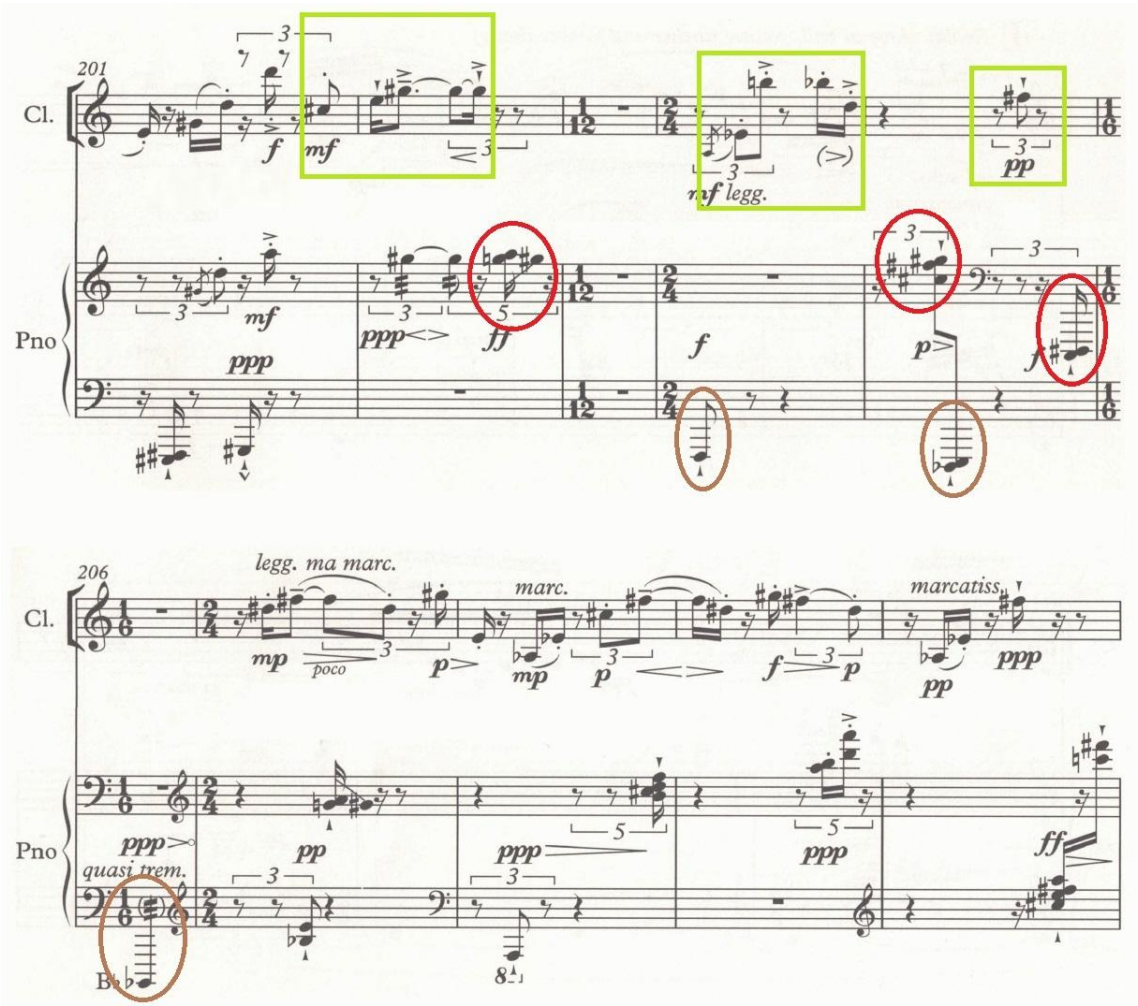
A few patterns emerge from Example 3.22. The piano only ever plays quintuplets in the right hand and only when the clarinet plays triplets in the latter half of the bar. In the first system, the triplet rhythms seem to alternate between the piano and clarinet, while the straight rhythms follow melodically ascending phrases in bars 201-202.

The individual notes parenthesised in bars 202, 207, and 209 are tied notes belonging to a different pulse speed. For example, the parenthesised $^{3}\!\!\!

In the second system of Example 3.22, the straight rhythms in the clarinet line are only situated in the first half of each bar, and they generally coincide with the piano's left hand triplet rhythms. Conversely, the triplet rhythms in the clarinet are only situated in the second half of most bars, and they coincide with either straight or quintuplet rhythms in the right hand of the piano.

As with Example 3.19, there is a process of bar elongation with these OFTS bars in Example 3.23 (a reannotation of the excerpt in Example 3.20): the ***1/12*** bar is a $\overset{3}{\text{♪}}$ long as opposed to the ***1/6*** bar, which is the equivalent duration of a ♩ note. The elongation here is a doubling of bar duration. (Note also that there is a notational inconsistency with bar 206, as Adès does not use the bracketed fraction tuplet notation to indicate that the $\overset{3}{\text{♩}}$ is a third of the length of a full triplet.)

Example 3.23: Reannotation of Example 3.20.[223]



[223] Adès, *Catch*, 21.

The technique of sequential truncation also occurs when all lines are taken into account. The sequence involves the clarinet and strings playing a phrase demarcated by a green box, followed by a red-circled chord in the piano's right hand, and then a brown-circled note/chord in the left hand. This sequence is then repeated twice. The truncation procedure is most obvious within the green box phrases. (Note that the string lines are not included in Example 3.23 because they play in rhythmic unison with the clarinet.)

The truncation in the piano is not seen in the duration of the notes but rather in the time elapsed between the piano's attacks (i.e. between the red and brown circles). Initially, the duration between the onsets of the first red and brown circles is two $^{5}\!\!\!

Chapter 4: *Traced Overhead* Concentrated Example

Unlike *Catch*, *Traced Overhead* has an abundance of OFTSs, though they are concentrated entirely in the second of the piece's three movements. This is Adès' first solo composition to contain the notational device, and it will be used here as a concentrated example of the composer's rhythmic and metric technique. The work is written for piano, which Adès himself is proficient at playing.

Adès is preoccupied with the notion of musical alternation throughout this work, and this is manifested in the notation through the use of alternating time signatures, proportions, and rhythmic interpolation. He also develops motifs and sections through fragmenting, truncating/expanding, and reproportioning material. Finally, he uses notation to reframe concepts and shed new light on them. All these usages are interwoven throughout the second movement, so all the instances of OFTSs will be analysed chronologically to provide a systematic indexation of these techniques.

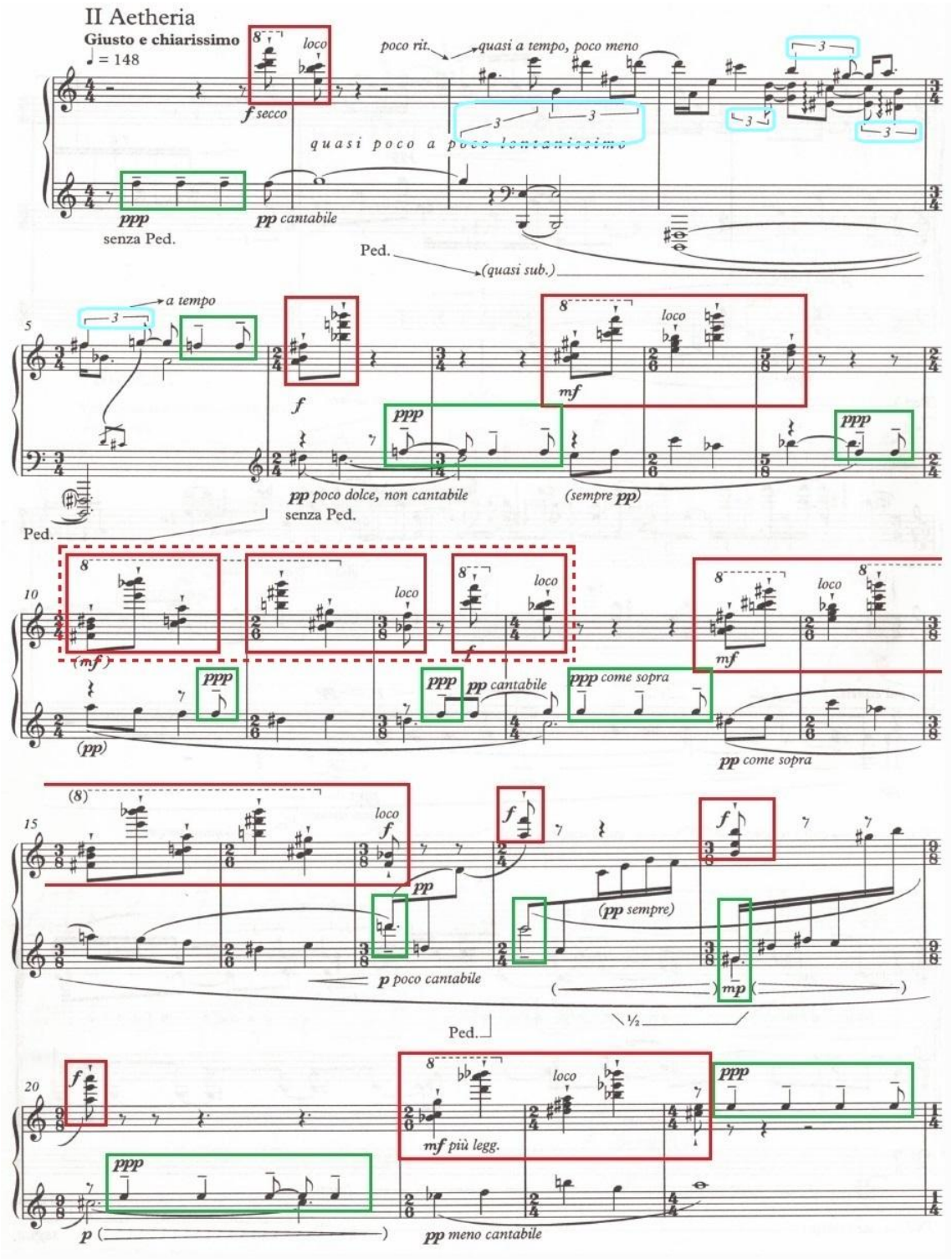
The second movement of *Traced Overhead* has been divided into these sections:

1. Bars 1-32;
2. Bars 33-55;
3. Bars 56-77;
4. Bars 78-97; and
5. Bars 98-107.

The two main rhythmic motifs are established at the very beginning of the movement (see the dark green and red boxes in Example 4.1). Adès introduces preliminary rhythmic-motivic developments as a foretaste of the techniques to come throughout the remainder of the movement.

The one element not highlighted in Example 4.1 is the melodic material, as the focus of this thesis is the notation of time-related musical parameters; therefore, only the recurring rhythmic elements of *Traced Overhead* are addressed. As the opening section spans bars 1-33, it is too long to fit into one excerpt, so the section has been split into two excerpts: bars 1-23 covered in Example 4.1 (with smaller passages taken from bars 1-23 covered in greater detail in Examples 4.2-4.7); and the remaining bars 24-33 covered later in Example 4.8.

Example 4.1: Adès, *Traced Overhead* (bars 1-23).[224]



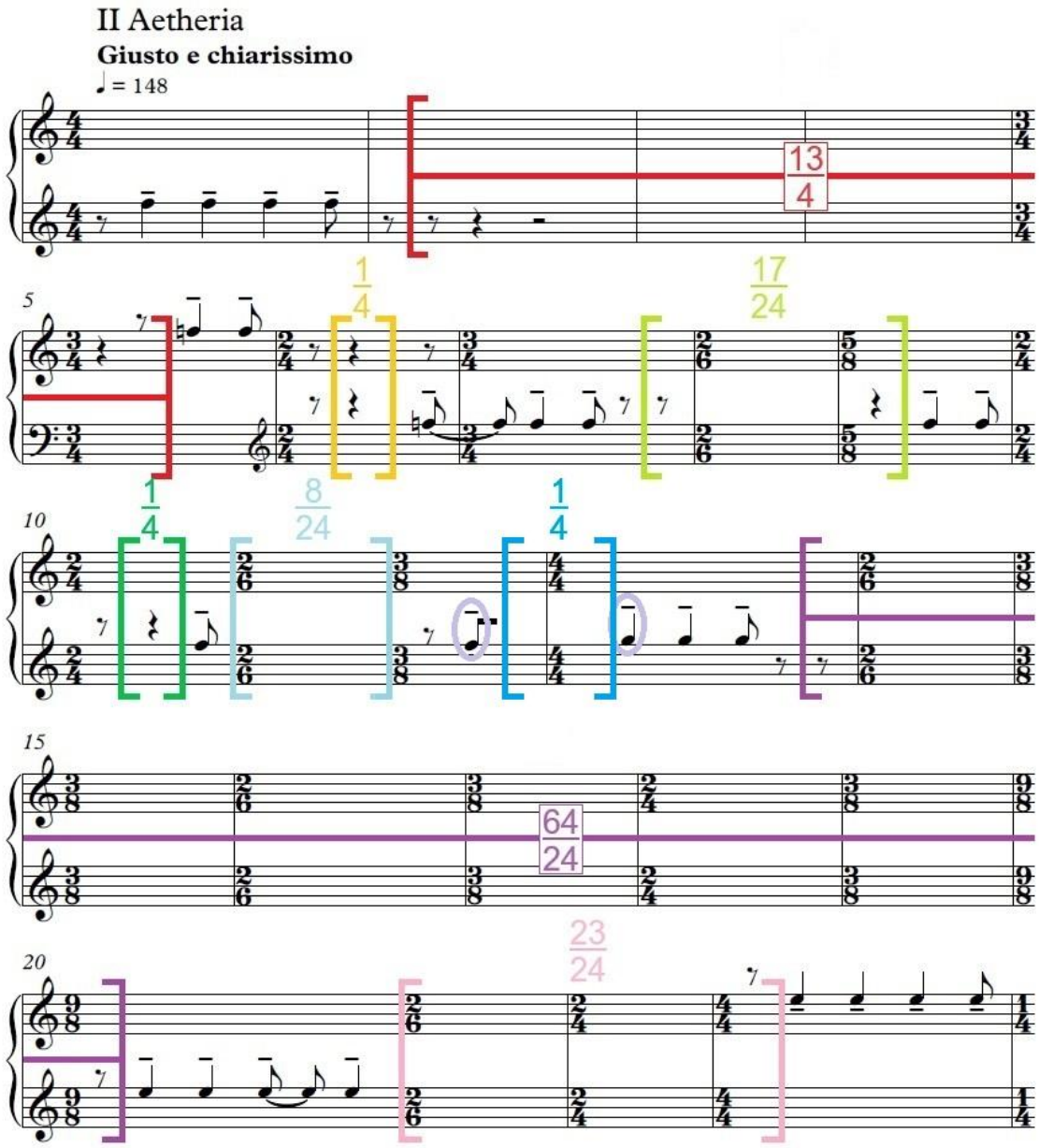
The dark green-boxed rhythmic motif in Example 4.1, which will henceforth be labelled as the "pulsing motif", features repeated, pulsing tenuto ♩ notes notationally offset from the **4/4** ♩ beat. However, it is not initially clear that this pulsing motif is metrically offset—the very first notational "event" is a quaver rest in the bass staff—and

[224] Adès, *Traced Overhead*, 4.

since the work has only just started, the rhythmic figure is metrically unmoored as there is no frame of reference.

There are certainly implications for the performer playing this opening as they would recognise the notation as syncopation and so they would be able to feel and communicate it in their body. However, it is not until the left hand plays the 𝅝 G in bar 2, coupled with the change of register of the second right-hand chord, that the downbeat is made apparent. This initiates a sense of metric ambiguity, at least in the first bar of the work.

Example 4.2: Adès, *Traced Overhead* (bars 1-23), with omissions.[225]



[225] Ibid.

To add to the metrical ambiguity, the clear downbeat of bar 4 is followed by 29 consecutive bars of changing time signatures. The idea of syncopation, in which rhythms are offset against a metric grid, is not particularly felt here, as the changing time signatures call into question the location of the downbeats. Despite this, there is a sense of metric projection due to the repetitive and recurrent nature of the pulsing motif. Example 4.2 has excised all pitch-related material apart from the green motif.

Assuming the pulsing motif of Example 4.1 is made up of tenuto crotchets, it is hypothesised that the implied pulse stream of crotchets should persist and be projected—even when the motif is not articulated—remaining consistent with the nature of a pulse stream. The exception to this projection of ♩ durations is at bar 12 and/or bar 13. There is a disruption caused by the notes circled in grey, but it is ambiguous as to which one is the true disruptor.

In bar 12, the ♪ is not a ♩ in duration, and so it could be argued that it is an interruption of the ♩ pulse stream. However, the other tenuto ♪ notes (such as in bars 1 and 5) have a rest immediately after, so the ♩ duration is implied due to the elapsed duration between the onset of the tenuto note and whichever attacks follow. Therefore, the alternative interpretation would be that the tenuto ♩ circled in grey in bar 13 resets the ♩ pulse stream, as it comes in a ♪ duration too late.

The brackets in Example 4.2 frame sections of the music where the pulsing motif is not articulated, and the fractions express durations that are proportional to a 𝅝 (akin to time signatures). All easily rationalisable durations are annotated in fractions with a 4-denominator (e.g. the red bracket has a duration of 13/4, which means it is 13 ♩ in duration). So, when the motif comes back in bar 5, it is still consistently articulated according to the ♩ pulse stream.

All durations that are not easily rationalisable have 24 as the denominator, as this is the lowest common denominator given the combination of conventional and OFTS denominators. The first to be encountered is the lime green bracket, which has a duration of 17/24. If it was 18/24, it would equate to 3 ♩ durations; however, it is shy of 3 ♩ by 1/24, which is equivalent to a ^{3}♪ duration.

For convenience, bar 11 has been annotated with light blue brackets, separating the two ♪, which are the equivalent duration of the tenuto ♩ of the motif. Bar 11 has the

equivalent duration of 8/24, which is short of 2 ♩ by 4/24 (i.e. a ^{3}♩). Then there is quite a substantial gap of 64/24 seen with the purple bracket: it is shy of 11 ♩ by a ^{3}♪ (2/24 = ^{3} ♪). Finally, the pink bracket with a 23/24 duration is short of 4 ♩ by another ^{3}𝅘𝅥𝅯, just like the lime green bracket.

The repetition of the tenuto ♩ notes of the same pitch is reminiscent of a click track or metronome, thus the ♩ pulse stream could be entrained to throughout this passage. However, Adès uses subtle truncations of some sections between pulsing motif articulations to slightly shift the metric grid so they land earlier than previously established. These shifts are only possible by using OFTSs, as the incomplete tuplet figures and shortened bar durations are the defining element of the truncations. This in turn distorts the projection of the ♩ pulse stream, which enacts an underlying sense of rushing and anticipation.

Returning to Example 4.1, Adès initially develops the pulsing motif through fragmentation and sequential truncation in the second and third systems, changing from three attacks in bars 6-7 to two in bar 9, then to one in bar 10. It then elongates from one attack in bar 12 to three attacks in bar 13. These two single attacks in bars 12-13 introduce a minor interruption of the motif with the tied ♪ notes over the bar line, which are actually part of the *cantabile* melodic line (this will be discussed with the red chordal rhythmic motif shortly).

The fourth system of Example 4.1 features some anomalies as the note durations of the green boxes are further modified. The tenuto notes have a compound function to be simultaneously the held bass notes of bars 17-19, and also incorporated into the middle voice arpeggiations. The pulsing motif finally settles into its most recurrent form in the final system of Example 4.1: four *notationally* offset tenuto repeated notes (that are not necessarily offset in terms of aural syncopation).

The red rhythmic motif, which will henceforth be labelled as the "chordal motif", is characterised by staccatissimo chords in generally alternating melodic contour. In this opening section, these chords are always played in the right hand while the left hand plays the *cantabile* melodic line (as indicated by the phrase slurs). The triplet rhythms highlighted in aqua blue annotations in bars 3-5 are a precursor to the "incomplete" triplet rhythms introduced in the OFTS ***2/6*** bars, which are used to gradually elongate the chordal motif throughout the excerpt.

The term "incomplete" here is somewhat debatable. Although technically two $\overset{3}{\text{♩}}$ are used within the ***2/6*** bars, they are always followed by a staccatissimo attack on the downbeat of the next bar. This pattern persists throughout the whole movement. Therefore, in terms of onsets, the three attacks of the triplet are articulated, with the third attack realising the projection of the triplet duration from the first to second attacks.

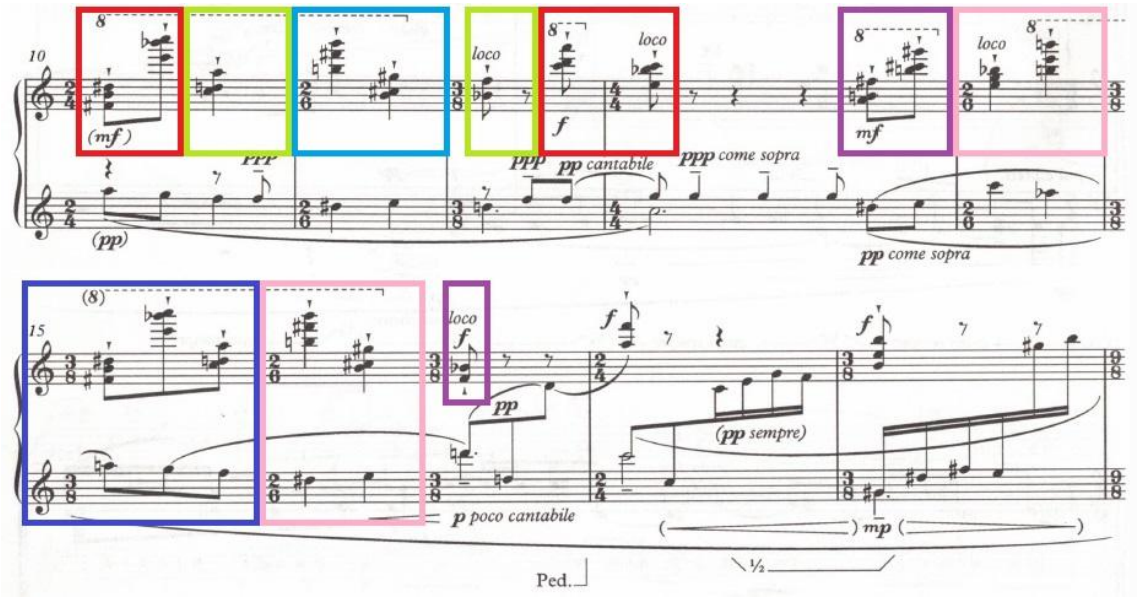
However, durationally, the triplet is incomplete: as can be seen in the notation, the end of the triplet is elided with the downbeat of the next bar. The final note of each "triplet" involving a ***2/6*** bar simply does not have the same duration as a $\overset{3}{\text{♩}}$, but since they are all staccatissimo attacks, this provides further metric and rhythmic ambiguity. In a way, they are "complete" triplets, but the amount of durational space they take up is distorted.

Within these chordal motifs is an alternation between the normal ♪ pulse speed and the $\overset{3}{\text{♩}}$ pulse speed from the second system onwards. The straight ♪ pulse speed is ♪ = 296 BPM compared to $\overset{3}{\text{♩}}$ = 222 BPM in the ***2/6*** bars (i.e. they have a 4:3 ratio). If the ***2/6*** bars with $\overset{3}{\text{♩}}$ $\overset{3}{\text{♩}}$ were replaced with ***3/8*** bars with ♪. ♪., there would be an easily rationalisable hemiola pattern within a consistent ***3/8*** metric grid: ♪. ♪. | ♪ ♪ ♪ (i.e. a 2:3 ratio).

However, since ♪. = 197.333 BPM, the speed difference between ♪. and $\overset{3}{\text{♩}}$ is very slight at an 8:9 ratio, and this proportion is also reflected between the ***2/6*** and ***3/8*** bar durations. Therefore, there is a sense of swaying and elasticity due to the tempo/pulse speed fluctuation as the motif's phrase lengths continue to expand in bars 10-13 and again in bars 13-17.

Adès also introduces rhythmic symmetry with these two occurrences of motivic expansion. Bar 10 contains two ♪ durations (see the first red box in Example 4.3) followed by a ♩ (see the first green box). There is a palindromic effect where bars 12-13 reverse the rhythm with a straight ♪ and quaver rest, amounting to a ♩ duration (see the second green box). This is followed by two ♪ notes (see the second red box), and the point of symmetry is at the ***2/6*** OFTS bar (highlighted by the blue box).

Example 4.3: Adès, *Traced Overhead* (bars 10-19).[226]



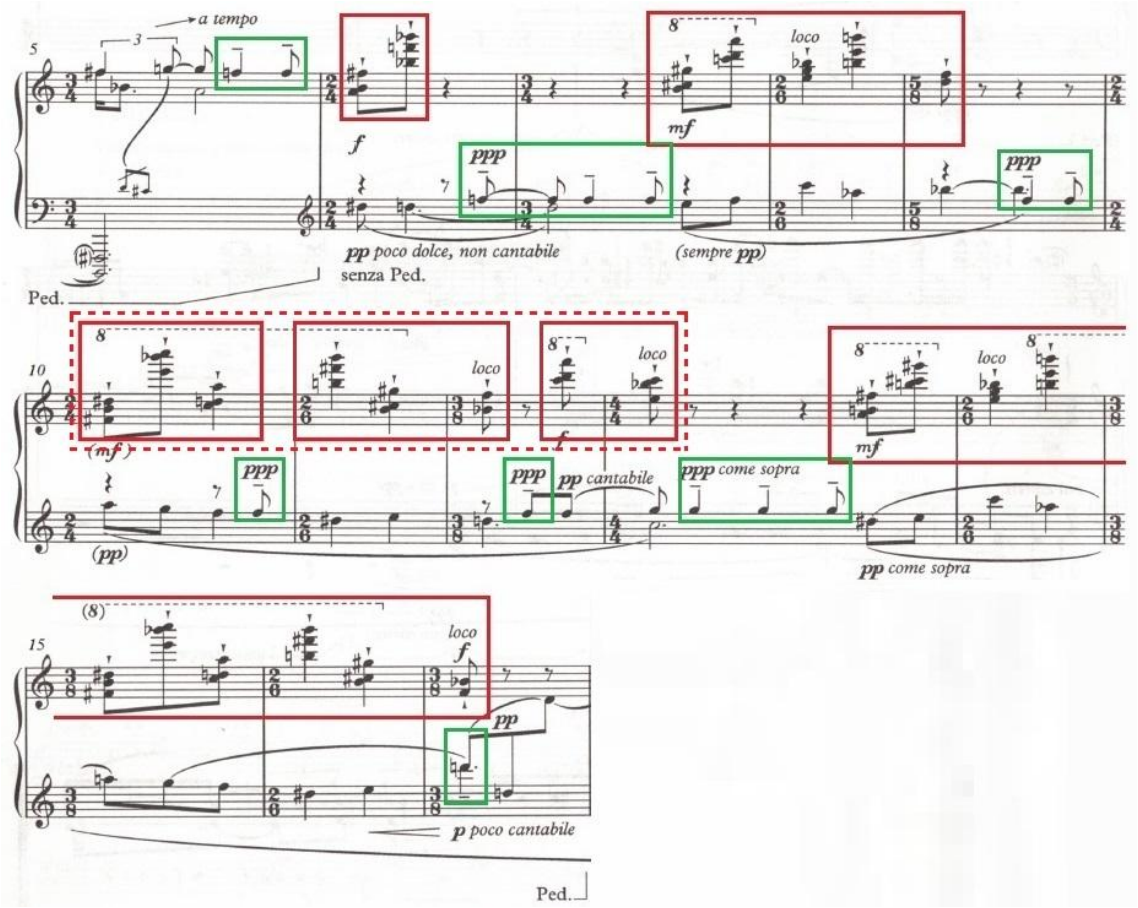
With bars 13-17, a conventional ***3/8*** time signature bar is the point of symmetry instead (see the navy box). Although the passage is not durationally symmetrical, since the phrase starts with two ♪ and ends with only one ♪ (see the purple boxes), there is still a notional sense of symmetry with the alternating placements of the ***2/6*** bars (see the pink boxes).

Taking a closer look at bars 5-17 (see Example 4.4), there seems to be a pattern of phrase elongation with the chordal motif: the first red box consists of two attacks, the second consists of five, the dotted red box consists of eight, and the final box consists of 10. The dotted red box is particularly curious, as Adès inserts multiple conflicting elements to make the interpretation of the relationship between the red and green rhythmic motifs somewhat ambiguous.

The reason the dotted red box contains three solid red boxes is because each of these segments follows certain rules of the chordal motif established up until this point: each chordal motif phrase only contains straight ♪ or ^{3}♩ durations; if there are any other durations, such as the straight ♩ in the latter half of bar 10, the phrase terminates; and each chordal motif phrase alternates with the pulsing motif. Therefore, the solid red boxes in bars 10-13 reveal one interpretation.

[226] Ibid.

Example 4.4: Adès, *Traced Overhead* (bars 5-17).[227]

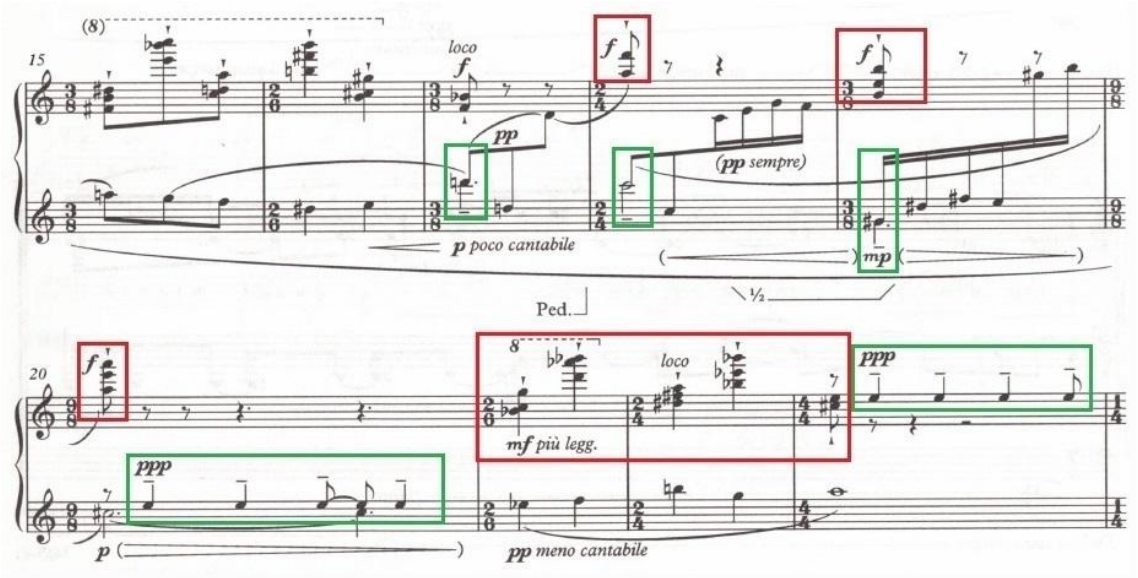


The dotted red box represents another interpretation, which is supported by the fact that the phrase slur for the *cantabile* melodic line in the left hand stretches the whole length, and up until this point, the *cantabile* melodic line is always accompanied by the red motif. Furthermore, the pulsing motif is not normally expressed as single tenuto 𝅗𝅥 notes, and the use of a straight 𝅗𝅥 note in bar 10 does not necessarily preclude it from being in the middle of a chordal motif phrase (as evidenced in Example 4.5 by the straight 𝅗𝅥 notes in the middle of the chordal motif in bar 22).

The ambiguity of interpretation in Example 4.4 makes the chordal motif of bars 10-13 anomalous. This ambiguity is a sign of the development of the chordal and pulsing motifs, and their overall interaction. The next development is seen with the next chordal motif phrase (spanning bars 14-17), which accompanies two *cantabile* melodic phrases instead of the usual one.

[227] Ibid.

Example 4.5: Adès, *Traced Overhead* (bars 15-23).[228]



The anomalies of the pulsing motif in bars 17-19 (see the green boxes in the upper system of Example 4.5) are echoed by the one-chord anomalies of the chordal motif one bar later in bars 18-20 (see the red boxes). These six instances are anomalous, as the pulsing motif does not normally contain note durations which are longer than a ♩, and the chordal motif does not normally appear as only one attack.

In bars 21-23 of Example 4.5, the chordal motif undergoes a final modification: the first two chords—rather than the middle two—are in an OFTS bar. Therefore, the ^{3}♩ notes initiate the phrase, but because the middle two chords are straight ♩ instead of the ♪ of the previous instances, there is still a sense of distortion as the pulse speeds transition from ^{3}♩ = 222 BPM to ♩ = 148 BPM, then to ♪ = 296 BPM.

In bars 13-23, Adès alternates time signatures, and he also uses different metric notation to recontextualise rhythms (see Example 4.6). The blue brackets highlight the time signature alternations between odd-factored and conventional time signatures. Although bars 21-22 feature a short, isolated alternation, the ***2/6–2/4*** pairing returns later in the movement, so it is included in the analysis here. These alternations are bookended by durations of ***4/4***.

[228] Ibid.

Example 4.6: Adès, *Traced Overhead* (bars 13-23).[229]

Bars 18-20 (in the second set of red brackets) feature differing time signatures: ***2/4***, ***3/8***, and ***9/8***. The bar lines, and therefore the time signatures dictating bar duration, delineate the micro-phrases/arpeggiations as well as the right-hand staccatissimo chords, which fall on downbeats. The ***9/8*** time signature is especially important, as it allows the four tenuto notes to continue being notationally offset from the beat (as is normally the case with the pulsing motif of Example 4.1). There is, then, a motivic symmetry between bars 20 and 23, where these two bars contain the first instances of the pulsing motif in groups of four attacks.

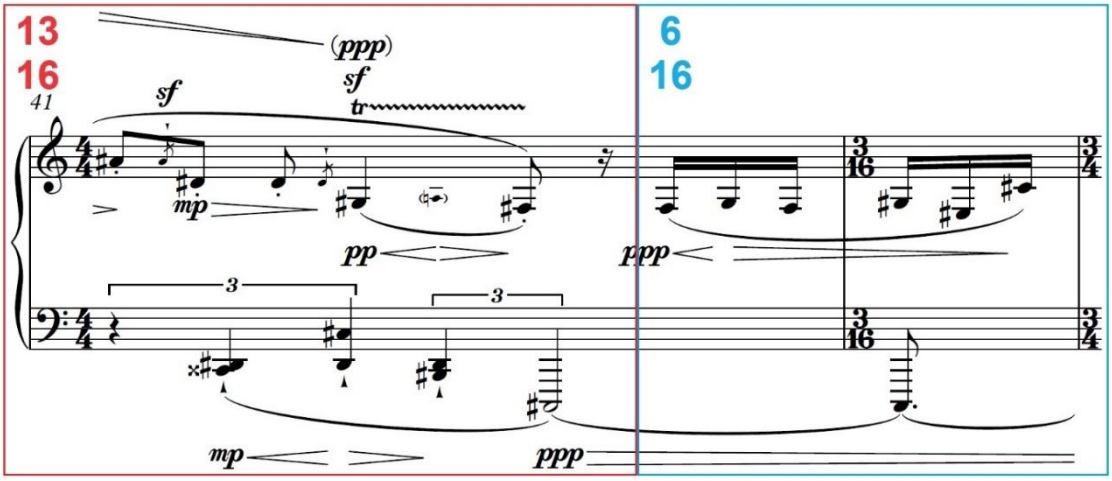
However, the notated time signatures of bars 18-20 obscure another possible interpretation: two ***4/4*** durations (annotated by the red brackets). This alternative reading is reinforced by the phrase slur and the downbeat of the ***3/8*** bar coinciding with a typical bisection of a ***4/4*** bar.

According to this interpretation, each instance of time signature alternation is consistently framed by ***4/4*** durations in Example 4.6 (i.e. the ***4/4*** bars in red brackets bookend each of the time signature alternations in blue brackets). The only problem with this interpretation is that the "***4/4*** bar" duration in bar 20 differs from bar 23 with respect

[229] Ibid.

to the tenuti being on or off the ♩ beat. Nevertheless, it is interesting to observe that the bars with no alternations between OFTS and conventional time signature bars are of durations that could be expressed as groups of ***4/4*** bars/durations.

Example 4.7: Adès, *Traced Overhead* (bars 41-42).[230]



The different interpretations of the bar durations in Example 4.6 reoccur later in bars 41-42 (see Example 4.7). Due to the phrasing, bars 41-42 could be reinterpreted to be in different time signatures, especially with the alternating ♬ figures in the latter part. The ^{3}𝅗𝅥 in the left hand could be renotated to ^{3}♪ 𝅘𝅥𝅯 (a triplet quaver tied to a straight semiquaver, equal to 7/48 in duration) at the end of the ***3/16*** bar, and then it would be tied to a conventional ♩. to fill out the ***6/16*** bar. However, the isolation of the ***3/16*** bar gains significance later in the third section of the movement (in bars 56-77), which explains the original time signatures used.

Example 4.8 shows the latter part of the first section that was excluded from previous examples (i.e. bars 24-33 of the first 33 bars that constitute the first section). Bars 24-28 hearken back to the symmetry of bars 10-17 with the bar durations decreasing then increasing in the ***1/4***, ***1/6***, ***1/8***, ***1/6***, ***1/4*** sequence (annotated in the blue bracket). However, what is particularly interesting is Adès' use of time signatures to enact a steady elongation of bar lengths in the lead-up to the next section of the movement.

[230] Adès, *Traced Overhead*, 5-6.

Example 4.8: Adès, *Traced Overhead* (bars 24-33).[231]

As shown by the red fractions, the denominator 24 is the lowest common denominator when bars 26-33 are all considered together. Bars 28-32 are reminiscent of bars 16-19 due to the melodic contour and arpeggiated figures in the middle voice, so it is important to note that bar 32 differs from bar 19 in function: bar 19 (notated in ***3/8***) functions as the second half of a reinterpreted ***4/4*** bar, which assists in the continuation of the motivic material, whereas bar 32 (notated in ***3/4***) elongates the 𝅘𝅥𝅯 run to lead into a new section of the movement. The new section is evidenced by the new metronome mark above bar 33, although there is oddly no actual change of tempo. It is speculated that the tempo range gives license for rubato in performance.

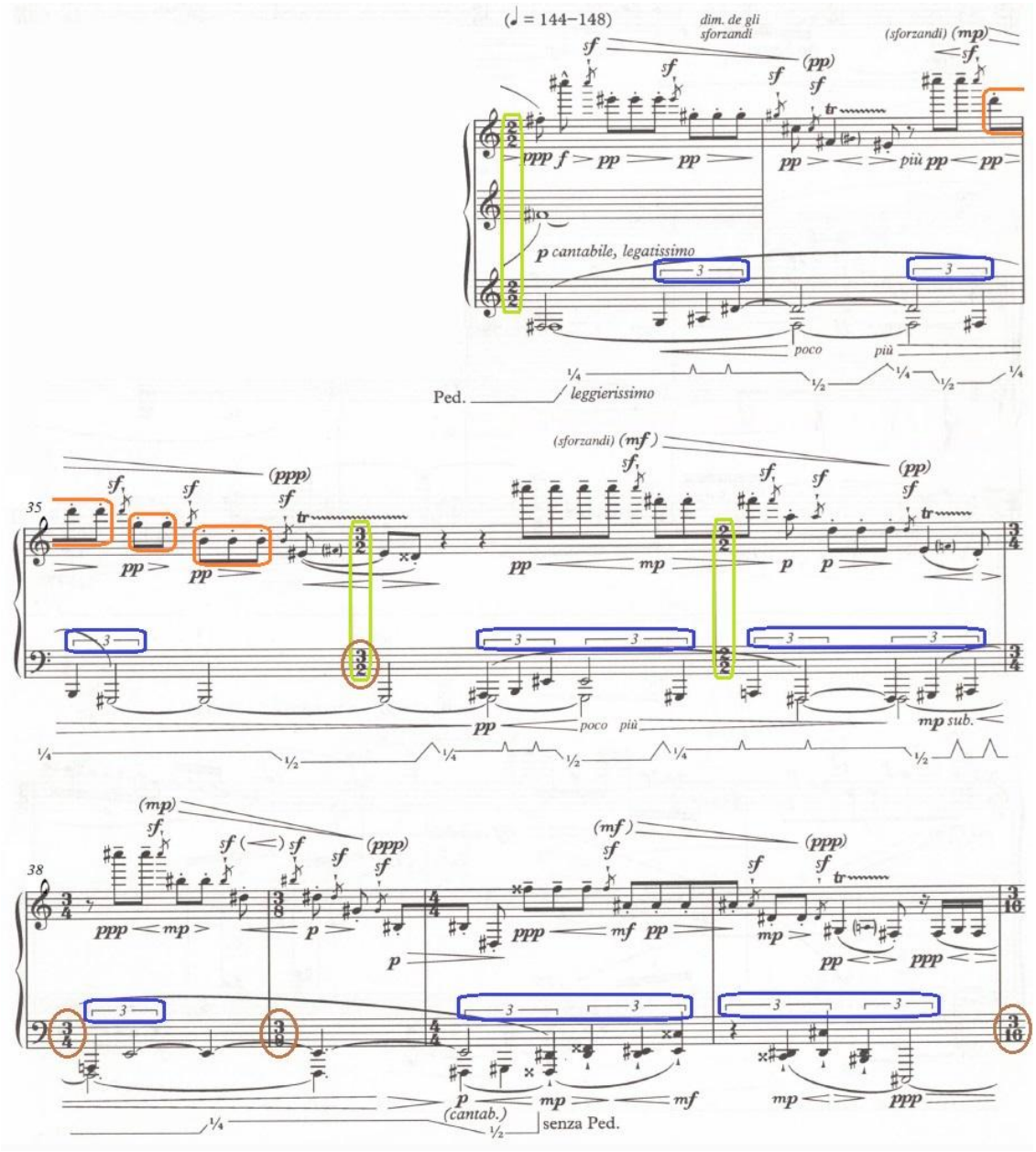
This first section of motivic development found in Examples 4.1-4.8 represents a microcosm of thematic development throughout the remainder of the movement. Adès utilises OFTSs to contribute to musical development of motivic material and the structuring of time in this work.

The second section of the second movement of *Traced Overhead* spans bars 33-55, and OFTSs do not appear until the end of the section. However, bars 33-41 (see Example 4.9) are still noteworthy in this analysis, as they contain rhythmic and inter-bar patterns

[231] Adès, *Traced Overhead*, 5.

that Adès introduces in conventional time signature bars before incorporating them into his OFTS use.

Example 4.9: Adès, *Traced Overhead* (bars 33-41).[232]

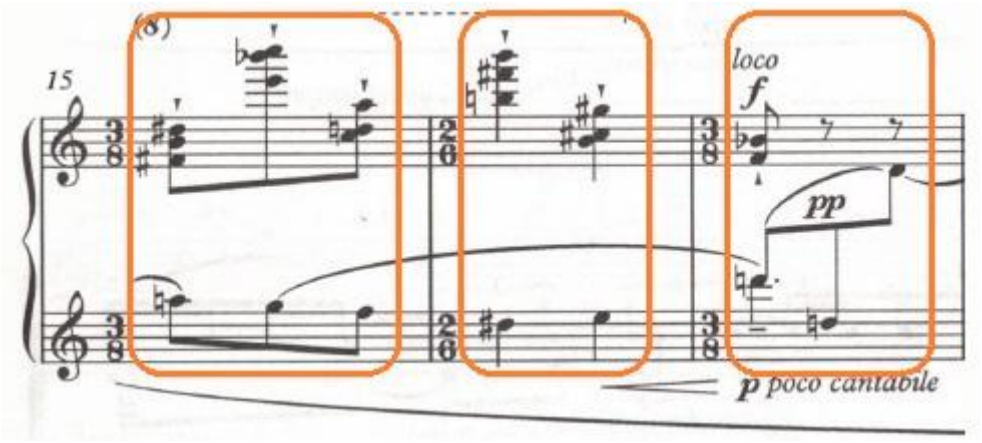


The triplet rhythms from bars 3-5 return in the left hand of Example 4.9, but it is important to note that they are played against straight ♪ pulses and ♩ beats, creating 3:4 and 3:2 ratios respectively with the right hand. This is significant, as Adès exploits multiple alternations and comparisons of groups of two and three throughout this excerpt. Bars 35-37 have consecutive numerators of ***2***, ***3***, and ***2*** again in the time signatures (see the green annotations; the time signature for bar 35 is carried over from bar 33).

[232] Adès, *Traced Overhead*, 5.

Leading into bar 35, the right hand plays repeated staccato notes grouped in three, two, and three again, (see the orange annotations in Example 4.9). Compare this to bars 15-17, where the middle two attacks are at a different pulse speed due to the OFTS (see Example 4.10). Therefore, although the number of attacks can be represented in the same 3 : 2 : 3 ratio found in the orange annotations of Example 4.9, there is a 9 : 8 : 9 ratio in the overall durations in Example 4.10:

Example 4.10: Adès, *Traced Overhead* (bars 15-17).[233]

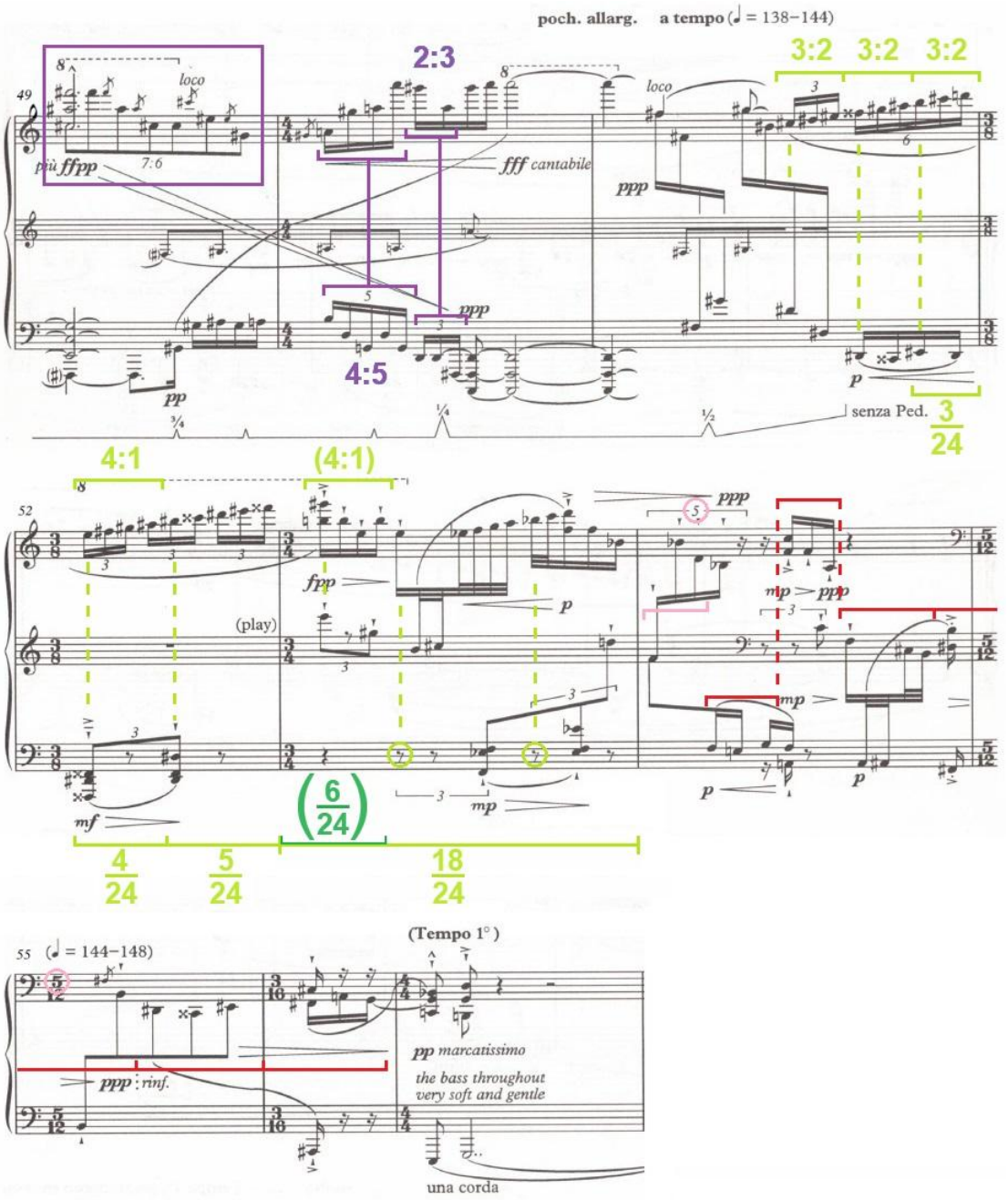


However, the most curious 2:3 relationship in Example 4.9 is seen in the halving of the bar durations with a ***3*** as the numerator: the ***3/2*** bar 36 is halved to become ***3/4*** in bar 38, which is halved again in the next bar as ***3/8***, and halved a final time to become ***3/16*** in bar 42 (see the brown annotations in Example 4.9). Adès recontextualises the 2:3 relationship in multiple rhythmic and metric layers throughout Example 4.9 and reflects this again in bars 50-51 (see Example 4.11).

Example 4.11 is located at the tail end of section 2. This example demonstrates Adès' use of truncation and elongation, his preoccupation with proportionality, and his ability to recontextualise musical material. The middle staff in the first system is not considered, as it is an unplayed melody: an homage to *Humoreske* in which Robert Schumann developed the technique where 'an unplayed melody [emerges] mysteriously through the texture that results from the interplay between left and right hands'.[234] Therefore, the middle staff is only played in the second system and will only be considered in bars 53-54.

[233] Adès, *Traced Overhead*, 4.
[234] Thomas Adès, "Traced Overhead," Faber Music, accessed July 18, 2024, https://www.fabermusic.com/music/traced-overhead-2708.

Example 4.11: Adès, *Traced Overhead* (bars 49-57).[235]



In bars 49-50, there are two melodic lines that cross over, as evidenced by the descending *diminuendo* symbol and the ascending phrase slur. The descending line contains three phrases, which are defined by harmonic and registral shifts. Bar 49 contains arpeggiations of F♯ and C♯ major triads, the ^{5}𝅘𝅥𝅯 phrase arpeggiates a G major triad, and then the ^{3}𝅘𝅥𝅯 phrase arpeggiates a D major triad. Every triad is played in a different octave.

[235] Adès, *Traced Overhead*, 6-7.

These three phrases of the descending line also correspond with changes in pulse speed: the $^{7}\!\!\!

bar counts as a note group (see the green dotted coordination lines), then it would complete the elongation with a total duration of 6/24 (see the dark green bracket).

However, because the note groupings have previously been demarcated according to when the two hands coincide, the next real coordination point is not until the downbeat of bar 54. None of the ^{3}♪ notes played by the left hand in bar 53 align with any of the right-hand notes—apart from the first attack of the bar—as the other coordination points are between the right-hand note and a left-hand rest.

The red brackets in bars 54-56 indicate groups that are generally defined by a staccatissimo or accent articulation on the first note of each group. If the durations in the ***5/12*** bar were ♪ instead of ^{3}♪, the grouping would be every 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯. As it is, the ***5/12*** bar forces a deceleration of pulse speed and geometric elongation of the normative ♪ pulse duration: the group of three notes is still observed, as the third ^{3}♪ in the ***5/12*** bar initiates a phrase (see the slur trailing to the left-hand staccatissimo ♪ note).

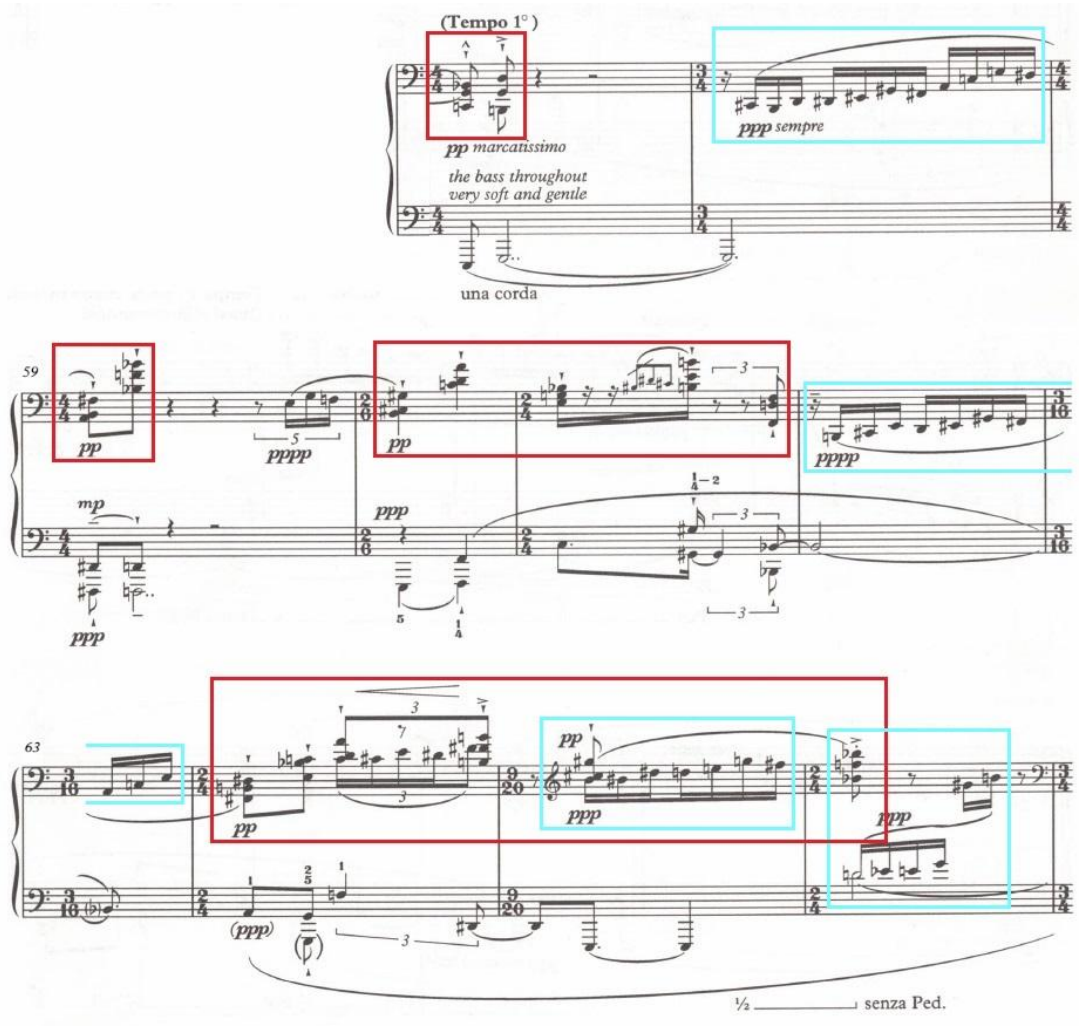
The pink bracket at the beginning of bar 54 indicates another group of three notes. However, instead of ^{3}♪, the pulses are ^{5}♪, which are faster than the following straight ♪ pulses. Therefore, this presents another geometric transformation of the pulse duration; so, from the beginning of bar 54 to the end of bar 55, the pulse durations of the note groups gradually elongate from ^{5}♪, to the normative ♪ pulses, then to the ^{3}♪ pulses in the ***5/12*** bar.

This pink bracket has been differentiated from the red brackets because the ♪ F of the first red bracket technically overlaps with the ^{5}♪ D of the pink bracket. However, it is curious that the ***5*** of the quintuplet bracket is seen again with the ***5***-numerator of the ***5/12*** bar. This may be a coincidence, but it is interesting that the two sections in bars 54-56 containing note groups of three at pulse speeds other than the normative straight ♪ pulse would both involve ***5***. In any case, Adès continues to use the techniques of truncation/elongation, reproportioning, and recontextualising notation to develop motifs and themes in increasingly more intricate and structurally complex ways.

The next occurrence of OFTSs appears in the third section of the movement. As this section spans bars 56-77, it is too long to fit into one excerpt, so it has been split into two excerpts (see Examples 4.12(a) and (b)). The chordal motif returns in the red boxes

but a new motif of running semiquavers in a generally ascending melodic contour is featured in the aqua boxes.

Example 4.12(a): Adès, *Traced Overhead* (bars 57-66).[236]



Note that the third section and the beginning of the fourth section contain music at the lowest register for this movement, which is significant since *Traced Overhead* is preoccupied with the idea of 'ascent', and this movement "Aetheria"—translated to ethereal—is 'a record of "things of the middle air"' and is intended to continue this ascent.[237] Therefore, this lower register is used as a means of building tension and impetus heading towards the climax.

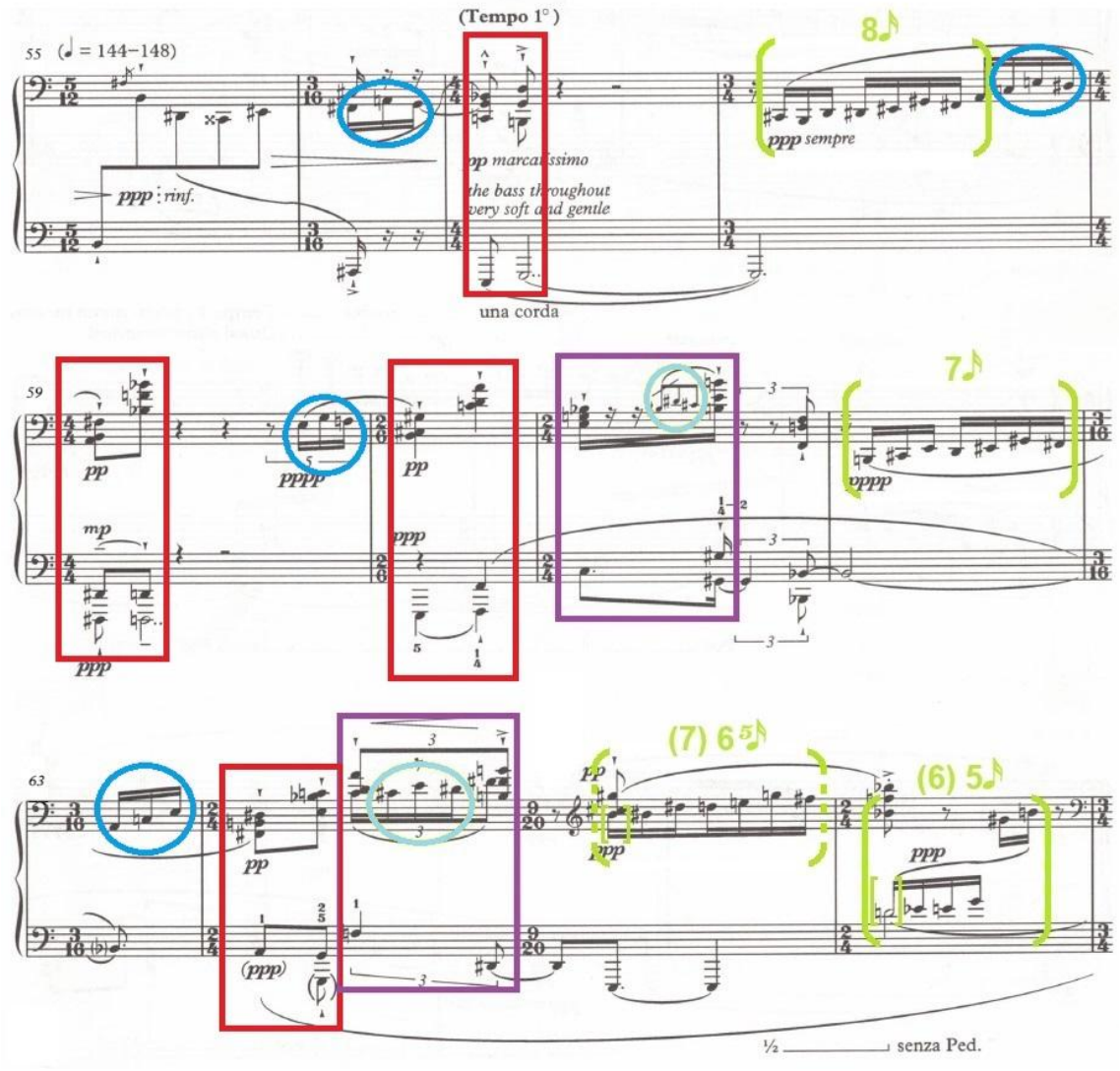
[236] Adès, *Traced Overhead*, 7.
[237] Adès, *Traced Overhead*, front notes.

Example 4.12(b): Adès, *Traced Overhead* (bars 67-77).[238]

There is a sense of overall alternation between the two different motifs. However, Adès layers many more procedures throughout this section. All the 2/6 bars in this third section continue to facilitate the chordal motif. The ***2/6–2/4*** bar pairing of bars 21-22 in Example 4.6 returns here in bars 60-61 (see the purple boxes in Example 4.13(a)): it signals the entrance of a variation to the chordal motif where the staccatissimo chords are interpolated with groups of three notes. The significance of the ***3/16*** bar 42 in Example 4.7 is finally revealed here in bar 56 as the establishment of a fragment of three short notes (see the dark blue circles in Example 4.13(a)).

[238] Adès, *Traced Overhead*, 8.

Example 4.13(a): Adès, *Traced Overhead* (bars 55-66).[239]



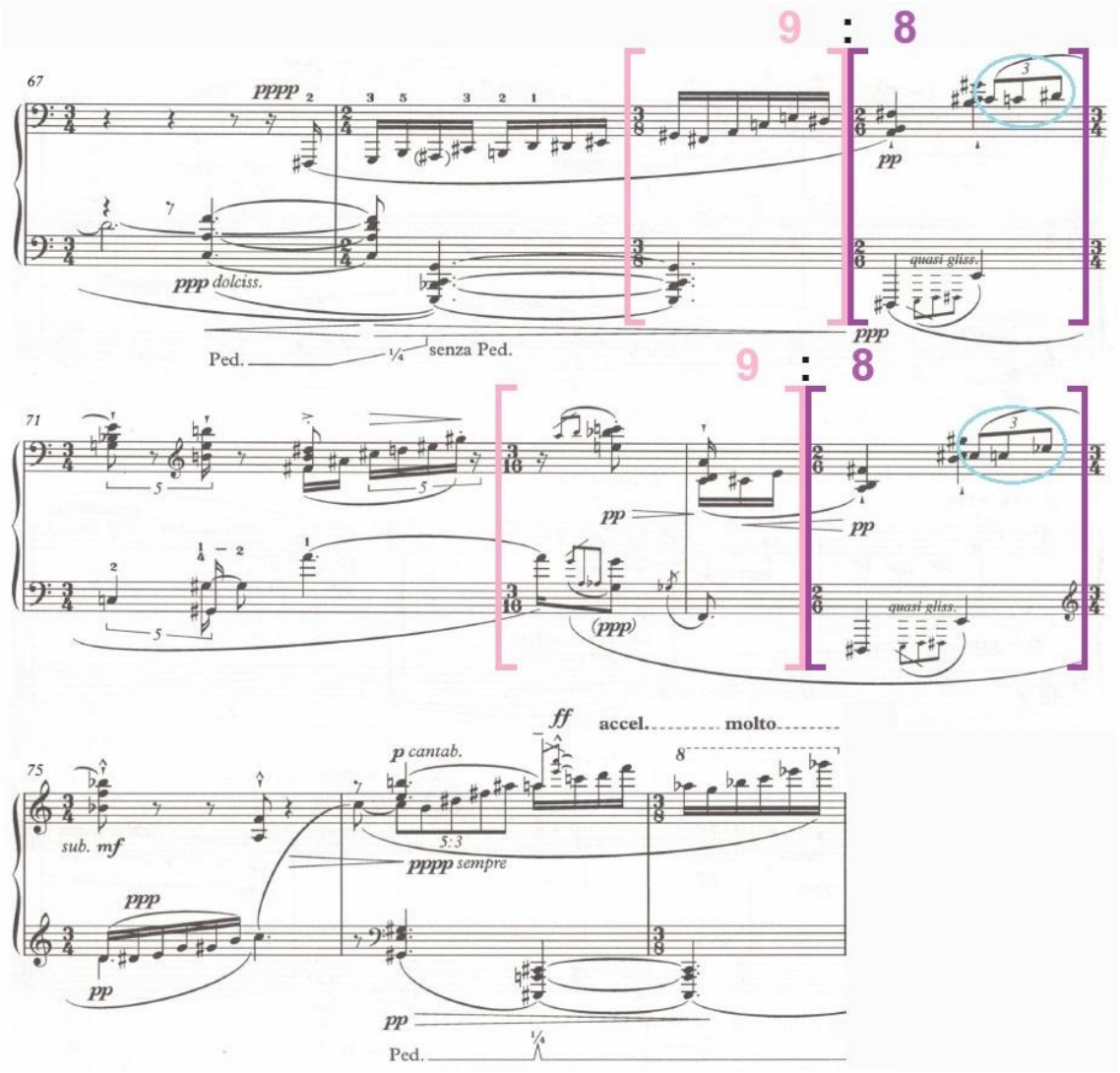
Regarding the new motif of ascending running 𝅘𝅥𝅯 figures (see the green brackets), each phrase undergoes a sequential truncation: eight, seven, six, and finally five notes. The non-bracketed numbers apply if the chords in bars 65-66 are not taken into account; this is to maintain analytical consistency, even when the motif in bars 58 and 62 does not incorporate any chords. However, the inclusion of the chords is another means of introducing variation into the motif, akin to the purple-boxed variations of the chordal motif.

The sequential phrase truncation of the green brackets hearkens back to bars 49-50 in Example 4.11, where the phrase durations decreased from a ***3/4*** bar to a 𝅗𝅥 duration, then to a 𝅘𝅥𝅯 length. However, due to the ***9/20*** OFTS in Example 4.13(a), there is also a geometric truncation of the pulse durations in the green phrases. This double layering

[239] Adès, *Traced Overhead*, 7.

of truncation processes seems to mirror the two types of elongation found in bars 51-55 in Example 4.11.

Example 4.13(b): Adès, *Traced Overhead* (bars 67-77).[240]



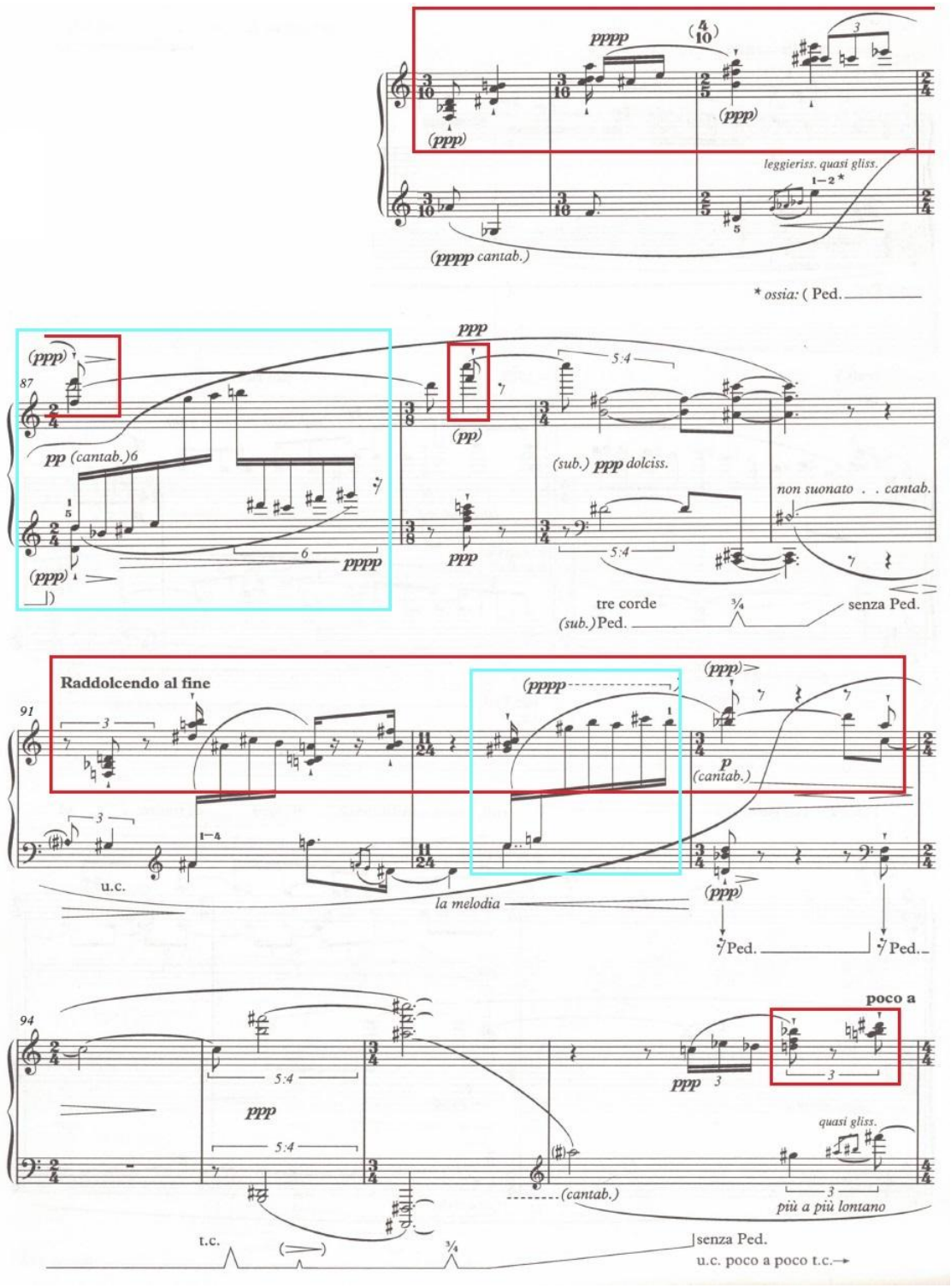
Example 4.13(b) contains only two bars of OFTSs, which continue to be used to facilitate the chordal motif. Significantly, bar 74 is rhythmically identical to bar 70, which points to the equivalence of bar duration (and function) of the preceding bars, annotated in the pink brackets. The two ***3/16*** bars of the second system can be seen as comparable, on some level, to the ***3/8*** bar of the first system.

This is also the first time where nested tuplets are featured in the movement: $\overset{3}{\text{♪}}$ within OFTS bars with an underlying $\overset{3}{\text{♩}}$ pulse speed (see the blue circles). The nested triplets result in note durations that are extremely close—at a 9:8 ratio—to the ♪ pulses in the preceding bars. The 9:8 ratio also applies to the bar durations as well. Adès uses

[240] Adès, *Traced Overhead*, 8.

two consecutive ***3/16*** bars in bars 72-73 to create a durational equivalence of a ***3/8*** bar. Therefore, the OFTSs are used to provide subtle proportional distortions of the pulse and bar durations in this passage.

Example 4.14: Adès, *Traced Overhead* (bars 84-97).[241]



[241] Adès, *Traced Overhead*, 9.

The climax of the piece is reached at bar 88 in the fourth section of this movement (bars 78-97), which is also where the next OFTSs are encountered (see Example 4.14). Bar 89 onwards begins to feature stretches of held chords paired with the denouement of the movement, evidenced by the gradually softening dynamics and the deceleration of the tempo (e.g. 'Raddolcendo al fine' above bar 91 shown in Example 4.14, and 'rall. quasi continuando - di poco - di molto - al' above bars 104-105 shown later in Example 4.18(a)).

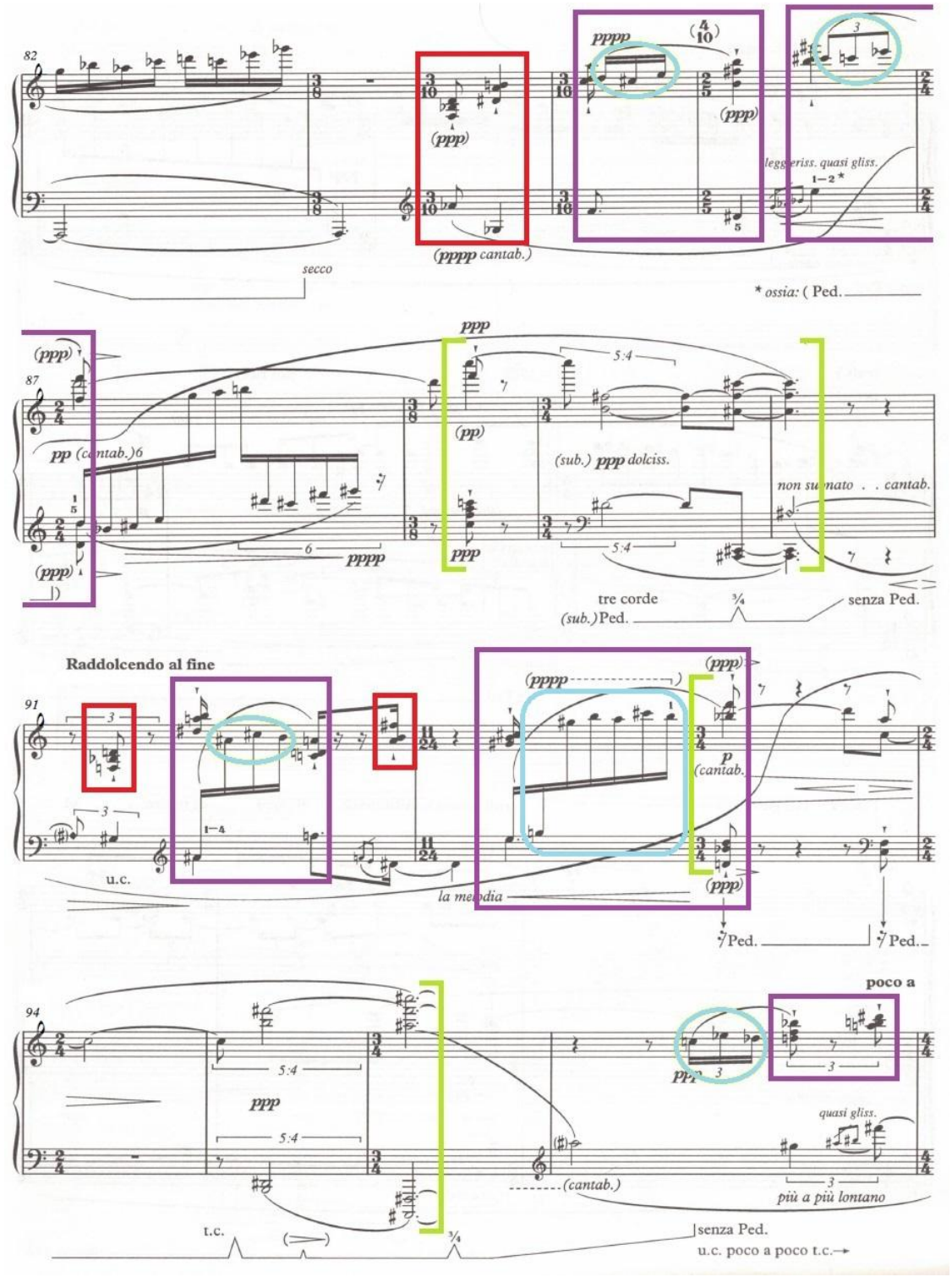
Example 4.14 continues to trace the development of the chordal motif (still annotated in red boxes) and the ascending running 𝅘𝅥𝅯 motif (in aqua boxes). Adès develops the nested tuplet idea even further in bar 86 by including the only occurrence of a nested tuplet with differing tuplet values (see the blue circle in bar 86 in Example 4.15).

This nested tuplet is a ^{3}𝅘𝅥𝅯 figure within an OFTS bar with an underlying quintuplet pulse speed: a triplet nested within a quintuplet, which produces an even closer durational relationship with 𝅘𝅥𝅯 than the previous 9:8 ratio in Example 4.13(b). This time, the 𝅘𝅥𝅯 : nested ^{3}𝅘𝅥𝅯 proportion is at a 15:16 durational ratio. Compare bar 86 to the previous bars 70 and 74, where they were triplets within triplets instead. Also, bars 84 and 86 are the only instances where the chordal motif engages with quintuplet rhythms, rather than triplet rhythms as previously established.

The parenthesised ***4/10*** time signature above bar 86 signifies one of the elongation procedures employed here. Bars 84-87 alternate instances of bar elongation, with the ***3/10*** bar 84 lengthening to the ***2/5*** bar 86 (i.e. ***4/10***). The ***3/16*** bar 85 experiences two layers of elongation to transform into the ***2/4*** bar 87.

If ***3/10*** was lengthened by one ***5***𝅘𝅥𝅯 to ***4/10*** (i.e. ***3/10*** + 1/10 = ***4/10*** = ***2/5***), then it should follow that ***3/16*** should lengthen by one 𝅘𝅥𝅯 to ***4/16*** (i.e. ***3/16*** + 1/16 = ***4/16*** = ***1/4***). The ***3/16*** bar contains three 𝅘𝅥𝅯 , which double in *number*—but not duration—to six ^{6}𝅘𝅥𝅯 in the first half of the ***2/4*** bar (equivalent in duration to a ***1/4*** bar). The second layer of elongation is that the expected ***1/4*** duration is doubled again into ***2/4*** (perhaps so the numerators of the consecutive bars pair: ***3–3*** in bars 84-85 and ***2–2*** in bars 86-87). Regardless, the ***3/16*** bar experiences two layers of elongation to become ***2/4***.

Example 4.15: Adès, *Traced Overhead* (bars 82-97).[242]



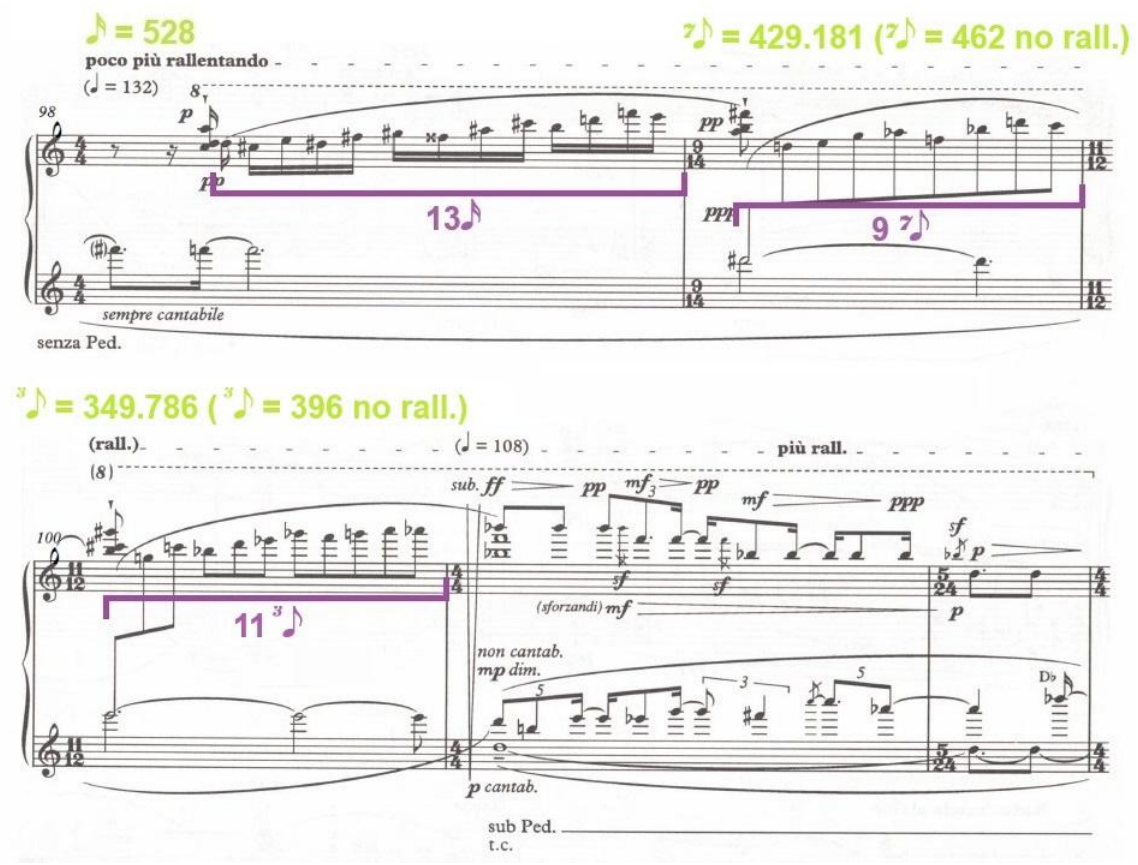
The green brackets show another elongation of phrase length with longer note durations in bars 93-96 as well as the inclusion of an additive procedure where the last chord in bar 93 and the tied note of bars 94-95 are added to lengthen the phrase. This additive procedure is also applied to the short notes figure within the blue oblong annotation of bar 92: the number of notes has doubled to six.

[242] Adès, *Traced Overhead*, 9.

However, due to the ***11/24*** OFTS, there is a geometric truncation imposed on the notes, so they are shortened to $^{3}\!\!\!\diagup$ instead of the usual $\diagup$ pulses. The $^{3}\!\!\!\diagup$ durations continue in bar 97 (see the blue-circled notes). The ***11/24*** duration of bar 92 is one $^{3}\!\!\!\diagup$ off from a ***2/4*** bar; this is significant because, like bar 87, which has a ***2/4*** time signature, bar 92 also precedes a green-bracketed section. So, as the green-bracketed sections experience phrase elongation, the bars preceding them undergo a truncation process.

Heading into the final section of the movement, bars 98-107 contain the fade-out, providing a transition into the next movement. This section contains unique OFDs which appear nowhere else in the piece, such as bar 99, which features the only septuplet denominator of the piece:

Example 4.16: Adès, *Traced Overhead* (bars 98-102).[243]



In Example 4.16, the metronome marks for bars 99-100 have been rounded to three decimal places for convenience. Although the 'poco più rallentando' is not meant to be performatively arithmetically precise, the annotated metronome marks are provided to give a sense of the deceleration that would occur. They were determined by interpolating the values with the following method:

[243] Adès, *Traced Overhead*, 10.

Bar 98 metronome mark: ♩ = 132 (𝅘𝅥𝅯 = 132 × 4 = 528)

Bar 101 metronome mark: ♩ = 108

132 – 108 = 24

Total duration of bars 98-100 = 4/4 + 9/14 + 11/12

$$= \frac{168 + 108 + 154}{168}$$

= 84 : 54 : 77

= 215

Bar 99:

♪ = ([♩ = 132] – [4/4 bar duration]) × 2

= (132 – (24 × 84/215)) × 2

$\overset{7}{♪}$ = ♪ × 7/4

= 429.1813953488 (429.181 rounded)

Bar 100:

♪ = ([♩ = 132] – [4/4 bar duration] – [9/14 bar duration]) × 2

= (132 – (24 × 84/215) – (24 × 54/215)) × 2

$\overset{3}{♪}$ = ♪ × 3/2

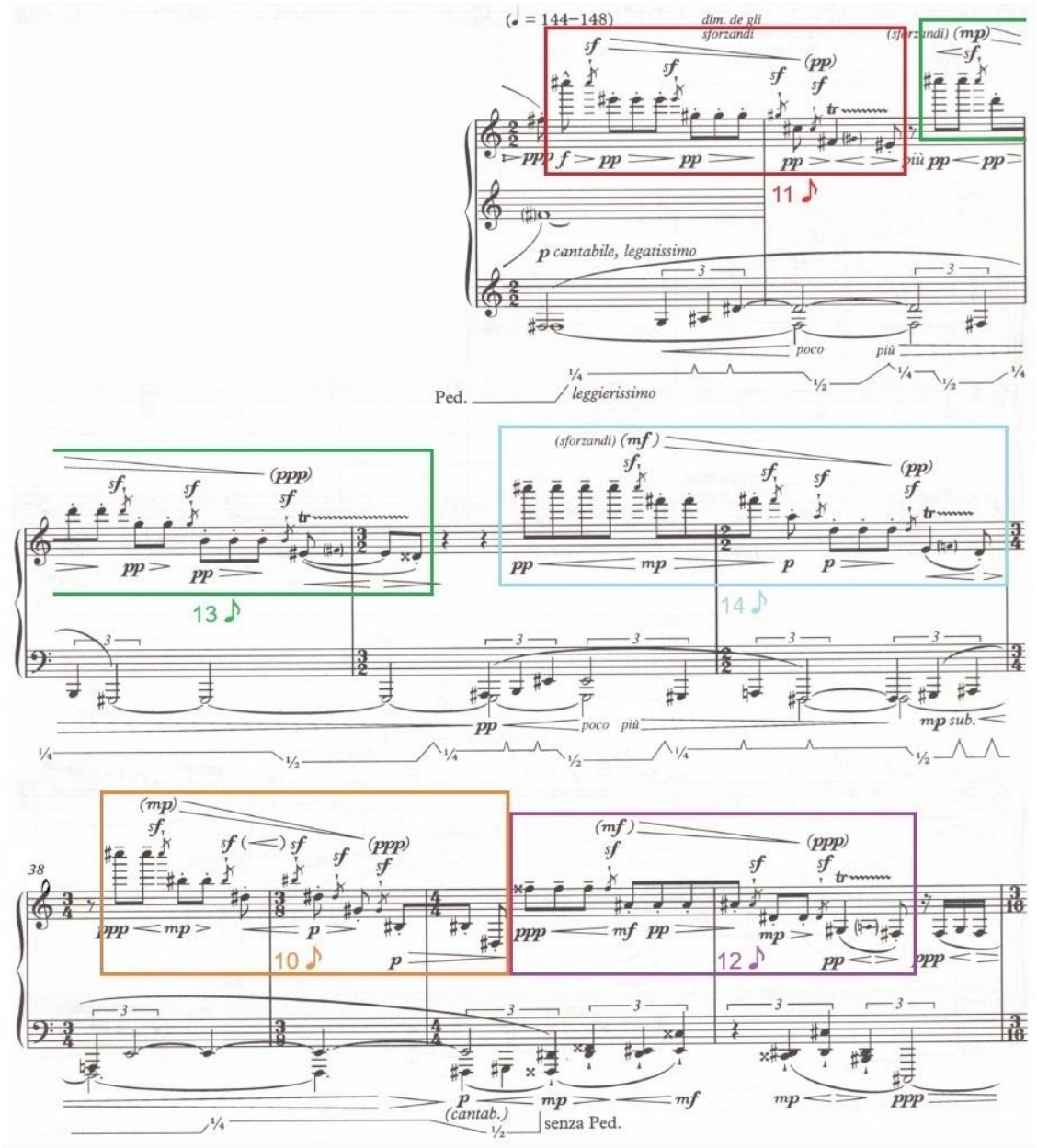
= 349.7860465116 (349.786 rounded)

When the *rallentando* is not superimposed onto these bars, the time signatures provide a sequential deceleration of 66BPM per bar, as there is an 8 : 7 : 6 ratio between the 𝅘𝅥𝅯 : $\overset{7}{♪}$: $\overset{3}{♪}$ pulse speeds. The *rallentando* magnifies the precise and proportional deceleration, which is a natural outcome of the notation.

As previously discussed, Adès uses procedures of reordering and permutation in certain segments of this movement. One of the techniques used in this piece is an ordered relationship between phrase lengths of a particular pulse value multiplied by consecutive integers, followed by a rearrangement of this order. In Example 4.16, he is using phrase lengths of consecutive odd-numbered durations; however, these are not arranged in ascending or descending order, but rather in a permuted order to provide variation.

This technique was first established in a couple of passages that do not have OFTSs: bars 33-41 and 43-49. The passage of Example 4.17 was previously encountered in Example 4.9 but it has been reannotated here to address the varying phrase lengths. Although this passage does not contain any OFTSs, the permutation technique employed is encountered later in passages that do feature OFTSs (see bars 58-65 and 98-100 in Examples 4.13(a) and 4.16 respectively), so it is worth briefly addressing to identify the foundation of these patterns.

Example 4.17: Adès, *Traced Overhead* (bars 33-41).[244]



The annotated phrase lengths in Example 4.17 have been numbered as such because although the final note of each phrase has staccato articulation and is therefore

[244] Adès, *Traced Overhead*, 5.

of indeterminate duration, the ♪ length of each final staccato ♪ could be projected, as the durations of the other staccato ♪ notes in the middle of the phrases can also be entrained to. Adès uses phrases of 10-14 ♪ but rearranges them to group the odd numbers before the even numbers as a means of reproportioning the phrase durations.

There are several factors contributing to the lack of metrical clarity in this passage: none of the phrases start on a downbeat; the rests between each phrase are inconsistent in length and intervene in a seemingly unsystematic way; the grace notes are metrically moored due to the *sforzandi* articulations and therefore affect the lengths of the main notes; and the trills obscure the rhythms. In fact, an argument could be made that Example 4.17 is polymetrical—or at least polyrhythmic—due to the fact that the right-hand phrasing is distinctly separate from the left-hand figurations and also because the ♪ pulse in the treble staff is played against the triplet rhythms of the bass throughout this passage.

Apart from the longer phrases in Example 4.17, Adès also uses the techniques of truncation and elongation to mutate the smaller fragments of repeated notes (which are delineated and separated by grace notes). Table 4.1 compares each phrase's number of repeated notes to show the various modifications of each fragment:

Table 4.1: Comparison of phrases and fragments in Example 4.17.

Phrases	Number of notes in each fragment				Trilled Note	Final Quaver
	Fragment 1	Fragment 2	Fragment 3	Fragment 4		
Red 11 ♪	1	3	3	1	♩	♪
Green 13 ♪	2	3	2	3	Tied ♫	♪
Blue 14 ♪	4	3	1	3	♩	♪
Orange 10 ♪	2	2	1 + 1	1	No trill but staccato ♫	♪
Purple 12 ♪	3	4	2	-	♩	♪

The orange 10 ♪ phrase is particularly anomalous due to a couple of factors: 1. The first grace note is the only grace note in this excerpt to not repeat the pitch of the previous main note; and 2. The ♩ duration leading into the final staccato ♪ is not trilled but is made up of two staccato ♪ notes instead. The ***3/8*** bar interpolates the middle of the phrase: up until bar 38, a 𝅗𝅥 metric grid was formed and enforced by the left hand. Bar 38, with the ***3/4*** time signature, accommodates one 𝅗𝅥 at the beginning of the bar, but the

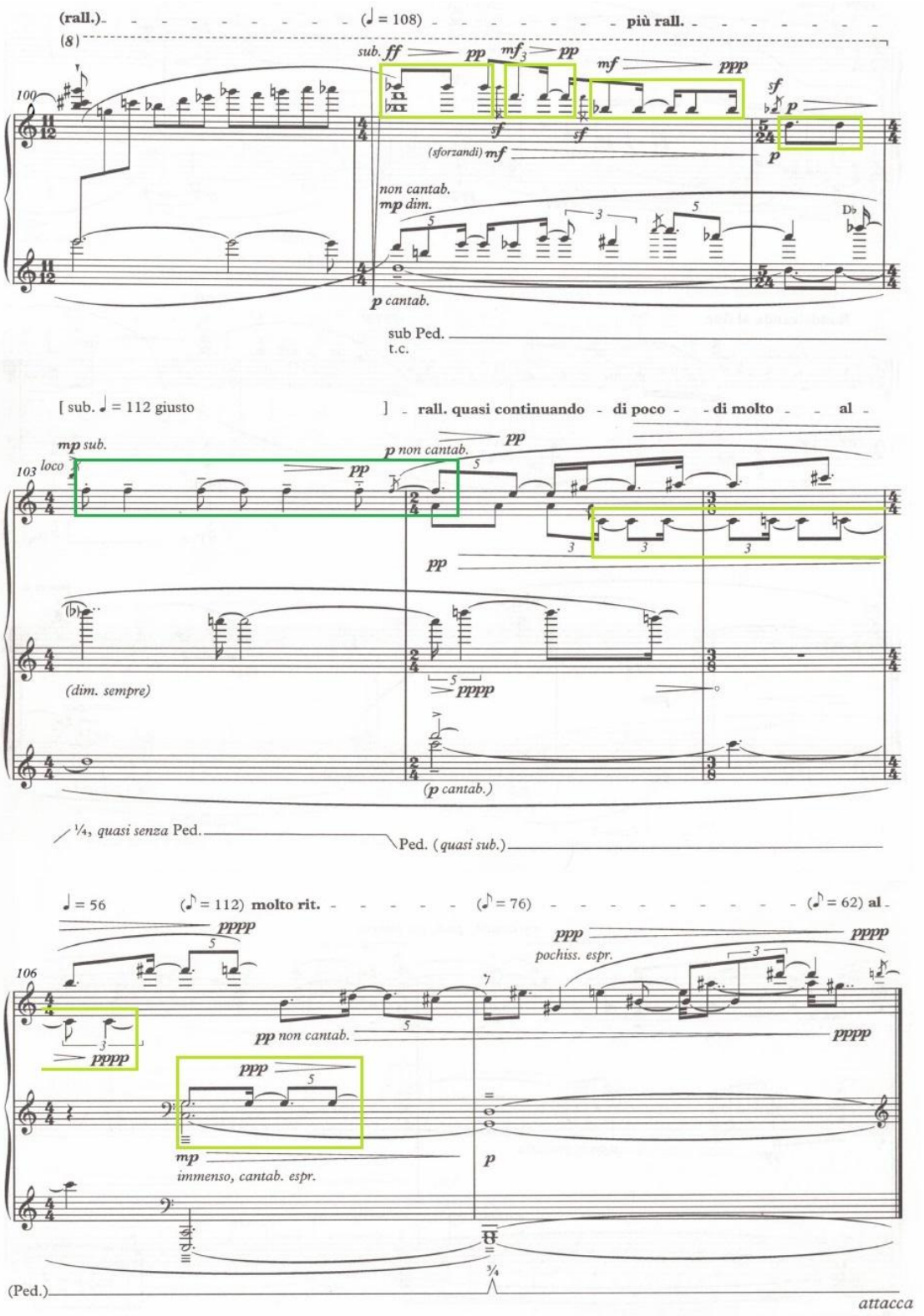
final ♩ coupled with the ♩. duration of the ***3/8*** bar forces a shift of this 𝅗𝅥 metric grid to be a ♪ later than it was previously established.

This hearkens back to Example 4.2, where Adès truncated some sections between motif articulations to slightly shift the metric grid to enact a sense of anticipation, but here he instead uses elongation to create a sense of delay or prolongation. Example 4.17 is the first time in the movement where his use of permutation incorporates truncation and elongation to provide metric ambiguity across conventional time signatures. This develops throughout the movement so that when the technique is finally utilised alongside OFTSs, like in Example 4.16, the metric ambiguity is heightened.

The last occurrence of OFTSs is found in the final bars of the movement, where the pulsing motif returns (see Example 4.18(a)). The pulsing motif reaches its final form of transformation: the notes are offset to the point where the tied notes are of different rhythmic values (e.g. the conventional 𝅘𝅥𝅯 in the middle staff of bar 106 is tied to a ^{5}♪. note). This is akin to the durational distortions of the 'pig-in-the-middle' motif in *Catch* where the durations often involved the combination of straight and tuplet note lengths leading to a heightened proportional complexity (see the discussion around Example 3.15 of the previous chapter).

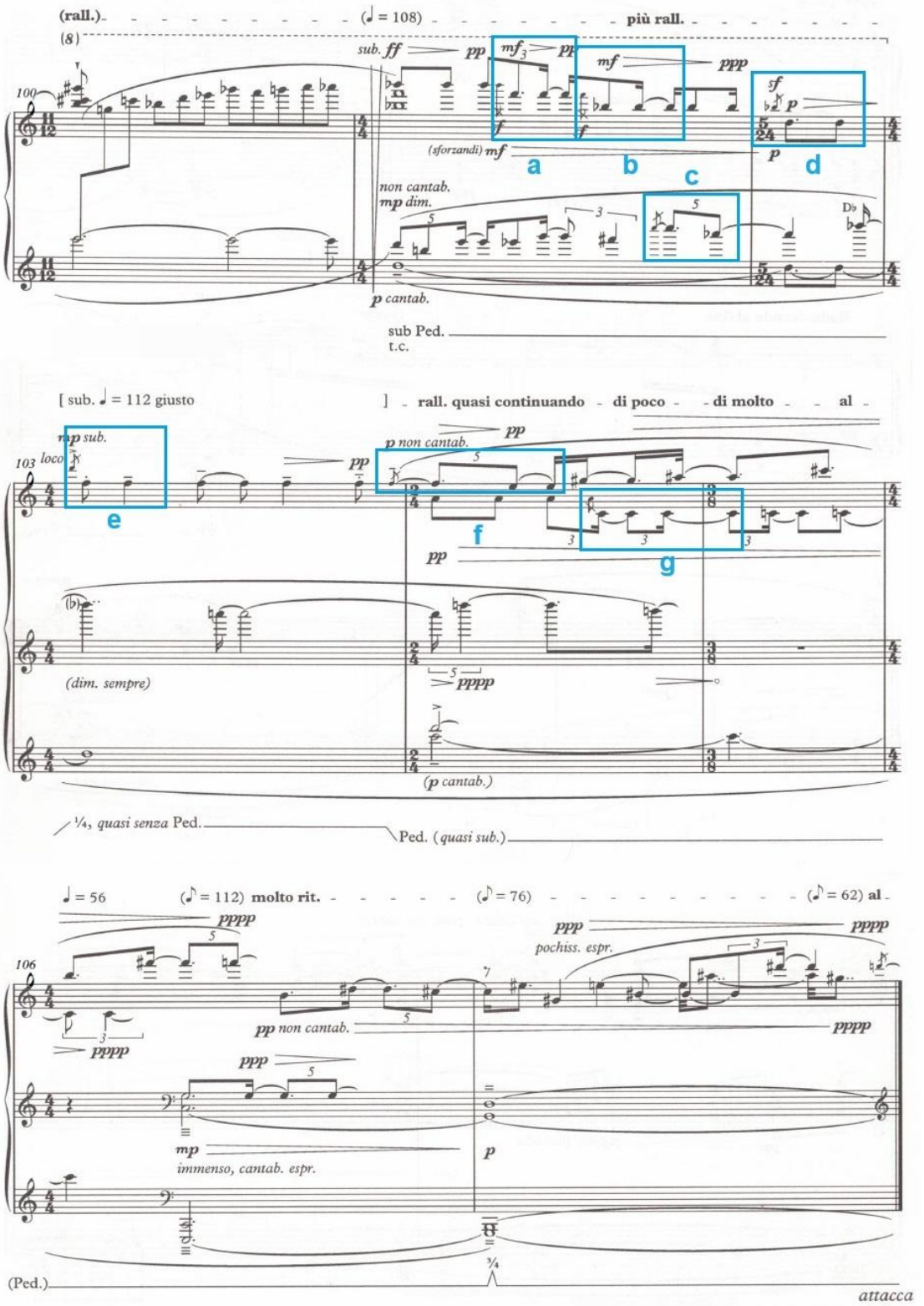
The last OFTS of the piece, the ***5/24*** in bar 102, is used to highlight the proportionalities associated with a little fragment motif only found in these last few bars. This fragment motif is characterised by a grace note followed by two durations of varying proportions. See the blue boxes in Example 4.18(b) for the delineation of the fragments, and see Table 4.2 for the elucidation of the proportions (which do not include the grace notes, as these have indeterminate durations). With the (c) fragment, the duration of the second note does not include the tied ♩ in the ***5/24*** bar, as the (d) fragment overrides it.

Example 4.18(a): Adès, *Traced Overhead* (bars 100-107).[245]



[245] Adès, *Traced Overhead*, 10-11.

Example 4.18(b): Adès, *Traced Overhead* (bars 100-107).[246]



[246] Ibid.

Table 4.2: The proportions of the fragment motifs in Example 4.18(b).

Reference	Notation		Simplified Ratio	Comparative Ratio (x : y / 240)
(a)			6:5	30:25
(b)			1:1	30:30
(c)			3:2	36:24
(d)			3:2	30:20
(e)			1:2	30:60
(f)			12:13	36:39
(g)			1:1	30:30

The comparative ratios in the final column of Table 4.2 are based on the lowest common denominator of 240 so that all the ratios can be compared. There are two pairs of identical simplified ratios: the 1:1 ratios of the (b) and (g) fragments, and the 3:2 ratios of the (c) and (d) fragments. With the 1:1 ratios, despite the fact that the (b) fragment is notated with straight rhythms while the (g) fragment is notated with triplet rhythms, they both actually equate to the same duration: 1/8 of a 𝅝 (i.e. a duration of ♪ note). This is a good example of note duration equivalence.

The 3:2 ratios, on the other hand, involve a process of geometric truncation of the note durations. The 3:2 ratio involving quintuplet rhythms (which equate to 36:24 / 240 durations) are shortened in length to become triplet rhythms (which equate to 30:20 /240 durations instead). Although they share the same relative proportion, Adès changes the pulse speed from fragment (c) to (d) to geometrically distort the proportions, and he does this with the use of the ***5/24*** OFTS.

There is also another potential reason to use the ***5/24*** OFTS when all the non-***4/4*** bars of Example 4.18(b) are taken into account. The ***11/12*** and ***5/24*** bars equate to a total duration of a ***9/8*** bar. The ***9/8***, ***2/4***, and ***3/8*** durations equate to a total duration of two ***4/4*** bars. The non-4/4 bars (i.e. the bars with the time signatures of ***11/12***, ***5/24***, ***2/4***, and ***3/8***) are expressed in an overall durational proportion of 22 : 5 : 12 : 9. Therefore, from bar 100 onwards, Adès has effectively written six ***4/4*** bar durations but has apportioned a third of these durations in a different way by incorporating the OFTSs.

Throughout the second movement of Adès' solo piano work, he employs alternations of time signatures, bar durations, proportions, and rhythmic interpolations to express multiple forms of comparison. He develops motifs through fragmentation, truncation, elongation, permutation, and reproportioning procedures to present

rhythmic ideas in the process of organic evolution. Furthermore, he uses notation to recontextualise various musical ideas and tempo proportions at different rhythmic and metric layers. All these techniques are greatly enhanced by the use of OFTSs, which allows these procedures to be conveniently rationalizable and notated.

The two example pieces of *Catch* and *Traced Overhead* provide a means of assessing Adès' early rhythmic and metric practices when incorporating OFTSs in his pieces. The uses of comparison and alternation are especially relevant when considering the inherent proportional nature of the notational device, and this is epitomised in the case study piece, *Piano Quintet*.

Chapter 5: *Piano Quintet* Case Study

Piano Quintet is a 20-minute work composed by Adès for two violins, a viola, a violoncello, and a piano. It was commissioned by the Melbourne International Festival of the Arts and premiered on 29 October 2001 with the Arditti Quartet and Adès himself playing the piano.[247]

The piece focuses on the subtle relativity of time as experienced through rhythmic distortions and proportional sensations of tempo. Adès employs OFTSs more extensively and with more complexity here than in any of his other works.

Table 5.1 indexes the different uses of OFTSs throughout the piece. These are arranged in chronological order for ease of reading (the assigned sections are dictated by rehearsal marks, bar numbers, and OFTS usage). These uses will be defined, explained, and expanded upon throughout this case study chapter.

Piano Quintet features sections of music where different instruments do not share time signatures or corresponding bar lines. Indeed, this happens to such an extent that the bar lines between the piano's two staves do not correspond at points, which makes it difficult to delineate and assign bar numbers. Therefore, an instrument will be associated with each bar number assignment in Table 5.1. For example, "bars 29-61 (piano)" would indicate the 32 bars of the piano line for that section of the piece, but the number of bars would differ for the strings.

Regarding the "Uses of OFTSs" column in Table 5.1, the label "proportionality" is used for all sections that contain OFTSs, since proportionality is fundamental to any use of the notational device. Therefore, any cells in this column that do not contain any content are assumed to imply proportionality as the usage of OFTSs in that section. Otherwise, the alphanumerical entries in the column refer to the subsections of this chapter, which are all listed at the end of this introductory section to reflect the order in which these topics appear in the chapter. For example, "2a(i)" in the "Uses of OFTSs" column refers to the corollary effect of rhythmic interjection.

[247] Adès, *Piano Quintet*, front notes.

Table 5.1: A summary of *Piano Quintet*.

Macro Structure	Section Number	Rehearsal Mark(s)	Bar Numbers (according to instrument)	Uses of OFTSs
Exposition	A1	0	0-14 (all)	1(i) (Phasing) 2a (Phrase elongation/truncation)
	A2i	1-start of 2	End of 14-28 (piano)	
	A2ii	2	29-61 (piano)	1(ii) (Mathematical consistency) 2a
	A3	3	62-80 (piano)	1(iii) (Ease of reading)
	A4	4-5	81-134 (all)	1(iii) 2a 2b (Artificial tempo change)
	A5	6-7	135-174 (strings/cue line)	2a 2a(i) (Rhythmic interjection) 2b
	A6	8	175-196 (violin 1 and piano)	2a 2b 3 (Rhythmic feeling)
	A7	9	197-220 (piano RH)	
	A8	10	221-231 (all)	2a 3
	A9	11-halfway through 12	232-252 repeat (piano)	
Exposition (repeated)	A10i-A16 (A2i-A8 repeated)	1-10	End of 14-231	*Refer to the above rows*
	A17 (most of A9 repeated)	11-halfway through 12	232-251, 253 (piano)	
Development	B1	Halfway through 12-13	254-269 (piano)	2a 3
	B2	14	270-287 (strings)	2a
	B3	15	288-311 (viola and cello)	1(i) 2a 2b
	B4	16	312-332 (piano)	4 (Tumultuous passage)
	B5	17	333-380 (all)	
	B6	18	381-407 (strings)	3

Macro Structure	Section Number	Rehearsal Mark(s)	Bar Numbers (according to instrument)	Uses of OFTSs
Recapitulation	A'1	19	408-424 (all)	*No OFTSs*
	A'2	20	425-448 (piano)	
	A'3	21-22	449-479 (strings)	*No OFTSs in rehearsal mark 21*
	A'4	23-24	480-519 (piano)	1(ii) 3

Adès discussed his use of sonata form in *Piano Quintet* with Tom Service and felt that the 'material would lend itself to a piece in that design'.[248] In the official programme notes for *Piano Quintet*, Service elaborates and expounds upon the sonata form: the repeated long exposition 'is full of subtle metrical juxtapositions, with the piano and string quartet often playing in different time-signatures simultaneously… [creating] a disorienting sense that the music is continually shifting in and out of temporal focus'. The transformation of motivic material is explored in 'the extremes of the central development section', which will be discussed later in more detail.[249]

Piano Quintet could be interpreted as adhering to a rounded binary form instead, as the recapitulation is much shorter than is typical, and it is characterised as 'a gigantic accelerando which speeds up to four times the original speed … [generating] enormous, seemingly unstoppable momentum'.[250] However, there are precedents for this greatly telescoped recapitulation, such as Dmitri Shostakovich's use of sonata form in the first movements of his 5th, 8th, and 10th symphonies, where the recapitulation acts more as a coda. Furthermore, the rounded binary interpretation would downplay the importance of the development section in *Piano Quintet*. This is not supported by the work, as the most climactic uses of OFTSs are found in the development section.

A major discussion of current theories of sonata form, and how they may or may not apply to *Piano Quintet*, will be avoided in this chapter. The intent is not to analyse in any detail a purported sonata form in the piece, as an overall analysis of this work is not the main objective of this chapter. Rather, references to basic sonata form principles will be made for the purpose of contextualising the analysis of the use of OFTSs.[251]

[248] Adès and Service, *Full of Noises*, 47.
[249] Tom Service, "Piano Quintet," Faber Music, accessed May 4, 2022, https://www.fabermusic.com/music/piano-quintet-3267.
[250] Ibid.
[251] For Adès' detailed discussion of the opening to *Piano Quintet* in relation to structural form, keys, pitch, and harmony, see Adès and Service, *Full of Noises*, 47-49. For other commentary surrounding the use of sonata form in *Piano Quintet*, see Stoecker, "Aligned Cycles," 32-64; Edward Venn, "Adès and Sonata Forms," *Tempo* 75, no. 298 (2021): 20-40; James Donaldson,

Table 5.2: Proportion of OFTS bars in the first part of *Piano Quintet* (866 bars total, including the exposition repeat [sections A10i-A17]).

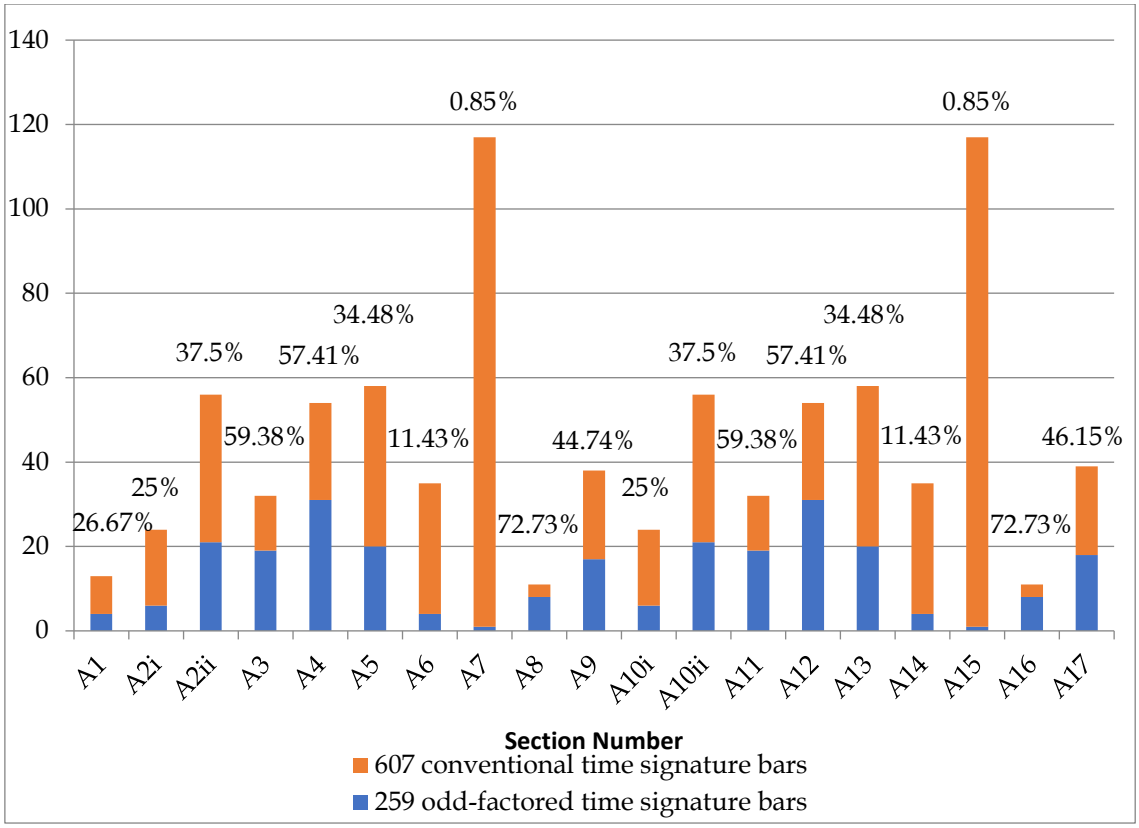
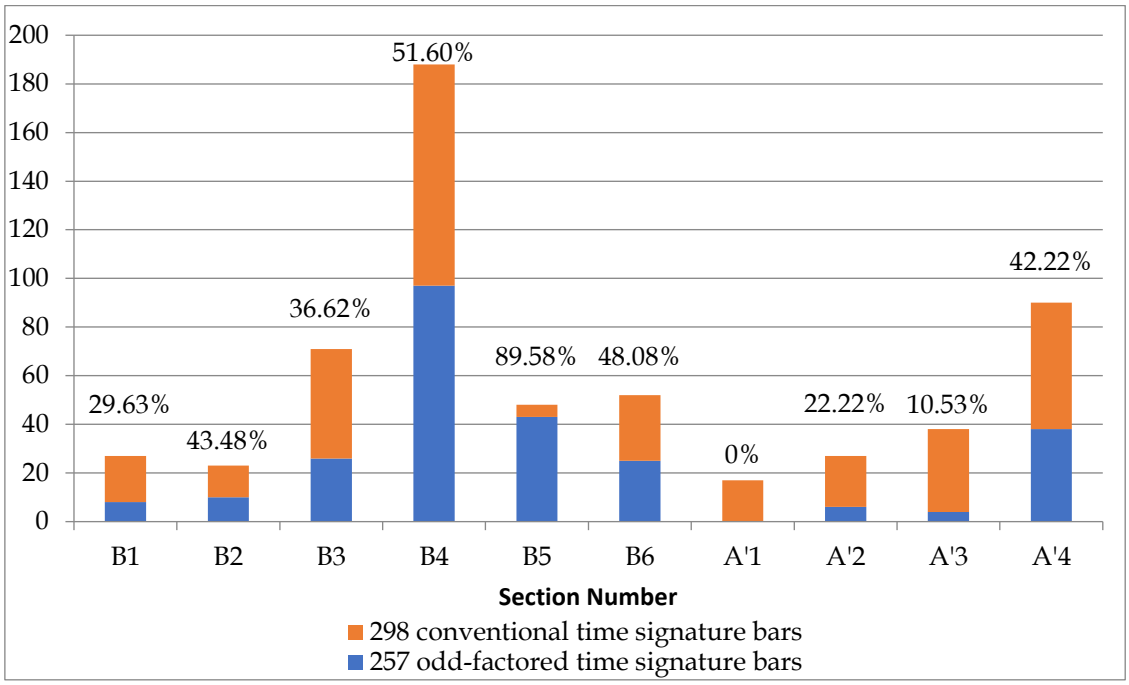


Table 5.3: Proportion of OFTS bars in the second part of *Piano Quintet* (555 bars total).



As such, when the caption of Table 5.2 refers to the "first part" of the piece, this comprises the exposition and its repeat; whereas the "second part" label in the caption

"Kaleidoscopic Topics in the music of György Ligeti and Thomas Adès," *Music Theory Online* 30, no. 2 (2024).

of Table 5.3 involves the development and recapitulation sections. Tables 5.2 and 5.3 show the distributions of OFTS bars across the whole work, indicated in percentages.

The percentages given in Tables 5.2 and 5.3 are meaningful and helpful in conceptualising the proliferation of OFTSs throughout the work. However, these figures only quantify the number of bars, not the durations, further complicated by the fact that the bar durations themselves fluctuate so dramatically due to the ever-changing time signatures throughout the piece. To wit, a **1/7** bar and a **5/4** bar are not commensurate in length. Therefore, the percentages in Tables 5.2 and 5.3 are inaccurate representations of the structural proportions of OFTS bars throughout the work.

To a lesser extent, there are other factors that impact the accuracy of Tables 5.2 and 5.3 as representing anything other than the proliferation of OFTSs in *Piano Quintet*. There are various performance directions that allow a degree of indeterminacy, such as the circa metronome mark at the beginning of the piece and the independent *accelerandi* just before rehearsal mark 10. Also, there are sections of superimposed differing time signatures that lead to non-alignment of bar lines (a consequence explored in greater depth later in this chapter). Therefore, Tables 5.1–5.3 can only refer to the number of notated bars instead of the time duration of each section, as each performance would differ on account of the aforementioned factors.

Due to the conventional repeat of the exposition, it is longer than the development and recapitulation sections by more than 300 bars. Yet, the number of OFTS bars in the first part (259 bars) is virtually equal to the quantity found in the second part of the piece (257 bars), so it is possible to assert that OFTSs are prevalent throughout the work. However, as is evident from Tables 5.2 and 5.3, the OFTS bars only account for 29.91% (259 out of 866 bars) of the exposition and its repeat, whereas they account for 46.31% (257 out of 555 bars) of the development and recapitulation. Thus, OFTSs are more prevalent towards the latter part of the work, supporting the interpretation that *Piano Quintet* is preoccupied with 'rich and intricate processes of transformation'.[252]

With so many OFTSs present, *Piano Quintet* naturally employs various distinct uses of the notational device throughout the work. Analysing each application is helpful in discerning the development of the technique on a large scale. Adès' very specific utilisation of OFTSs to fuel proportional relationships between instruments, rhythmic

[252] Service, "Piano Quintet."

gestures and other elements, is primarily showcased in this piece. Therefore, this chapter will deal with uses of OFTSs in the following order:

1. Proportionality
   (i) Corollary Effect: Phasing
   (ii) By-Product: Mathematical Consistency
   (iii) Ease of Reading

2a. Rhythmic Ornamentation: Phrase Elongation/Truncation
   (i) Corollary Effect: Rhythmic Interjection

2b. Rhythmic Ornamentation: Artificial Tempo Change

3. Rhythmic Feeling

4. Tumultuous Passage

This order correlates to the alphanumerical labels in the "Uses of OFTSs" column in Table 5.1. The difficulties posed by the particular tempo changes, rhythmic techniques, and other musical parameters Adès wants to engage with on a complex level are solved by the notational convention of OFTSs. Effectively, he is attempting to find straightforward notational solutions to communicate intricate proportional musical relationships between instrumental parts, sections, phrases, and other elements, while simultaneously addressing specific tempo and rhythmic challenges.

1. Proportionality

Piano Quintet is potentially the pinnacle of Adès' use of OFTSs purely by virtue of the frequency and density of the technique (to say nothing of the complexity of their utilisation). Of primary importance in this intricate work is the focal use of OFTSs to enact a thorough examination of proportionality, significantly experienced in terms of tempo changes and rhythmic complexity but also through its other musical parameters.

Proportionality in the context of OFTSs can be more precisely defined as the establishment of an implied regular pulse speed against another implied regular pulse at a different speed, establishing a specific proportional relationship, i.e. ratios between tempi. (Ratios of bar durations will also be discussed, especially in chapters 6-8, as that applies more to Ferneyhough's case studies.)

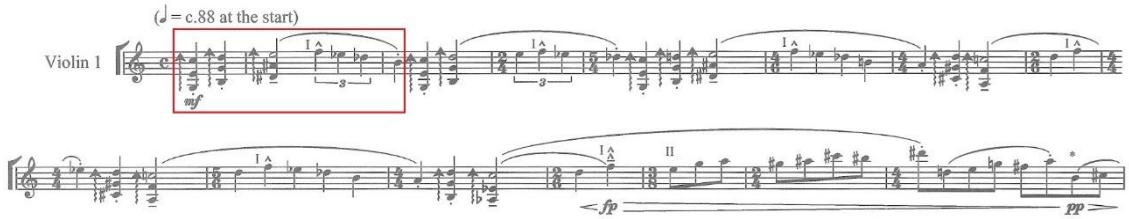
In the strictest sense, proportionality regarding OFTSs interrogates direct geometric relationships between two different sequences of time. Ultimately, what is

being examined in Adès' works is the interaction of rhythmic patterns that are, on the surface, locally regular but related by unusual proportional means.

Adès harnesses multiple concurrent and/or successive OFTSs in such a way that each implied pulse speed is distinct and coherent, but he establishes the relationship between them by superimposition and/or juxtaposition. In this way, OFTSs are used as a method of exploring instrumental independence and interdependence to push the boundaries of chamber ensemble relationships in performance.

Let us observe some of the key elements of the unfolding texture to provide a context for the understanding of OFTSs in this work. In particular, let us focus on the establishment of the main motivic material introduced by the violin 1 line, and how it will be organically elaborated and transformed throughout the rest of the piece. The first phrase, as annotated in the red box in Example 5.1, consists of the first seven attacks: three triple-stop chords (which we will refer to as the "A Figure") followed by four notes (the "B Figure").

Example 5.1: Adès, *Piano Quintet* (page 1), violin 1 line.[253]



The A Figure has an ascending melodic contour, is chordal in texture, and contains longer note values compared to the B Figure (i.e. the A Figure of the first phrase has a ♩ ♩ 𝅗𝅥 rhythm). Its first two chords can be diatonically perceived as tonic and dominant chords (assuming the C major key), but they land on a 016 pitch class set (i.e. the D♯-A♯-E chord).[254] Philip Stoecker analyses these first three chords as an 'aligned cycle':

> The first three trichords of the piece are structured in such a way that three different interval cycles unfold simultaneously: the highest registral voice

[253] Adès, *Piano Quintet*, 1.
[254] Adès uses a similar technique in *Powder Her Face* where he draws pitches from octatonic or whole-tone pitch-class sets, but he 'registrally partition[s them] in order to evoke an extended-tertial jazz harmony' instead of a purely diatonic harmony: see Roeder, "Co-operating Continuities," 135.

> unfolds an ascending interval-2 cycle, a member of the 'even' whole-tone collection; the middle voice ascends by an interval-3 cycle; and the lowest registral voice ascends by a 4-cycle, a subset of the 'odd' whole-tone collection. This note-against-note alignment of different interval cycles is what David Headlam calls an 'aligned cycle'... I label this particular aligned cycle as (2,3,4): the leftmost number represents the highest-registral interval cycle that unfolds; the middle number refers to the inner-voice cycle; and the rightmost number represents the cycle that unfolds in the lowest register.[255]

I recommend Stoecker's article for a more theoretically elaborate analysis, especially with regard to the commentary surrounding harmony and form. However, for the specific purposes of framing and contextualising OFTSs, an alternative intervallic analysis will be discussed at the beginning of section 2a. "Rhythmic Ornamentation: Phrase Elongation/Truncation", as the intervallic treatment of the opening sections parallels and intersects with the development of rhythmic processes. In any case, the melodic notes of the first three chords (C, D, E) all belong to the same whole tone field.

The A Figure is complemented and answered by the B Figure, which features a descending melodic contour, a single melodic line, and rhythmic diminution with shorter note values (i.e. the B Figure of the first phrase has a $^{3}\!\!\downarrow$ $^{3}\!\!\downarrow$ $^{3}\!\!\downarrow$ and straight $\downarrow$ rhythm). Although rhythmic diminution has traditionally been conceptualised in terms of durations that are a half or quarter of the original durations, because OFTSs allow diminution in any proportion, the term "rhythmic diminution" has been used here. The pitches of the B Figure belong to a different whole tone field from the A Figure (F, E♭, D♭, B), but in a diatonic context, the first and last notes could be perceived as a dominant-functioning tritone leading back to another supposed tonic chord in the next phrase.

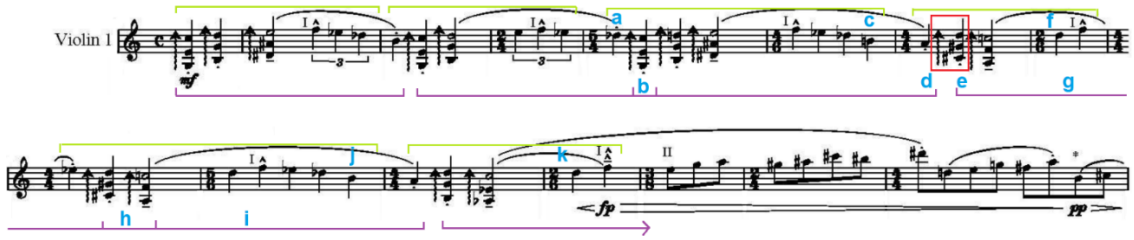
Together, this whole first phrase will be known as the "AB Configuration" which is characterised by high contrast and alternation in the intervallic contour, textural, rhythmic, and tonal/harmonic parameters. This configuration continues to transform throughout the rest of the violin 1 introduction (which is detailed later in the discussion around Example 5.2 and Table 5.4). This preoccupation with alternation is essential to how proportionality is expressed and explored throughout *Piano Quintet*.

[255] Dave Headlam, *The Music of Alban Berg* (New Haven: Yale University Press, 1996), 77-79; as cited in Stoecker, "Aligned Cycles," 32.

1(i) Corollary Effect: Phasing

A particularly important technique used to organically transform the AB Configuration is phasing between two different musical parameters: namely, the rhythmic and intervallic contour parameters. These have been annotated in Example 5.2, with the rhythmic pattern demarcated in green brackets and the intervallic pattern delineated in purple brackets. The rhythm is concerned with—and created by—the alternation of two pulse speeds (in this instance, the alternation between straight ♩ and ^{3}♩ pulses).

Example 5.2: Adès, *Piano Quintet* (page 1), violin 1 line.[256]



In bars 0-3 (assuming the anacrusis is bar 0), the rhythmic pattern consists of six notes (i.e. ♩ ♩ 𝅗𝅥 vs ^{3}♩ ^{3}♩ ^{3}♩). Though the commentary regarding the B Figure with Example 5.1 encapsulated the ^{3}♩ ^{3}♩ ^{3}♩ *and* the following straight staccato ♩, due to the other considerations (such as the whole tone fields and phrasing), when the rhythmic pattern is taken as a whole in bars 0-3, the most consistent rhythmic alternation is between the straight rhythms and triplet rhythms. Thus, the initial rhythmic pattern is conceptualised as containing only six notes.

In bars 4-5, the rhythmic pattern consists of eight notes, an addition of two notes (i.e. ♩ ♩ ♩ 𝅗𝅥 vs ^{3}♩ ^{3}♩ ^{3}♩ ^{3}♩; an additional straight ♩ and ^{3}♩). In bars 6-7, the pattern consists of five notes (omitting a ♩ chord and ^{3}♩ ^{3}♩ notes), and so on. There is an additive-subtractive principle to enact changes of proportion, which is detailed in Table 5.4, further explored with the intervallic pattern.

As previously discussed, in the initial AB Configuration, the intervallic pattern of contrasting whole tone fields consists of seven notes (three ascending and four descending). Thus, in bars 0-4, due to the rhythmic patterns being six notes, there is a 6:7

[256] Adès, *Piano Quintet*, 1.

ratio in the phasing of rhythm and melodic intervals. The concept of proportionality is subtly introduced here.

Table 5.4: Description of the letter annotations from Example 5.1.

Letter	Type	Description
a	Rhythmic	Additional straight ♩
b	Elision	Final note of whole tone descent elides with first note of succeeding whole tone ascent
c	Rhythmic	Additional ^{3}♩
d	Intervallic	Additional note of whole tone descent
e	Intervallic	Additional note preceding whole tone ascent
f	Rhythmic	Omitted ^{3}♩ notes
g	Intervallic	Omitted E note from whole tone ascent
h	Elision	Final two notes of whole tone descent elide with the first two notes of succeeding whole tone ascent
i	Intervallic	Omitted E note from whole tone ascent
j	Rhythmic	Additional ^{3}♩
k	Rhythmic	Omitted ^{3}♩ notes

As with the rhythmic pattern, the intervallic pattern also begins to alter in bars 4-6, with an additional descending note at the end (i.e. the A at the beginning of bar 6). The melodic interval grouping now results in a total of eight notes. Bar 6 then adds an extra descending note before the ascent (refer to the red box annotation in Example 5.2), and the intervallic pattern further devolves from then on.

Although this thesis is not overtly concerned with musical parameters apart from the rhythmic and metric elements, there are clearly independent recurring patterns in other parameters. As such, proportionality and phasing procedures are evident very early in *Piano Quintet*, and these become characteristic of the way rhythmic patterns are transformed later in the piece.

Having discussed the other musical parameters characteristic of the AB Configuration, we can now examine proportionality in the specific context of OFTSs. A proportional relationship in the AB Configuration can be observed within the rhythm dictated by the alternating time signatures: a 2:3 hemiola is exploited between the differing denominators in Example 5.2. This is because most of the conventional time signature denominators are in $x/\mathbf{4}$, implying ♩ pulses, and the OFDs are in $x/\mathbf{6}$, implying ^{3}♩ pulses. Therefore, a 4:6 ratio is established, which can be simplified to 2:3. This intra-

instrumental ratio is found between bars but within the section, and it will recur in later passages.

Notably, Adès initially introduces a standard full triplet figure in a conventional time signature bar (i.e. in common time) before including it in an altered form in the ***4/6*** OFTS bar (using 𝅗𝅥³ 𝅗𝅥³ 𝅗𝅥³ 𝅗𝅥³, which equates to a full triplet + ⅓ of a triplet; i.e. this bar necessitates an incomplete triplet figure). Adès maintains this pattern throughout the piece: he introduces tuplet rhythms in conventional time signature bars first before including them in OFTS bars. In this way, performers can become accustomed to the feel of the tuplet in relation to standard rhythmic figures on a small scale (e.g. within a bar) prior to playing them on a larger scale (e.g. in incomplete tuplet forms and between bars or instrumental parts).

In the next section, rehearsal mark 1, another important proportion is introduced: the 5:8 ratio, as seen in the piano line in Example 5.3. Most conventional denominators are in $x/\mathbf{8}$ while the OFDs are in $x/\mathbf{5}$. As previously seen, the proportionality is explored intra-instrumentally, between bars, and within the same section. Just like 2:3, the 5:8 ratio itself is between an odd prime number and a number that is a power of two.

Subtly, a deeper relationship is established between the piano and the violin 1 lines at rehearsal mark 1: violin 1 plays a consistent ♪ pulse in 4/4 while the piano takes on the melody reminiscent of the previous section. However, to add further metric complication, Adès makes a note at the bottom of page 1 with an asterisk: 'vln 1: from [the start of rehearsal mark 1] until fig. 2 [i.e. rehearsal mark 2] treat each new phrase as if it begins on a downbeat'.[257] This effectively nullifies the conventional purpose of time signatures to delineate a hierarchy of pulses and beats within a given bar, instead creating a metric ambiguity to the passage.[258] Therefore, the main accents of this section are ultimately those which are emphasised in individual parts.

[257] Ibid.
[258] Justin London, "Metre," in *Grove Music Online*, *Oxford Music Online*, http://www.oxfordmusiconline.com, accessed July 18, 2024.

Example 5.3: Adès, *Piano Quintet* (rehearsal mark 1), violin and piano lines.[259]

Note the numbers explored thus far in the aforementioned ratios: 2, 3, 5, and 8. These are all part of the Fibonacci sequence, and this bears a strong relationship with the golden ratio, which is one of the most prevalent proportions in the natural world. The ratios 2:3 and 5:8 are two of the most recurring ratios in *Piano Quintet*. The other ratio to bridge the gap in the Fibonacci sequence, 3:5, is introduced at rehearsal mark 2 in the viola's melodic line.

[259] Adès, *Piano Quintet*, 2.

Example 5.4: Adès, *Piano Quintet* (rehearsal mark 2), viola and piano lines.[260]

Rehearsal mark 2 starts to complicate the proportionality by pitting OFTSs against conventional time signatures while also pitting odd prime-numbered tuplets against each other. In Example 5.4, triplet rhythms are consistently pitted against quintuplet rhythms, featuring a notational 3:5 ratio (refer to the alternating blue and green box annotations). Note that $\overset{3}{\text{♩}}$ and $\overset{6}{\text{♩}}$ are notationally synonymous, as they connote the same tuplet duration: a sixth (1/6) of a $\mathbb{o}$. Although, technically, this is in fact a 6:5 ratio between the differing pulse speeds, the notation of triplets instead of sextuplets visually highlights a type of 3:5 ratio. An actual 3:5 ratio is discussed later with Example 5.9.

These ratios based on the Fibonacci sequence resemble one another quite closely but are not the same: the 2:3 ratio is 0.67 in decimal representation; 3:5 is 0.6; and 5:8 is 0.625. By having the first three pages of the score contain these specific ratios, Adès illuminates the intricate nature of the proportional relationships being explored in *Piano Quintet*.

Rehearsal mark 2 is also the first instance in the piece where consecutive bars of OFTSs do not share the same denominator, such as the purple box annotation in Example 5.4, where the denominators are in a 6-, 5-, 6-denominator sequence. This occurrence is a tacet in the piano line where no sensations of pulse or tempo are actually

[260] Adès, *Piano Quintet*, 3.

articulated, but it is a precursor for future instances of consecutive bars of OFTSs that do not share the same OFD.

This is also the first time in which the proportionality is felt not just within a single instrumental line (i.e. *intra*-instrumentally) but between instruments as well (i.e. *inter*-instrumentally). In Example 5.4, the 6:7 ratio is explored between the piano line and the strings (except for violin 1). Refer to the red box annotations where, in the first two instances, the triplet rhythms are in the strings' OFTS ***4/6*** bars whereas the septuplet rhythms are in the piano's conventional ***2/4*** time signature bars. However, in the last red box, located in the second system, the septuplet rhythms are finally placed in the piano's OFTS ***2/7*** bar.

The septuplet rhythms transitioning from conventional time signature bars to OFTS bars illustrate that, once again, Adès introduces tuplet rhythms in a conventional setting first before including them in more complex contexts (such as in OFTS bars). It is particularly germane for him to do this here since this is the first time septuplet rhythms are experienced in the piece.

1(ii) Mathematical Consistency

Example 5.4 also showcases a necessity of OFTSs: achieving mathematical consistency. Consider the same example but reannotated (see Example 5.5). Initially, the idea is quite simple. In the section with the red boxes, the strings (represented by the viola line) are playing one bar of ***4/6*** and one bar of ***2/4***. The piano plays one bar of ***2/6*** and one bar of ***2/4***, then compensates the remaining time with another bar of ***2/6***. However, the next section (with blue and pink boxes) is more complex: the piano still has two ***2/6*** bars to equate to the strings' ***4/6*** bar, but now the strings also have a ***7/10*** bar, which is accounted for in the piano by a combination of a ***2/4*** bar (equal to ***5/10***) and a ***2/10*** bar.

Although the second system, indicated by the green and purple boxes, looks more complex due to the mixed denominators, it contains a passage that applies the same principle: the combination of the ***2/7*** and ***3/14*** bars equate to ***7/14*** in total duration, which is the equivalent of a ***2/4*** bar. Therefore, the use of OFTSs to adhere to mathematical consistency is a necessary requirement when OFTSs are utilised in simultaneity with conventional time signatures.

Example 5.5: Adès, *Piano Quintet* (rehearsal mark 2), viola and piano lines.[261]

So far, intra-instrumental and inter-instrumental proportionality have been addressed. However, on closer inspection, there is a proportionality on an even larger scale, which is also evident within the first three pages of the piece. As previously discussed, violin 1 introduces the main AB Configuration and its primary permutations on page 1: the musical figures alternate between ♩ (A) and ^{3}♩ (B) pulses.

The piano then plays an altered form of the AB Configuration at rehearsal mark 1, where the figures alternate between ^{5}♩ (A) and ♪ (B) pulses. Finally, the viola helms the melody at rehearsal mark 2, which alternates between ^{3}♩ (A) and ^{5}♪ (B) pulses. Despite the transformations between each iteration, the repetition of the AB Configuration is discernible in all three passages.

Example 5.6 contrasts the different iterations of the AB Configuration with the alternating figures labelled and colour coded. Table 5.5 compares the durations and time signatures used at each equivalent location within the AB Configuration. Note with Table 5.5 how the duration column is signified by the pulse values; although the A Figures contain straight/tuplet ♩ and 𝅗𝅥 notes in the surface rhythms, only the pulse (that of the straight/tuplet ♩) is noted.

[261] Ibid.

Example 5.6: Adès, *Piano Quintet* (rehearsal marks 0-2), violin 1, piano, and viola lines.[262]

Table 5.5: Duration and time signatures of the bars containing the AB Configuration and its iterations from the first three pages of *Piano Quintet*.

Figure	Violin 1		Piano		Viola	
	Duration	Metre	Duration	Metre	Duration	Metre
A1	4	C	3	3/5	4	4/6
B1	3	C	5	5/8	7	2/4, 1/5
A2	4	C	4	4/5	4	4/6
B2	3	2/4	4	2/4	12	7/10, 2/4
A3	5	5/4	5	4/4	5	2/4, 2/6
B3	4	4/6	5	5/8	15	2/4 (× 3)
A4	4	4/4	4	4/5	4	2/4, 1/6
B4	2	2/6	8	3/4	9	2/5, 2/4

Comparing all the iterations of the A Figure, the straight pulse in violin 1 transforms into a quintuplet pulse in piano, which finally mutates into a triplet pulse in viola. In contrast, comparing all the iterations of the B Figure shows that the triplet rhythms in violin 1 become straight rhythms in piano before finally changing into quintuplet rhythms in the viola. The inclusion of OFTSs in this opening section aids the notation of these varied tuplet rhythms and are natural outworkings of the durational proportions, which are essential to the rhythmic character of the main AB Configuration.

This comparison also highlights a different rhythmic ornamentation technique of phrase elongation (especially seen with the viola AB Configuration elongating the B Figures), which will be explored in more depth later. As the AB Configurations are consecutively played, the transformations and differences are brought to the fore.

[262] Adès, *Piano Quintet*, 1-3.

The A Figure exploits the 4:5:3 proportion (i.e. straight ♩ vs ⁵♩ vs ³♩). The B Figure exploits the 6:4:5 proportion. Although the notated pulses of the B Figure initially played by violin 1 are ³♩ notes, for consistency of comparison with the ♪ notes of the other B Figures, ⁶♪ is used for the proportion. Therefore, the 6:4:5 ratio is derived from ⁶♪ vs straight ♪ vs ⁵♪. These figures translate to a discernible sense of proportionality between each iteration of the AB Configuration. This is a subtle example of proportionality displayed between macro-level sections.

There are two other instances where the main AB Configuration explicitly returns in some form. In the second half of rehearsal mark 12, as shown in Example 5.7, the piano plays a transformed and inverted form of the AB Configuration against a continual string rhythm, similar in premise to rehearsal mark 1. The AB Configuration continues to express the alternating pulse speeds and musical figures, articulated through the alternation between conventional and OFTS bars. The strings have the added complexity of running syncopated rhythms, which differ from the consistent ♪ pulse of violin 1 at rehearsal mark 1.

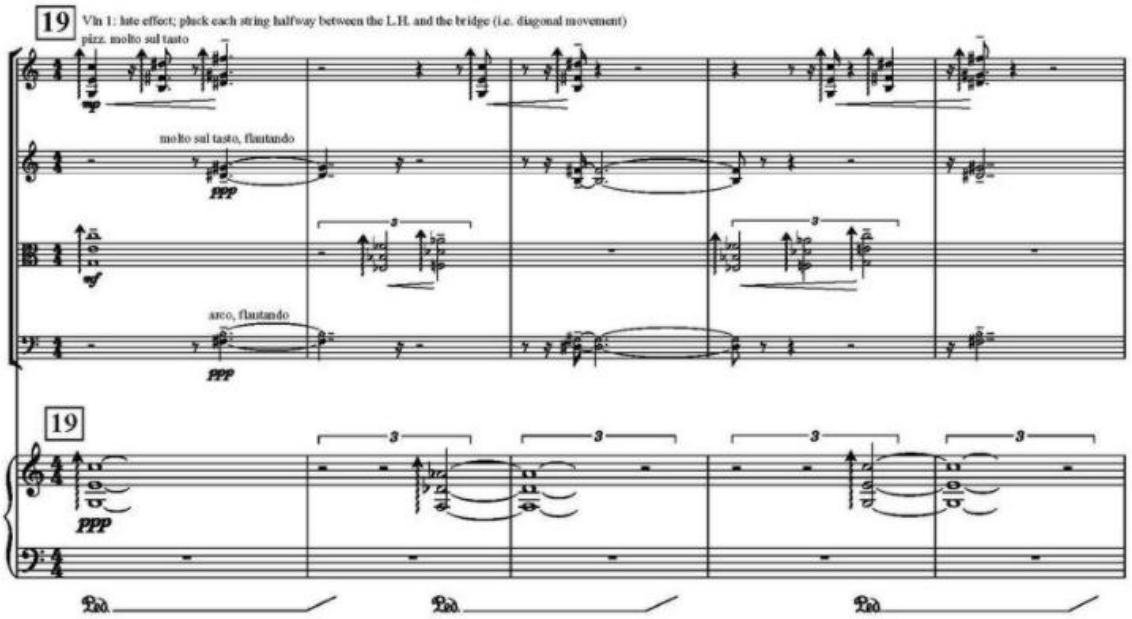
Example 5.7: Adès, *Piano Quintet* (rehearsal mark 12).[263]

The other occurrence is found at the beginning of the recapitulation, rehearsal mark 19, where the AB Configuration is fragmented so the B Figures are omitted and

[263] Adès, *Piano Quintet*, 17.

only the A Figures are played (see Example 5.8). Incidentally, rehearsal mark 19 is the first section of the piece to *not* contain OFTSs. Therefore, it is fitting that this section should only contain the arpeggiated triple stop fragments (i.e. the A Figure) of the AB Configuration as those figures are only found in conventional time signature bars when violin 1 introduces them at the beginning of the piece.

Example 5.8: Adès, *Piano Quintet* (rehearsal mark 19).[264]



The A Figure is initially played by violin 1 in Example 5.8, with attacks sounding at durational intervals equating to the total group length of 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯. Even the stretches of rests adhere to the five 𝅘𝅥𝅯 grouping (e.g. there is a gap equivalent to 20 𝅘𝅥𝅯 between the attack of the last arpeggiated chord in the first bar of the passage and the attack of the next arpeggiated chord in the second bar).

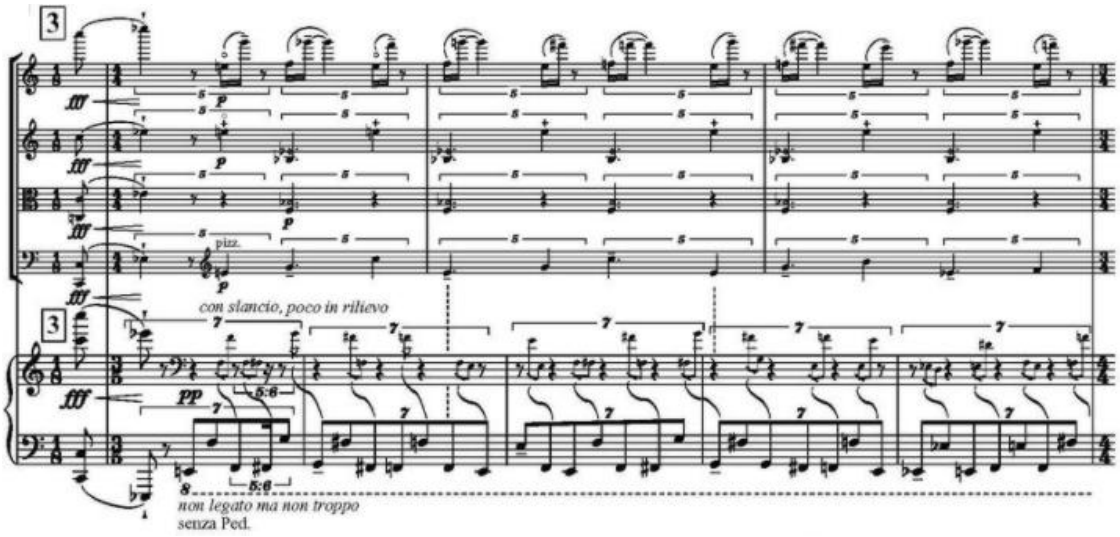
The fragmented AB Configuration of violin 1 plays in phase against the viola's A Figure which is expressed in $\overset{3}{\text{𝅗𝅥}}$ rhythms instead. Thus, a 15:16 polyrhythmic relationship is established between the violin 1 and viola rhythms. Although this proportionality is more complex and less reducible compared to the previous instances, the alternation of two different proportional pulse speeds is still present, merely expressed in conventional time signatures instead.

[264] Adès, *Piano Quintet*, 30.

1(iii) Ease of Reading

Looking back to an earlier point in the piece, rehearsal mark 3 exhibits proportionality through two parameters: on the bar level, and in the rhythmic interplay between instruments (see Example 5.9). With regard to the former, the strings' ***4/4*** time signature, which equates to a 𝅝 in duration, is played against the ***3/5*** in the piano. This means each bar of the piano's line is three-fifths or 60% the length of the strings' ***4/4*** bar. The time signatures are dictating bar durations at a 3:5 ratio between the piano and the strings.

Example 5.9: Adès, *Piano Quintet* (rehearsal mark 3).[265]



Although this passage appears complicated, the quintuplets of the strings align with the piano's metre; the strings are actually playing according to a 𝅘𝅥𝅯⁵ pulse. The piano is playing seven notes against every six notes by the strings, as evidenced by the fact that all instrumental lines align at the end of the system.

The elapsed duration between the start of the strings' ***4/4*** bars (or the piano's ***3/5*** bars) and the end of the system is 30 𝅘𝅥𝅯⁵ in the strings (or 35 𝅘𝅥𝅯⁷ in the piano). Therefore, the inter-instrumental polyrhythm is actualised in a 6:7 ratio relationship. This double layer of proportionality succinctly highlights the rhythmic and metric complexity that is characteristic of *Piano Quintet*.

Incidentally, rehearsal mark 3 can be renotated by converting all the time signatures into ***3/4*** (excluding the initial ***1/8*** bar) and coordinating all the bar lines. The

[265] Adès, *Piano Quintet*, 4.

piano will still maintain the septuplet notation, but the strings' quintuplet rhythms will be converted into straight rhythms:[266]

Example 5.10: Adès, *Piano Quintet* (rehearsal mark 3), renotated into conventional time signatures.

The problem with this renotation is that it loses the 3:5 ratio found in the first layer of proportionality (i.e. the ratio between the bar durations). So, although the original notation *appears* complex, it is ultimately the clearest way to express both layers of proportionality and aid with interpretation for performance.[267]

Huw Belling noted, in his commentary of this passage in rehearsal mark 3, that

> … Adès has determined, in this instance, that its [notational] difficulty does not supersede the value of the rhythm he has specifically conceived. This could be related to the fact that he played that very part *himself [sic]* at the premiere, and therefore had already internalised the rhythms. [As] a composer… [he] is surely aware of the control relinquished when a score is

[266] Example 5.10 proves that the first dotted coordination line between cello and piano in Example 5.9 is not accurate as the cello should technically attack slightly before the piano note. The only accurate, dotted coordination line in Example 5.9 is the second one (as seen at the beginning of the second-last bar in Example 5.10, where the ♩ G in the cello plays simultaneously with the tenuto G in the piano bass line).

[267] Adès bemoans this general discrepancy in his interview with Service: 'despite working to make [my music] simpler, it is difficult to play, more than I want it to be, but it just comes out that way. I try always to make it more reliable in the way I write it down…'. See Adès and Service, *Full of Noises*, 67.

> released. Here is a composer who is meticulous with rhythm, and in a piece of rhythmic extremes, the detail, he says, is worth it.[268]

Not only is it worth it, but it may be argued that it is necessary in order to convey all the layers of rhythmic nuances and intricacies Adès wants to communicate. In his interview with Service, Adès attributes notation to intention:

> Say a composer has written 'ritardando'. You don't just slow down because it is *[sic]* tells you to. The idea of the ritardando, the slowing down, was there in the music before he wrote the instruction. The reason for it being there is not just that he wrote it down. The music came first. So you must look for the reason why that ritardando has to happen, and then it will happen.[269]

Therefore, as we continue to canvas his uses of OFTSs, it is worth remembering that the intention for both effective and efficient communication of his musical ideas remains in the forefront of his notational practices.[270] The use of ease of reading will return with the discussion surrounding Examples 5.29 and 5.30.

Due to the sonata form, the passage in Example 5.9 is repeated with hardly any changes at rehearsal mark 20 (in the recapitulation). The use of OFTSs in Example 5.9 also produces an altered type of phasing. Although the strings and the piano are not playing the same musical material, the phasing technique can be felt as the strings come in and out of alignment according to the 6:7 ratio with the piano. This is seen explicitly where the piano initially plays in synchrony with the strings at the beginning of the system, falls out of alignment, then comes back into alignment at the very end of the system.

The clearest form of inter-instrumental proportionality is found in passages like rehearsal mark 4, where the strings and piano are playing the same rhythmic pattern but according to two different time signatures (and, therefore, at two different tempi/pulse speeds). This can be seen in Example 5.11 where the violin 1 line represents the strings and plays in opposition against the piano. In this instance, the rhythm is short-long-short-long, but the strings play the rhythm as $^{3}\!\blacksquare$ and $^{3}\!\square$ due to the ***6***-denominator, whereas the piano plays it as $^{5}\!\blacksquare$ and $^{5}\!\square$ due to the ***5***-denominator.

[268] Belling, "Thinking Irrational," 37.
[269] Adès and Service, *Full of Noises*, 107.
[270] Adès and Service, *Full of Noises*, 67.

Example 5.11: Adès, *Piano Quintet* (rehearsal mark 4), violin 1 and piano lines.[271]

As a result of the 6:5 proportional relationship, the two instrumental groups are playing the same rhythmic pattern while simultaneously experiencing the alternating pulse speeds. Compare this to the more straightforward iteration in the recapitulation, rehearsal mark 20, where a consistent ***4/4*** time signature, and thus a single consistent pulse speed, is maintained throughout:

Example 5.12: Adès, *Piano Quintet* (rehearsal mark 20), violin 1 and piano lines.[272]

The provided examples demonstrate that Adès employs OFTSs to explore the proportional relationships between bars, phrases, instrumental parts, whole sections, and even different musical parameters to enact corollary effects (particularly phasing procedures). Individually, performers must grapple with the proportional relationships within their own instrumental part. In ensemble rehearsal and performance, players are in turn compelled to contend with how their individual proportionalities relate to and affect one another to contribute to a larger-scale proportionality.

[271] Adès, *Piano Quintet*, 5.
[272] Adès, *Piano Quintet*, 32.

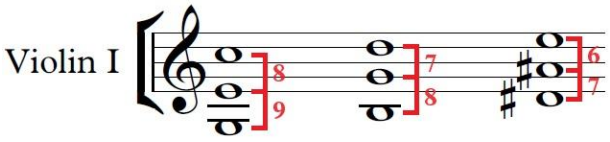
2a. Rhythmic Ornamentation: Phrase Elongation/Truncation

Adès uses OFTS bars to elongate or truncate phrase lengths throughout *Piano Quintet*. There are two different ways these changes of phrase lengths are expressed:

1. Arithmetic phrase elongation/truncation: adding/subtracting notes to a phrase; and
2. Geometric phrase elongation/truncation: stretching/diminishing the note durations within a phrase.

As seen with the corollary effect of phasing between the rhythmic and intervallic parameters at the beginning of the piece, musical parameters other than rhythm reflect and intersect with the development of rhythmic processes. To preface and demonstrate by way of analogy the rhythmic procedures of elongation and truncation, let us revisit the beginning of the piece and observe elongation and truncation processes in other musical parameters.

Example 5.13: The first three chords of Adès, *Piano Quintet* (bars 0-1), violin 1 line.[273]



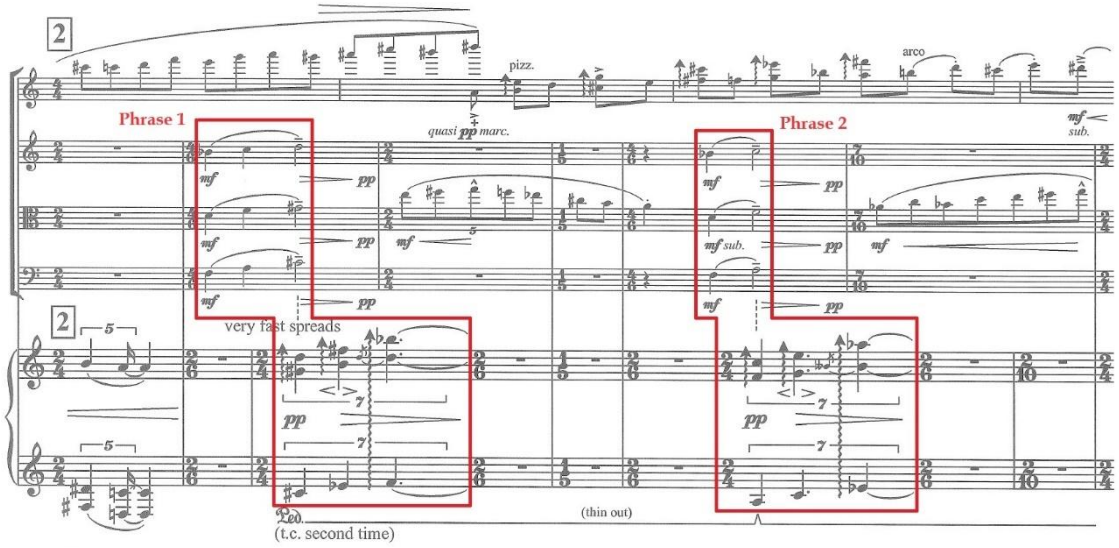
Example 5.13 features the violin 1 line's three triple-stop chords that open the work, devoid of the original notated rhythm/note durations and with annotations detailing the number of semitones between each harmonic interval. There is clearly a progression of truncating intervals from one chord to the next, and this truncation can be interpreted as *both* arithmetic and geometric in nature: arithmetic due to the subtraction of the number of semitones from one chord to the next, and geometric in the sense that the preoccupation is not with the pitch class space but rather with the *pitch space* (i.e. the way the chords are registrally voiced).

In the original discussion of the A Figure with relation to Example 5.1, it was asserted that the first two chords could be diatonically perceived but that the final chord was a 016 pitch class set.[274] However, it is more likely that Adès conceived of the

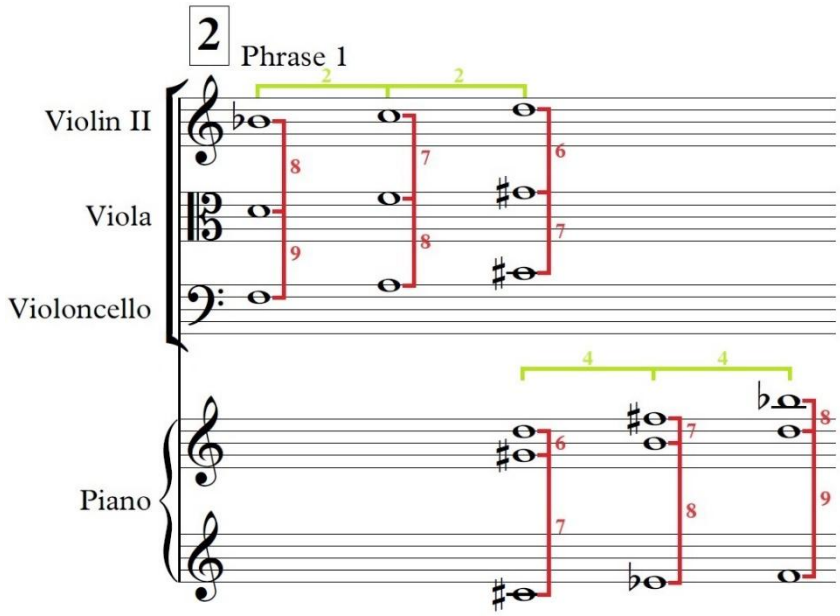
[273] Adès, *Piano Quintet*, 1.
[274] See also Roeder, "Co-operating Continuities," 135.

intervallic logic first and then decided to impersonate a tonal progression after the fact.[275] This order of conception seems to be reinforced when rehearsal mark 2 is considered.

Example 5.14: Adès, *Piano Quintet* (page 3), first system.[276]



Example 5.15: Phrase 1 of Example 5.14.



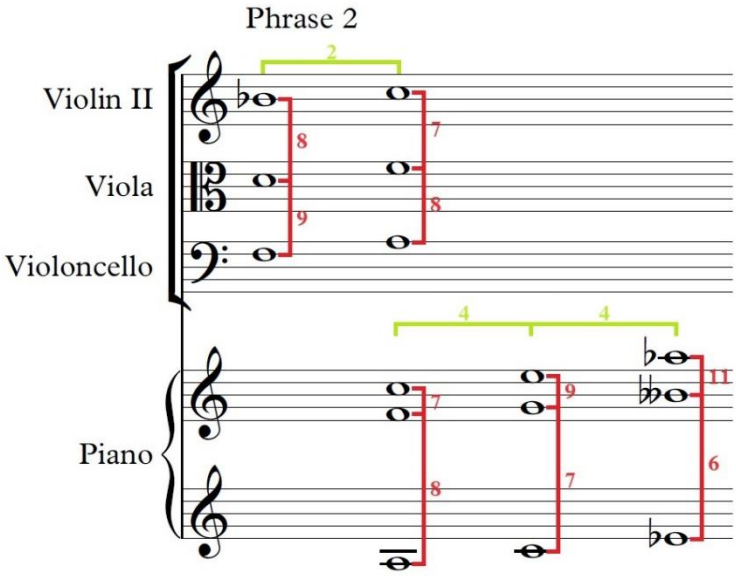
The intervals being explored are no longer just harmonic (i.e. vertical) in nature and within a singular instrumental line; they have now progressed into the melodic (i.e. horizontal) dimension and include interaction between multiple instrumental lines. Where the strings and piano play together provides an elision point, made obvious by the fact that all instrumental lines are playing the same chord with the same voicing (and

[275] See also Stoecker, "Aligned Cycles," 32.
[276] Adès, *Piano Quintet*, 3.

therefore the same harmonic intervals). The melodic line is crucial to understanding these sequences of intervals in rehearsal mark 2.

The additional information of the piano chords in Example 5.15 suggests that Adès calculated the harmonic intervals based on the melodic intervals first. The strings' melody ascends in two-semitone intervals, and then the piano's melody ascends in four-semitone intervals. Once these melodic intervals were set, the remainder of the notes in the chords were selected based on the harmonic intervallic progressions of truncation with the strings and elongation/addition with the piano chords.

Example 5.16: Phrase 2 of Example 5.14.



The process of truncation and elongation in the harmonic intervals is compounded in the piano line of Example 5.16, where the upper intervals are elongating by two semitones while the lower intervals are truncating by one semitone (acting as a continuation of the strings' lower harmonic intervals). There is then a gradual isolation of the melodic line as the top note of each piano chord in Example 5.16 becomes more intervallically separated from the rest of the chord.

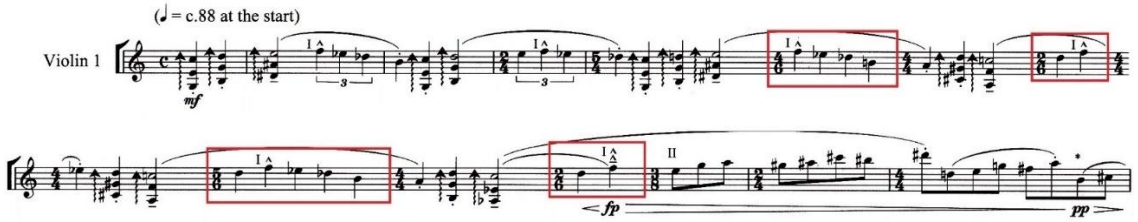
The two chords played by the strings in Example 5.16 are shared chords with Example 5.15, but the strings' third chord (C♯-G♯-D) in Example 5.15 is omitted from Example 5.16. Therefore, the elision chord between the strings and piano shifts to the strings' second chord. This shift of the elision chord completely transforms which chords are played by the piano in Example 5.16. In other words, the arithmetic *rhythmic* phrase truncation of Example 5.16 exhibited by the omission of the strings' third chord has

ramifications for the subsequent pitch and harmonic parameters (i.e. the geometric intervallic elongations and truncations of the piano line).

This brief intervallic analysis is relevant by analogy to the additive/subtractive processes of transformation applying in the rhythmic domain. Indeed, John Roeder makes a similar comparison with Adès' ''expanding interval' idea' and demonstrates how this procedure is 'ubiquitous throughout Adès's music' due to the fact that the composer often coalesces 'durational and pitch continuities'.[277] Ultimately, Adès uses interval cycles to generate particular geometries, and this is analogous to his preoccupation with number sequences, prime numbers, and interval and ratio chains which will now be explored.

To examine only the rhythmic aspects of the opening of *Piano Quintet*, subtly executed arithmetic phrase elongations/truncations are found where the added OFTS bars act as extensions. The elongations are disguised by being placed in the middle of the phrase. These arithmetic phrase elongations/truncations (highlighted in the red boxes in Example 5.17) arise out of straightforward $^{3}\!\!\downarrow$ $^{3}\!\!\downarrow$ $^{3}\!\!\downarrow$ figures initially located in bars 1 and 3, further concealing these subtle extensions. The ***4/6*** and ***5/6*** bars simply add one or two $^{3}\!\!\downarrow$ (i.e. arithmetic phrase elongation) whereas the ***2/6*** bars subtract $^{3}\!\!\downarrow$ (i.e. arithmetic phrase truncation) to achieve this effect.

Example 5.17: Adès, *Piano Quintet* (bars 1-15), violin 1 line.[278]



The latter half of rehearsal mark 12 is a melodically inverted fragment of the opening sequence in Example 5.17. The transformative nature of the passage in Example 5.18 befits the beginning of the development section. It also employs a simple arithmetic phrase truncation by subtracting a $^{3}\!\!\downarrow$ in the ***4/6*** bar (compared to the ***5/6*** bar):

[277] Roeder, "Co-operating Continuities," 126, 150. See also Roeder, "Co-operating Continuities," 134, where he demonstrates how Adès combines enlarging harmonic intervals with tempo deceleration in his opera, *Powder Her Face*.
[278] Adès, *Piano Quintet*, 1.

Example 5.18: Adès, *Piano Quintet* (page 17).[279]

Example 5.19: Adès, *Piano Quintet* (rehearsal mark 14), piano line.[280]

The simplest form of arithmetic phrase elongation can be found at rehearsal mark 14 where Adès uses the time signature notation to make the technique obvious (see

[279] Adès, *Piano Quintet*, 17.
[280] Adès, *Piano Quintet*, 18–19.

Example 5.19). Focusing on the piano part, the time signature is initially ***3 × 5/12*** (i.e. three lots of ***5/12*** rhythms), then it elongates to ***4 × 5/12***, and finally it extends to ***5 × 5/12***. With each iteration, the bar length is stretched by another lot of ***5/12*** rhythm (which, in this instance, is a coupling of a ♩ chord and a ^{3}♩ chord).

The use of arithmetic phrase elongation/truncation can also be seen over multiple iterations throughout the piece, and it is sometimes coupled with the use of geometric phrase elongation/truncation. At rehearsal mark 5, there is a call and response figure between the strings and the piano (see Example 5.20). The strings call with a phrase consisting of a ♪ (in ***1/8***) and a staccato ^{3}♩ (in ***2/6***), and the piano responds with an accented ^{3}♩ block chord (still in ***2/6***).

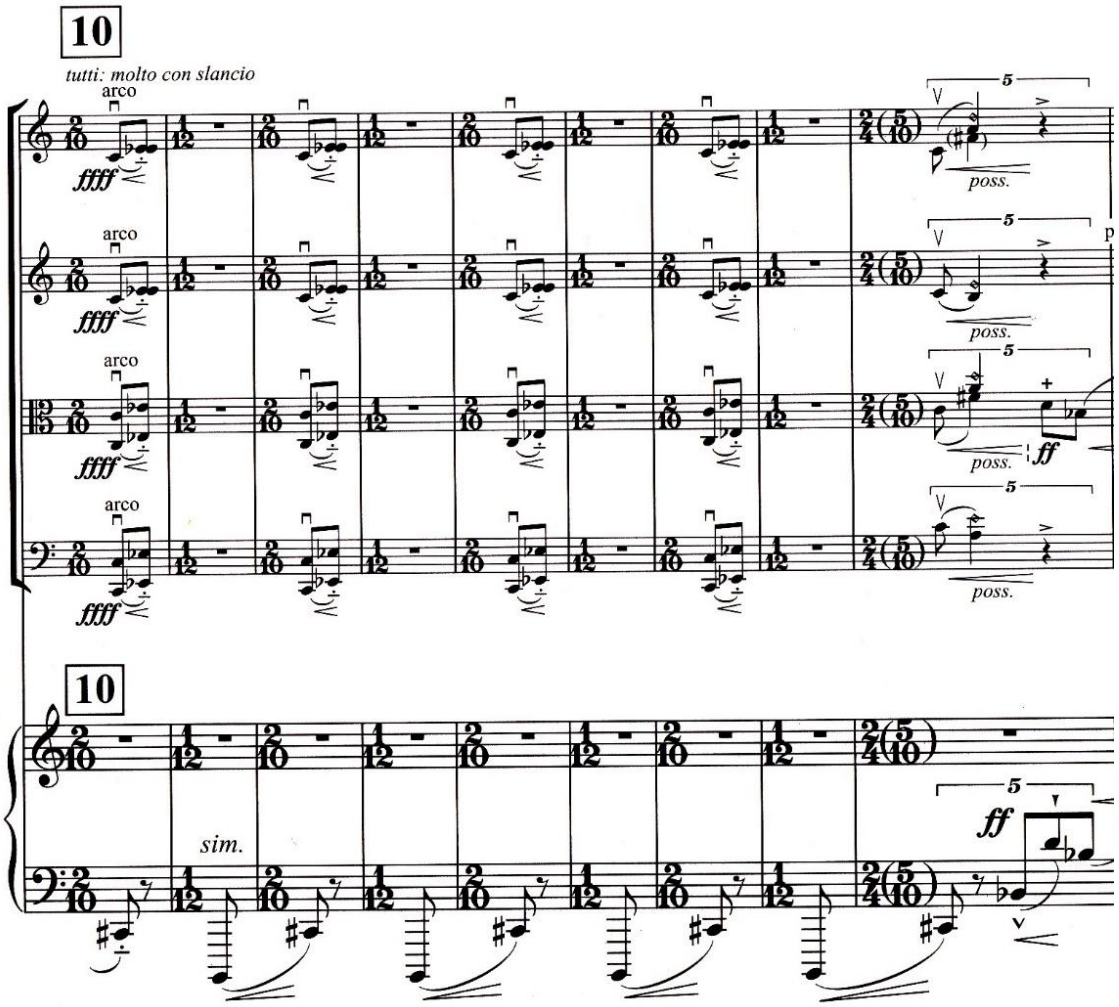
Example 5.20: Adès, *Piano Quintet* (rehearsal mark 5).[281]

Since ^{3}♩ are longer than ♪ but shorter than straight ♩, there is a lopsided feel in the strings' two-note call: the ♪ vs ^{3}♩ rhythm can be expressed in a 3:4 ratio (0.75 in decimal representation), derived from ***1/8*** vs ***1/6***. There is also a general lopsided feel to the overall call and response figure: the combined duration of the strings' ♪ and ^{3}♩ notes compared to the piano's sole ^{3}♩ chord would be expressed as a 7:4 ratio (1.75 in decimal representation), derived from ***1/8+1/6*** (= 7/24) vs ***1/6*** (= 4/24).

[281] Adès, *Piano Quintet*, 7.

The call and response figure returns at rehearsal mark 10 (see Example 5.21). This time, however, the piano has gained another note due to arithmetic phrase elongation, so there are now two-note phrases calling and responding between the strings and piano. In this instance, the piano adopts the call role, and the strings respond. It is also important to note that at rehearsal mark 10, to achieve the lopsided feeling, the alternating time signatures do not oscillate between a conventional time signature and an OFTS; rather, the interchange is between two OFTSs, though the 1:2 ratio is maintained in the numerators (i.e. ***1/12*** and ***2/10***).

Example 5.21: Adès, *Piano Quintet* (rehearsal mark 10).[282]



The geometric phrase truncation can be seen in the denominators of the time signatures: the ♪ represented by the ***8***-denominator at rehearsal mark 5 is shortened to a ^{3}♪ here, as represented by the ***12***-denominator, and the ^{3}♩ ***6***-denominator at rehearsal mark 5 is shortened to a ^{5}♪ length here, as represented by the ***10***-denominator. However, there is a complication associated with this passage: the second note of each strings' two-

[282] Adès, *Piano Quintet*, 14.

note figure is affected by a mezzo staccato, so the OFTSs do not impact the sounded duration of the notes. Rather, the time signatures alter the *elapsed duration* between the attacks of the notes played by the strings.

Furthermore, every second note of the piano's two-note figures overlaps with each first note of the strings' two-note figures. So, the distinctive call of rehearsal mark 10 adopted by the piano is only one note—the octavely displaced B—and the response contains two notes played by the strings. The proportion that is of interest is calculated based on the duration between the piano's first note call compared to the total duration of the strings' response (which is really the elapsed duration between the attack of the strings' first note and the next attack of the piano). Thus, the relevant proportion is 5:12 (0.417 in decimal representation), derived from ***1/12*** (= 5/60) vs ***2/10*** (= 12/60). This proportion is more complex than the ones introduced at rehearsal mark 5, as the ratio involves larger integers.

This section is developed one last time at rehearsal mark 15, with the addition of one more note in both strings and piano (i.e. arithmetic phrase elongation). As seen in Example 5.22, both the piano's calls and the strings' responses alternate between two-note phrases and a single held chord, essentially making up their own contained call and response figures (where the strings have their own call and response figure, and the piano line also has its own call and response).

Example 5.22: Adès, *Piano Quintet* (rehearsal mark 15).[283]

[283] Adès, *Piano Quintet*, 20.

Table 5.6: Call and response proportion between the strings' lines (red box annotation in Example 5.22).

Durations	Call			Response		Proportion [Decimal]
	First Note	Second Note	Rest	Note	Rest	
Separated	1/7	1/7	1/7	2/9	1/9	9 : 9 : 9 : 14 : 7
Assimilating rests	1/7	2/7		1/3		3 : 6 : 7
Overall	3/7			1/3		9 : 7 [1.286]

Table 5.7: Call and response proportion within piano line (yellow box annotation in Example 5.22).

Durations	Call			Response	Proportion [Decimal]
	First Note	Second Note	Rest	Tied Note	
Separated	1/7	1/4	3/16	1/16+2/7	16 : 28 : 21 : 7+32
Assimilating rests	1/7	7/16		39/112	16 : 49 : 39
Overall	65/112			39/112	5 : 3 [1.667]

Table 5.8: Call and response proportion between the viola and cello lines (blue box annotation in Example 5.22).

Durations	Call			Response	Proportion [Decimal]
	First Note	Second Note	Rest	Note	
Separated	1/7	1/7	1/8	1/4	8 : 8 : 7 : 14
Assimilating rests	1/7	15/56		1/4	8 : 15 : 14
Overall	23/56			1/4	23 : 14 [1.643]

As seen in the tables above, these are the least reducible and most complex proportions thus far. This consistent accumulation of notes contributes to arithmetic phrase elongation over multiple iterations throughout the piece and lends to further rhythmic complication by means of more complex proportions.

With regard to geometric phrase elongation, the piano's two-note call concentrates on a $\overset{7}{\text{♩}}$ (elongated from the $\overset{3}{\text{♪}}$ at rehearsal mark 10) and straight ♩ (elongated from the $\overset{5}{\text{♪}}$). The piano's response is a tied duration from straight ♪ to $\overset{7}{\text{𝅗𝅥}}$ (elongated from the strings' combined $\overset{5}{\text{♩}}$ duration at rehearsal mark 10). This can all be seen in the yellow annotated box in Example 5.22.

The strings' elongation, annotated in the red box, is easier to compare with rehearsal mark 10, though it is more complex in nature. The strings' calls are $\overset{7}{\text{♩}}$ $\overset{7}{\text{♩}}$ (which are longer than the previous combined duration of $\overset{3}{\text{♪}}$ and $\overset{5}{\text{♪}}$), and the responses are $\overset{9}{\text{𝅗𝅥}}$

(which are longer than the previous 5 durations). Although septuplets and nonuplets are geometrically truncated from triplet and quintuplet rhythms, the use of longer note values (and vs and) elongates the phrase arithmetically, and ultimately elongates the length of the overall phrase of rehearsal mark 15.

Example 5.22 also presents the two layers of strings vs piano as independent, no longer rhythmically coupled, as evidenced by the independent bar lines. This independence leads to further non-alignment within the strings as violins 1 and 2 decouple from the viola and cello (seen at the end of the system in the blue box annotation).

In the following discussion, "non-alignment" refers to instances where the accent points between different parts do not align but are still coordinated in some manner (i.e. a certain strict structure remains). This is different from "incoordination", which insinuates a lack of coordination and affords indeterminacy to the performance. As an aside, for a clear illustration of total incoordination, all lines accelerate independently just before rehearsal mark 10, and Adès accounts for the indeterminacy by providing parenthesised fermatas above the final rests:

Example 5.23: Adès, *Piano Quintet* (page 14).[284]

By contrast, the previous Example 5.22 poses an interesting middleground where different time signatures and pulse speeds are used in individual strata. Although the

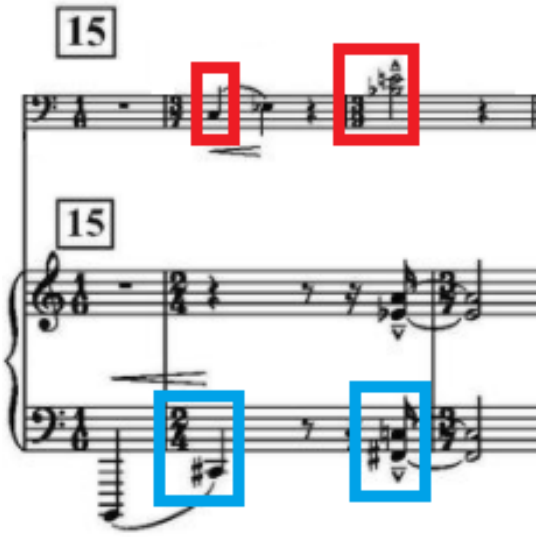
[284] Adès, *Piano Quintet*, 14.

different parts are coordinated conceptually, there is a sense of incoordination in the performance, as the different parts are enacting independent tempi.

There is a further complication to the passage in Example 5.22: the addition of rests augments the rhythmic complexity of this section. There are dotted quaver rests between the call and response of the piano line (as seen, for example, within the yellow box). There are septuplet crotchet rests after the call, and nonuplet crotchet rests after the response, of the initial strings (in the red box). Finally, there are straight quaver rests between the call and response of the viola and cello when they diverge from the violins by the end of the system (in the blue box).

In Example 5.24, the red box annotations indicate the onsets of the strings' notes (the cello line is used to represent the strings in this example). The elapsed duration between the onsets of the strings' notes is 3/7 (= 48/112) of a 𝅝 , whereas the duration between the piano's onsets (annotated in blue boxes) is 7/16 (= 49/112) of a 𝅝 . When comparing the two elapsed durations, the proportion comes to 48:49. The piano chord at the end of the ***2/4*** bar is very slightly offset by the difference in time signatures.

Example 5.24: Adès, *Piano Quintet* (rehearsal mark 15), cello and piano lines.[285]



This non-alignment continues to grow as the passage engages with phasing procedures, and this is made possible by the OFTSs used (which dictate the different but proportionally related pulse speeds). As seen previously in Example 5.22, the phasing is compounded by the divergence of the viola and cello from the violins a few bars later, making the effect denser and more impactful. This corollary use of OFTSs to engage in

[285] Adès, *Piano Quintet*, 20.

phasing serves as an organic means to build momentum, culminating in the chaotic nature of the tumultuous passage at rehearsal mark 16 (discussed later in greater depth).

When considering the broader context of rehearsal marks 5, 10, and 15, this recurring call and response motif is brought to the fore as a tool for developing the overall structure of the piece. Rehearsal mark 5 is preceded and followed by passages where there is total alignment between the strings and the piano. Rehearsal mark 10, however, is the opposite: it is immediately preceded by utter incoordination between all instruments, and it is followed by a systematic phased non-alignment between the strings and the piano.

Rehearsal mark 10 acts as a slight reprieve where the strings and piano come back into brief alignment. Rehearsal mark 15 signifies the most development. It is similar to rehearsal mark 10 in that it is immediately preceded and followed by passages of non-alignment between all the instruments; however, it goes one step further by featuring phased non-alignment within itself.

2a(i) Corollary Effect: Rhythmic Interjection

Rhythmic interjection is another corollary effect associated with the elongation/truncation of phrases. Though rhythmic interjection is more prominently featured in Adès' *Totentanz* as a use of OFTSs, there is one notable occurrence in *Piano Quintet* at rehearsal marks 6 and 7. Significantly, it is not the use of OFTSs alone that brings on this effect; rather, it is the combination of and relationship between odd-factored and conventional time signatures that draws this out.

In Example 5.25, the strings play an alternating short-long rhythm mapped against fluctuating pulse speeds. The red and pink annotated brackets delineate the first four rhythmic phrases, which are characterised by the rhythmic pattern of short-long-short-long-*short*. Although not obvious yet, the last *short* notes in each phrase may be viewed as rhythmic interjections—hiccups in an otherwise regular and predictable rhythmic pattern. This is made more apparent at rehearsal mark 7 and will be discussed later.

Example 5.25: Adès, *Piano Quintet* (rehearsal mark 6), violin 2 line.[286]

The first short note of each phrase lands on the notated downbeat of each ***4/4*** bar. Observe how the last note of each phrase is always contained in an OFTS bar (either in a ***1/6*** or ***2/5*** bar). The bar lengths themselves also adhere to a macro pattern of alternating long and short durations, with the conventional ***4/4*** bars acting as the "longs" and the odd-factored ***1/6*** and ***2/5*** bars acting as the "shorts".

The second and fourth phrases (annotated in pink brackets) geometrically elongate the original phrase due to the exact rhythmic augmentation (transforming triplet/sextuplet rhythms into longer quintuplet durations). Thus, this augmentation establishes a 6:5 ratio between phrases 1 and 3 (red brackets) and phrases 2 and 4 (pink brackets).

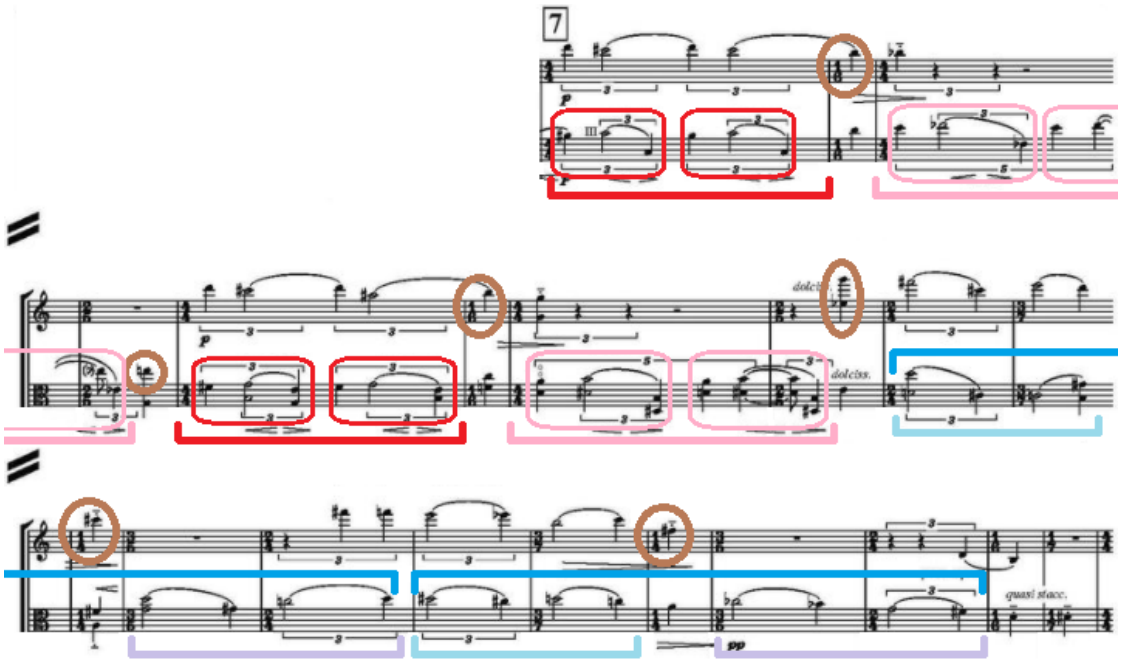
The remaining phrases of rehearsal mark 6 indicate a different approach to the rhythmic pattern. The dark blue annotated brackets demarcate two macro phrases spanning the time signatures ***2/4***, ***3/7***, ***1/4***, ***3/5***, and ***2/4***. This time, the rhythmic pattern of the previous phrases is reversed: it is now long-short-long-short. The rhythmic interjections are made apparent in the delineated ***1/4*** bars, interrupting an otherwise predictable pattern of long-short-long-short. Within the micro phrases of the light blue annotated brackets, a 6:7 ratio is established, whereas the purple brackets return to the 5:6 ratio.

A similar structure occurs at rehearsal mark 7 with regard to the phrasing patterns (see Example 5.26(a) with the same-coloured annotated brackets as Example 5.25 for each corresponding phrase). Examples 5.26(a) and 5.26(b) only include the violin 1 and viola lines, but it should be noted that violin 1 is in rhythmic unison with the cello,

[286] Adès, *Piano Quintet*, 8–9.

and the viola is generally in rhythmic unison with violin 2 (although there are a few slight deviations).

Example 5.26(a): Adès, *Piano Quintet* (rehearsal mark 7), violin 1 and viola lines.[287]



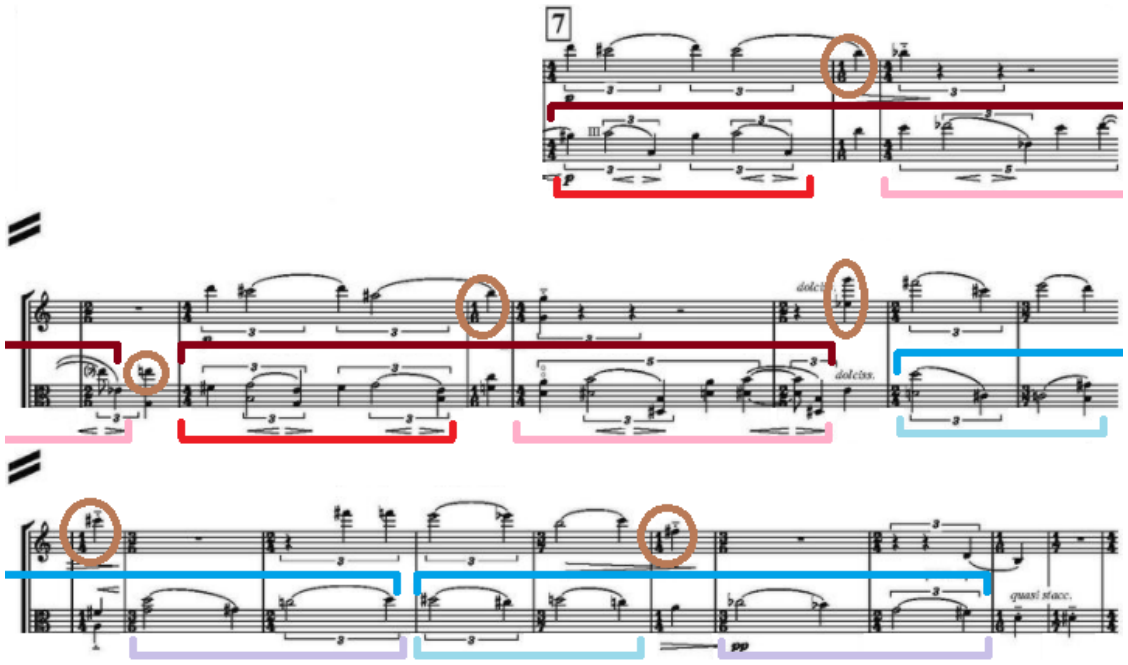
The first half of Example 5.26(a) is particularly noteworthy, as it significantly deviates from rehearsal mark 6. This time, it is more obvious that Adès is using the short ***1/6*** and ***2/5*** OFTS bars as a means of rhythmic interjection (see the brown circles amidst the red and pink annotations). The violin 1 and cello lines maintain the previous rhythmic pattern from rehearsal mark 6, but the viola and violin 2 take on a different rhythmic pattern in the first phrase: two mini phrases of short-long-short (i.e. the red boxes delineate the mini phrases of $^{3}\!\!\downarrow$, nested $^{3}\!\!\downarrow$, nested $^{3}\!\!\downarrow$; the pink boxes demarcate the mini phrases of $^{5}\!\!\downarrow$, $^{5}\!\!\downarrow$ tied to nested $^{3}\!\!\downarrow$, nested $^{3}\!\!\downarrow$). The arithmetic elongation of the additional nested $^{3}\!\!\downarrow$ brings the mini phrases to the fore, and thus, simultaneously geometrically diminishes the $^{3}\!\!\downarrow$ into nested $^{3}\!\!\downarrow$ notes.

Although it is the same overall duration as the violin 1 and cello phrases (i.e. a ***4/4*** bar), this short-long-short, short-long-short rhythmic pattern elucidates the self-contained three-note mini phrases and highlights the rhythmic interjections of the $^{3}\!\!\downarrow$ in the ***1/6*** bars and the $^{5}\!\!\downarrow$ in the ***2/5*** bars as notes that are not part of the actual phrase. Therefore, the rhythmic pattern may be more accurately represented as in Example 5.26(b): just like the phrases annotated in dark blue, the first half can also be viewed as

[287] Adès, *Piano Quintet*, 9–10.

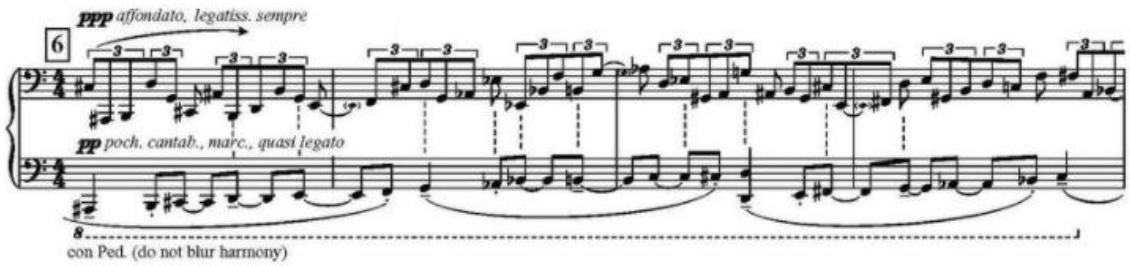
two macro phrases containing rhythmic interjections amongst rhythmic predictability (refer to the maroon bracket annotations).

Example 5.26(b): Reinterpretation of phrases in Example 5.26(a).[288]



Arguably, there are also rhythmic interjections featured in the piano line at rehearsal marks 6 and 7, because the right hand plays a consistent rhythmic ostinato: five ^{3}♪ followed by a straight ♪, which acts as the interruption (see Example 5.27). However, due to the consistency of this rhythmic pattern, the straight ♪ could be viewed as part of the ostinato and not only a hiccup in the flow of the ♪ notes. A 3:5 relationship may be drawn due to the five ♪, but this is a much more subtle proportion found in the notation of the piano part alone.

Example 5.27: Adès, *Piano Quintet* (rehearsal mark 6), piano line.[289]



[288] Ibid.
[289] Adès, *Piano Quintet*, 8.

These interjections distort, offset, and interrupt the predictable rhythmic pattern due to the slight idiosyncrasy caused by the relationship between the odd-factored and conventional time signatures. Although OFTSs rarely serve this specific purpose in *Piano Quintet*, Adès does extensively use them in other works (such as *Totentanz*) to produce rhythmic interjections in their own right.

2b. Rhythmic Ornamentation: Artificial Tempo Change

Rehearsal marks 6 and 7 present an appropriate segue to another use of OFTSs: to affect tempo (i.e. *accelerando* or *decelerando*, or to produce the effect of a measured rubato) via proportion in a controlled rhythmic setting.[290] Example 5.28 provides the cue line, which is the simplified strings' line for rehearsal mark 6; it is carried on in a similar fashion in rehearsal mark 7. In the latter half, starting from the orange annotated bracket, the pulse speed transitions from $^{5}\!\downarrow$ (***2/5***) to $^{6}\!\downarrow$ (the triplets in ***2/4***), to $^{7}\!\downarrow$ (***3/7***), and then a fascinating elision occurs in the ***1/4*** bar.

Example 5.28: Adès, *Piano Quintet* (rehearsal mark 6), cue line.[291]

Up until this point in the orange bracket, two attacks have occurred per pulse speed. The ***1/4*** bar is an exception to this pattern. However, it can be interpreted as two implied straight ♪ pulses, in which case an acceleration has occurred: $^{5}\!\downarrow$ (1/5 of a 𝅝 duration) to $^{6}\!\downarrow$ (1/6) to $^{7}\!\downarrow$ (1/7) to straight ♪ (1/8); the pulse speed becomes progressively faster with each bar.

[290] Compare this to how Elliott Carter stratified polyrhythms to effect a 'precisely notated rubato': see David Schiff, *The Music of Elliott Carter* (London: Eulenburg Books, 1983), 172; as cited by Key, "Pan-Rational," 229.
[291] Adès, *Piano Quintet*, 8-9.

Conversely, the ***1/4*** bar can also be interpreted as is written, a straight ♩ beat, in which case it restarts the acceleration: straight ♩ (1/4 of a 𝅝 duration) to quintuplet (1/5) to sextuplet (1/6) to septuplet (1/7) to implied straight ♪ (1/8), as seen in the green annotated bracket. This acceleration is repeated one final time with an added ***1/6*** bar to emphasise the sextuplet pulse speed (see the purple annotated bracket).

The ambiguity of interpretation with the two ***1/4*** bar elisions (seen when the different-coloured annotated brackets overlap) affords a sense of localised acceleration, which is contrasted by the phrasing discussed in previous examples. Example 5.25 was characterised as the strings playing alternating short-long rhythms mapped against *fluctuating* pulse speeds (akin to the proportionality discussed at the beginning of the piece). Here, in the latter half of Example 5.28, it is made obvious that these short-long rhythms are mapped against *accelerating* pulse speeds; although the acceleration is also achieved via proportionality, there is a directionality to this movement instead of mere alternation or fluctuation.

Example 5.28 also presents another example of Adès incorporating OFTSs into grouping elisions to disrupt the metric continuity.[292] The phrases of localised accelerations may '[engender] a sense of 'linear' continuity' but the two ***1/4*** bar elisions thwart 'such projections' as the accelerations are forced to restart.[293]

Example 5.29: The first two systems of 'Rehearsal Mark 4, Adès, *Piano Quintet*, 5-7' reduced and with metronome marks added by Huw Belling.[294]

[292] Roeder, "Co-operating Continuities," 133.
[293] Ibid.
[294] Belling, "Thinking Irrational," 27.

Example 5.30: Metric modulation imposed onto the first two systems of Huw Belling's reduction of *Piano Quintet* (rehearsal mark 4).

In theory, Adès' use of OFTSs to affect tempo could be conventionally notated as metric modulations. In Belling's master's thesis, he provides a transcription of the relative tempo of each bar as dictated by the time signature changes (see Example 5.29). In particular passages, Adès changes time signatures so frequently and uses OFTSs so often that the addition of metric modulations above the staves in these passages would make it exceedingly difficult for the performer to gauge the tempo (see Example 5.30).

Furthermore, notating conventional metric modulation would introduce unnecessary clutter to the score. The ultimate complication in using conventional notation is the lack of common values sounded on the musical surface across the metric modulation points (e.g. there are no quintuplets in the first bar and no sextuplets in the second bar of Example 5.30). This absence of common note values across bars would hinder the interpretation of conventional metric modulation notation in this passage. Instead, Adès uses the ratios between the denominators to communicate the proportionality between each bar.

Example 5.31 looks back to rehearsal mark 15 where OFTSs are used to enact the corollary effect of phasing. Although the OFTSs in this passage do not directly contribute to an artificial tempo change as explored above, a sense of an artificial acceleration still occurs due to the momentum achieved by the independent parts phasing in and out of alignment with each other.

Example 5.31: Adès, *Piano Quintet* (rehearsal mark 15).[295]

The phasing is initially between two parts (i.e. the strings and the piano) in the first system, which evolves into three independent parts when the viola and cello diverge from the violins in the second system, contributing to the gaining of momentum. The viola and cello lines involve an artificial tempo change in that its new phrase length

[295] Adès, *Piano Quintet*, 20–21.

(***2/7+3/8***) is shorter than its previous phrase length (***3/7+3/9***). When all the instruments finally come back into alignment in the third system, the phasing seamlessly cross-fades to a regular polyrhythm, which heightens in intensity before the ultimate climax of rehearsal mark 16.

As a point of interest, the verticalisation found in the strings' response (originally seen in the strings' first ***3/9*** bar) is a C♯°7 chord. Coupled with the piano's initial verticalisation (found in the tied chord of F♯°7), Adès utilises an octatonic scale. However, as the viola and cello separate from the violins, they introduce the final full-diminished 7th chord (the remaining B°7 chord), which intensifies the dissonance.

Although this thesis does not primarily examine the harmonic dimension, this pitch and harmonic phenomenon is used, at least in part, to reinforce the metric and rhythmic strata associated with the different groups of instruments. Despite the enharmonic respellings of certain notes, all three instrument groups maintain their assigned full-diminished 7th chords throughout this passage. Not only does the phasing contribute to the building momentum, but the complete chromatic harmony employed also heightens the intensity of the passage.[296]

For a subtle example of artificial tempo change, observe how the cello line is in rhythmic unison with viola at rehearsal mark 8. Noting all the annotated red boxes in Example 5.32:

- First red box: the $^{3}\!\!\downarrow$ pulse in ***2/6*** is longer than the straight ♩ pulse in ***2/4*** (harnessing a 3:4 ratio);
- Second red box: the $^{3}\!\!\downarrow$ pulse in ***4/4*** is longer than the $^{7}\!\!\downarrow$ pulse in ***5/7*** (6:7 ratio); and
- Third red box: the $^{7}\!\!\downarrow$ pulse in ***5/7*** is longer than the straight ♪ pulse in ***1/4*** (7:8 ratio).

Adès specifies "second note: always short" with the two-note slurred figures (as highlighted in the blue box), which implies a staccato effect on each second note. So, although the OFTSs have no effect on the sounded duration of the second note (i.e. no geometric phrase truncation despite the OFTSs employed), the changing note values, as

[296] See also Roeder, "Co-operating Continuities," 134, where he demonstrates how Adès combines enlarging harmonic intervals with tempo deceleration in his opera, *Powder Her Face*.

dictated by the time signatures, indicate a progressively accelerated pulse speed given the metrical context within the viola and cello lines.

Example 5.32: Adès, *Piano Quintet* (rehearsal mark 8), cello line.[297]

3. Rhythmic Feeling

At certain points in the piece, Adès instructs the performer to play with an OFTS feel even where there are conventional time signatures. This is generally notated in a small staff underneath the relevant instrumental line (not to be confused with the cue line, which is also notated in a small staff) with a direction of 'as if' or 'i.e.'. The first instance of this is at rehearsal mark 8, where the rhythmic feeling of the piano is expressed below the proper piano grand staff (see Example 5.33).

Example 5.33 is indicative of how Adès wants the performer to approach and express the tuplet rhythm. The actual notated rhythm of the piano is according to the ***4/4*** time signature of the strings and is used to aid coordination between the strings and piano. However, the 'as if' staff expresses the rhythmic feeling that the pianist is supposed to convey, and this aids in the performer's understanding of how to express the downbeats, phrasing, and further intricacies of the rhythmic pattern. Incidentally, the first system features a prime example of a reappearance of the 3:5 ratio as violin 2 plays $^{3}\!\!\downarrow$ against the piano's $^{5}\!\!\downarrow$ in the first three bars of the example below.

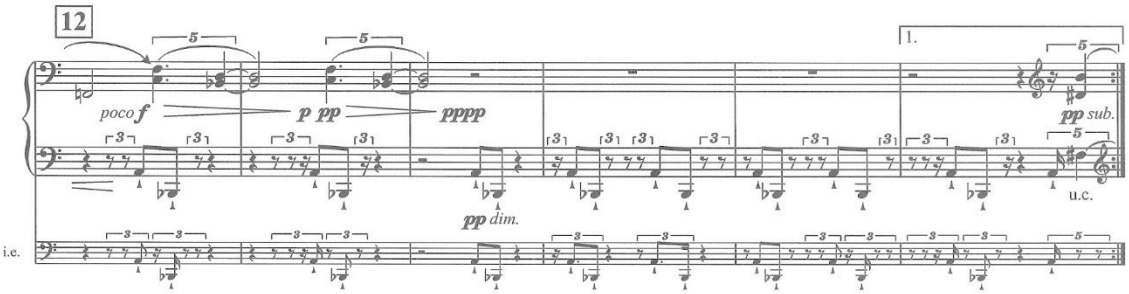
The simplicity and regularity of the 'as if' rhythms clearly show that this passage features the superimposition of different tempi in a precise 5:6 ratio after the first three bars of rehearsal mark 8 (i.e. the piano's tempo of $^{5}\!\!\downarrow$ = 110 is superimposed upon the strings' tempo of $^{3}\!\!\downarrow$ = 132). Also, violin 1 is directed to adhere to the piano's bar lines when it diverges from the other strings, so the conventional notated time signature and bars of the piano serve to aid coordination with violin 1. This passage also pits the piano's quintuplet rhythms against the violin's triplet rhythms.

[297] Adès, *Piano Quintet*, 10–11.

Example 5.33: Adès, *Piano Quintet* (rehearsal mark 8), violin 1, violin 2, and piano lines.[298]

There are two other instances where alternative notation is used to express rhythmic feeling in *Piano Quintet*, and although they do not directly use OFTSs to explicitly communicate the tuplet rhythm, they are nevertheless connected to that concept. Example 5.34 displays rehearsal mark 12, which uses alternative notation to assist the pianist in rationalising the left-hand accented attacks:

Example 5.34: Adès, *Piano Quintet* (rehearsal mark 12), piano line.[299]



[298] Ibid.
[299] Adès, *Piano Quintet*, 16.

There is a deeper level of polyrhythm featured in this passage: the gestures are evenly spaced, creating an ostinato pattern that is 13 𝅘𝅥𝅯 in length (which could be expressed as regular bars with the OFTS of ***13/24***). Looking back at Example 5.22 (repeated below for convenience), specifically at the yellow box annotation at rehearsal mark 15, the proportion between the call and response in the piano line comes to 65:39 (simplified to a 5:3 ratio with the factor of 13). It may be a mathematical coincidence that 13 reappears here, but it is worth noting that 13 is the next number in the Fibonacci sequence. The ratio in the piano line exploits the numbers 3 and 5, which add up to 8, and then 13 follows in this sequence.

Example 5.22: Adès, *Piano Quintet* (rehearsal mark 15).[300]

Rehearsal mark 18 uses the notation as a means of inverting its function with rehearsal mark 8: where rehearsal mark 8 has conventional time signatures and rhythmic notation that coordinates with the strings (and the alternative notation showing the OFTS rhythms), rehearsal mark 18 contains OFTSs and corresponding tuplet rhythmic notation (with the alternative notation showing the conventional time signature rhythms).

[300] Adès, *Piano Quintet*, 20.

Example 5.35: Adès, *Piano Quintet* (rehearsal mark 18).[301]

Example 5.35 demonstrates the use of this alternative notation as a means of aiding coordination between instrumental parts. Note, however, that it is included as alternative notation due to the fact that if the rhythms were notated in this manner in the proper score, it would be too cluttered and difficult to decipher.

Although it does not use the alternative notation method explored previously, there is a far more complex example of OFTSs used to convey rhythmic feeling at the very end of the piece (see Example 5.36). In the first system on the last page of the score, the strings play a series of differing tuplet values: septuplet, quintuplet, triplet, septuplet again, and an 11-tuplet. In the second system, the piano plays a bar of ***2/7+1/16*** before a bar of ***2/7+1/10+1/24***.

The highlighted passage in the first system of Example 5.36 depicts a rhythm that becomes progressively more asymmetrical. The first note of each two-note figure occupies progressively more of each beat, and the second note progressively less, creating a gradually more lopsided rhythm and leaning more into the long-short rhythmic pattern from rehearsal marks 6 and 7 (see Table 5.9).

[301] Adès, *Piano Quintet*, 27.

Example 5.36: Adès, *Piano Quintet* (page 39).[302]

Table 5.9: The progressively asymmetrical string rhythms of Example 5.36.

Rhythmic Figure	First Note Percentage of the ♩ Beat	Second Note Percentage of the ♩ Beat	Overall Ratio
First septuplet	57%	43%	4:3
Quintuplet	60%	40%	3:2
Triplet	66.67%	33.33%	2:1
Second septuplet	71%	29%	5:2
11-tuplet	73%	27%	8:3
Dotted quaver to semiquaver	75%	25%	3:1

[302] Adès, *Piano Quintet*, 39.

The ratios between each subsequent note pair become so precise that it is unlikely a performer could feasibly gauge them with complete accuracy; instead, this progressive asymmetry must be felt.[303] Similarly, the held chords in the left hand of the piano (from the F♯-B dyad which is tied across the ***2/4*** and ***3/7*** bars, all the way to the tied note in the ***2/7+1/10+1/24*** bar) experience a gradual elongation of note values which are likely too difficult to mathematically count out during a performance in real time. The OFTSs are also used to ensure the piano line will mathematically equate to the strings' lines and allow the bar lines to synchronise for the final two bars.

4. Tumultuous Passage

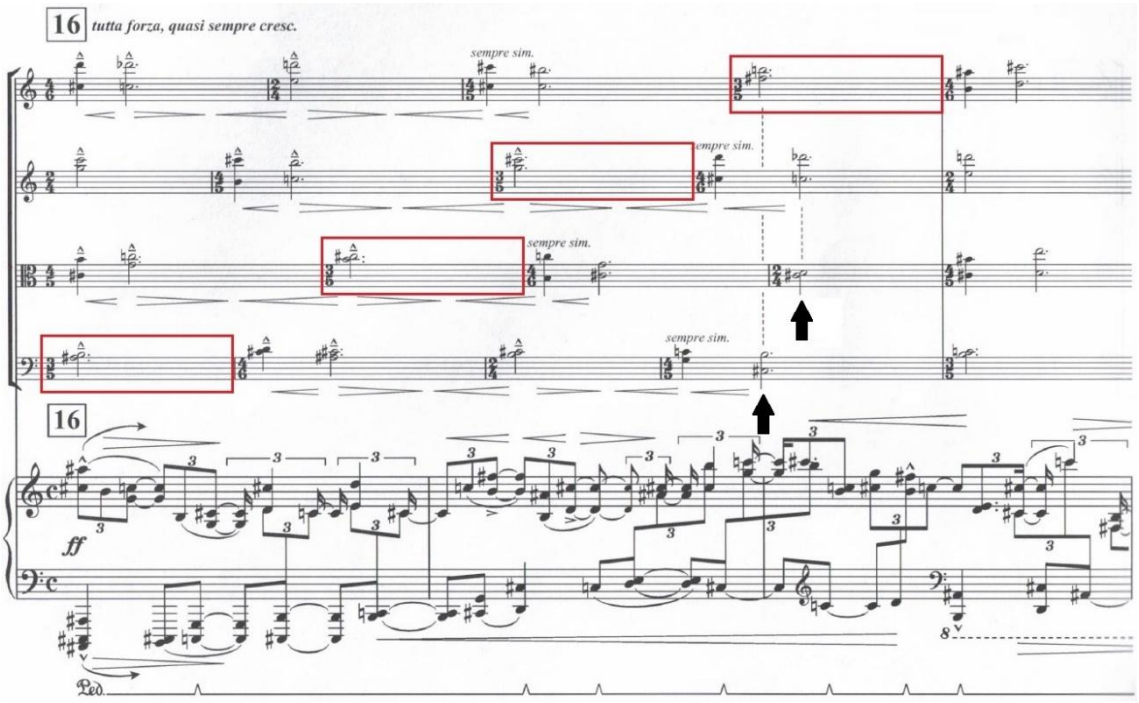
At times, Adès uses OFTSs in sections where almost every bar has a time signature change, adding to the rhythmic complexity to build tension, energy, and movement. At the end of the exposition section of the sonata form, in rehearsal mark 12, there is a brief calm where the viola, cello, and piano reach a temporary tonal stability (see Example 5.37).[304] After this point, the development section continues to grow in harmonic volatility until it culminates in rehearsal mark 16, 'the climax of the development', where the rhythmic and metric instability mirror the harmonic instability of the section (see Example 5.38).[305]

Example 5.37: Adès, *Piano Quintet* (rehearsal mark 12), viola, cello, and piano lines.[306]

[303] Compare to Strizich's comments regarding Elliott Carter's complex rhythmic notations: Robert Strizich, "Notation in Elliott Carter's 'Double Concerto'," *Ex Tempore* 2, no. 1 (1982): 62; as cited by Key, "Pan-Rational," 230-231.
[304] Adès and Service, *Full of Noises*, 49-50, 161. I differ with Service on the exact timing of the point of stability: Service has interpreted the A major portion towards the end of rehearsal mark 11 to be the point of stability, whereas I view it as rehearsal mark 12 instead.
[305] Adès and Service, *Full of Noises*, 50.
[306] Adès, *Piano Quintet*, 16.

As discussed earlier with Example 5.22 in relation to rehearsal mark 15, the rhythmic independence of the three instrumental groups (violins 1 and 2; viola and cello; and piano) is initially established as phasing. However, the phasing quickly escalates to complete notated non-alignment between all lines, a heightened incoordination, and an apt precursor for the chaotic nature of rehearsal mark 16, the climax of the piece:

Example 5.38: Adès, *Piano Quintet* (rehearsal mark 16, first subsection).[307]



Rehearsal mark 16 is the quintessential example of OFTSs used to create a tumultuous passage. Where rehearsal mark 15 employs phasing, rehearsal mark 16 is structured as a type of metric canon—led by the cello, as seen in Example 5.38—which is so metrically and rhythmically complex that there are very few corresponding bar lines between all the parts. Indeed, *Piano Quintet* tests the boundaries of coordinated time signatures throughout the whole piece, and this section represents the culmination of the piece's metric and rhythmic complexity.

The piano line plays complex macro and micro triplet figures in ***4/4*** while the strings experience a time signature change in almost every bar. These time signatures effectively dictate the note durations, as there are generally one or two notes/chords per bar. So, in actuality, the time signatures ultimately dictate the *rhythms* (i.e. note durations) played by the strings. Contrast this with most of the previous examples which

[307] Adès, *Piano Quintet*, 21.

were preoccupied with the use of OFTSs to affect pulse speeds and tempi rather than dictating the surface rhythms.

To concentrate only on the metrical aspect and specifically how Adès harnesses OFTSs in this rehearsal mark, a brief analysis of the canonic imitation is necessary. The rehearsal mark 16 is broken into four subsections which are delineated by coordinated bar lines across all four string parts. The first subsection is seen in Example 5.38 above and it consists of four different time signatures which rotate between the strings (led by the cello): ***3/5***, ***4/6***, ***2/4***, ***4/5***. The upward-pointing arrows indicate the points of coordination between rhythmic attacks.

In the second subsection, an additional ***2/4*** bar and a new ***3/7*** OFTS are included to constitute six total bars, as seen in the annotated part of Example 5.39. Again, the ***3/5*** bars are annotated in red boxes to highlight the canonic imitation. However, this time the ***4/6*** bars are also annotated in blue boxes to demonstrate how the additional ***2/4*** and ***3/7*** bars separate the original two time signatures in the sequence previously established in Example 5.38, so that the order is now ***3/5***, {***2/4***, ***3/7***,} ***4/6***, ***2/4***, ***4/5***.

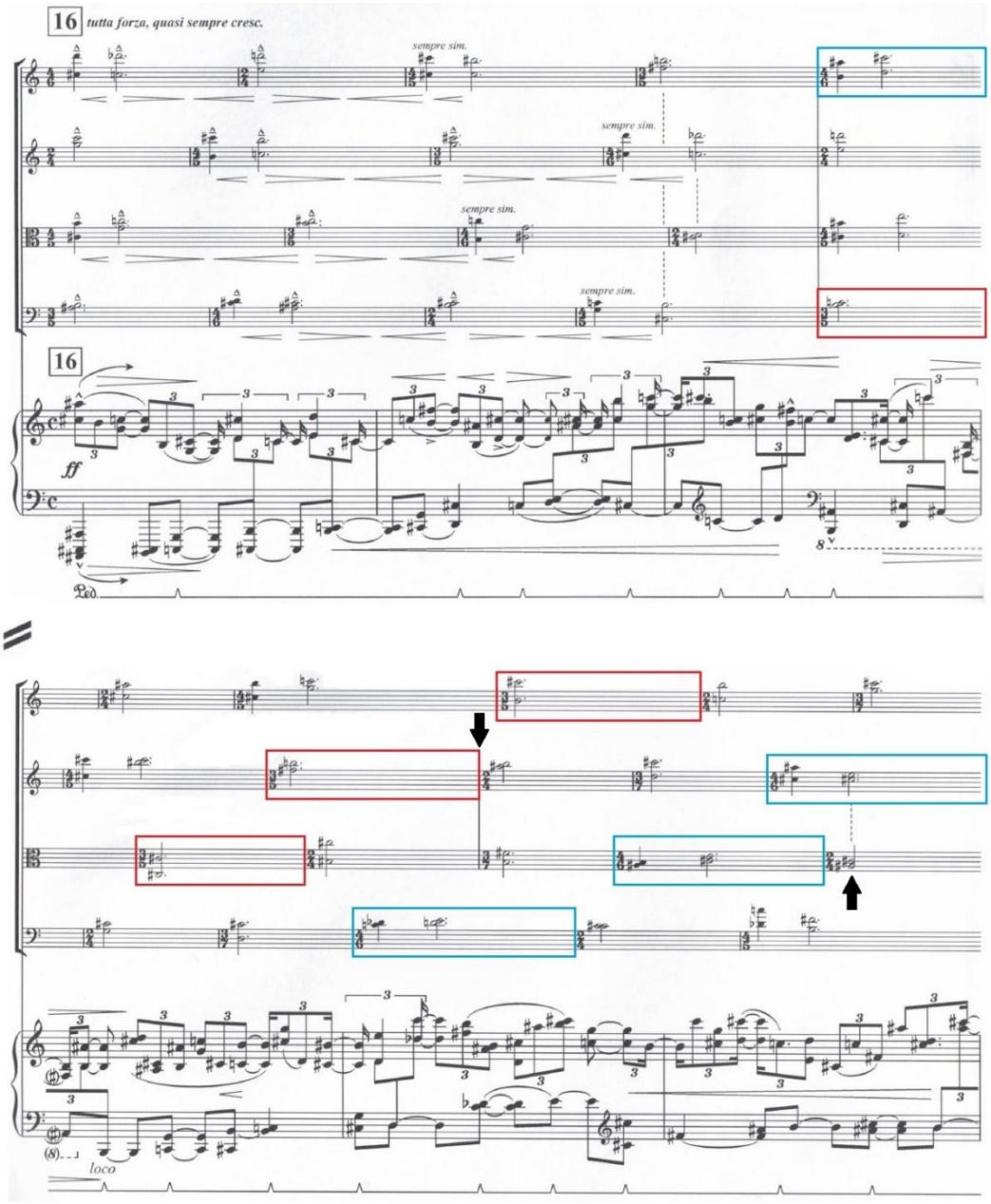
The upward-pointing arrow in Example 5.39 continues to indicate coordination between surface rhythmic attacks. However, the downward-pointing arrow highlights the first instance of *metric* coordination within a subsection of canonic imitation (i.e. a shared bar line between different instruments), made possible due to the additional ***2/4*** bar. The six bars of violin 2 and viola are subdivided into three bars of the same time signatures each (i.e. the first three bars are ***2/4***, ***4/5***, ***3/5***; the second three bars are ***2/4***, ***3/7***, ***4/6***), but due to the canonic imitation, the second violin's order is a permutation of the viola.

Already in the second subsection, it is evident that the time signatures are used as a result of structural procedures Adès has set in place. In the first and second subsections, there were several shared commonalities:

1. The points of rhythmic coordination, indicated in the score by dotted lines and annotated with upward-pointing arrows, were found in the latter half of each subsection, and only between the strings;
2. The cello led the time signature canonic imitation;
3. The time signatures would change with every single bar;

4. There would only be one attack per bar unless the numerator was ***4***, in which case there would always be two attacks in a 1:3 durational ratio (e.g. in a ***4/5*** bar, the rhythmic attacks would be $\overset{5}{\blacksquare}$ $\overset{5}{\text{𝅗𝅥}}$.); and
5. All the numerators of the time signatures were more than ***1***.

Example 5.39: Adès, *Piano Quintet* (rehearsal mark 16, first and second subsections).[308]



Commonalities 3-5 are of particular note. The metric dissonance would seem to be compounded with constantly changing time signatures. However, Adès has actually employed note/bar durational equivalences over these two subsections. ***2/4*** is equivalent to 3/6 in duration, and 3/6 is the length of the $\overset{3}{\text{𝅗𝅥}}$. notes in the ***4/6*** bars (see

[308] Adès, *Piano Quintet*, 21-22.

the green lines in Example 5.40). The $^{5}\!\!\!

Therefore, there is a 6:5 proportional alternation of pulse speed over two-bar groups, obfuscated by the canonic imitation.

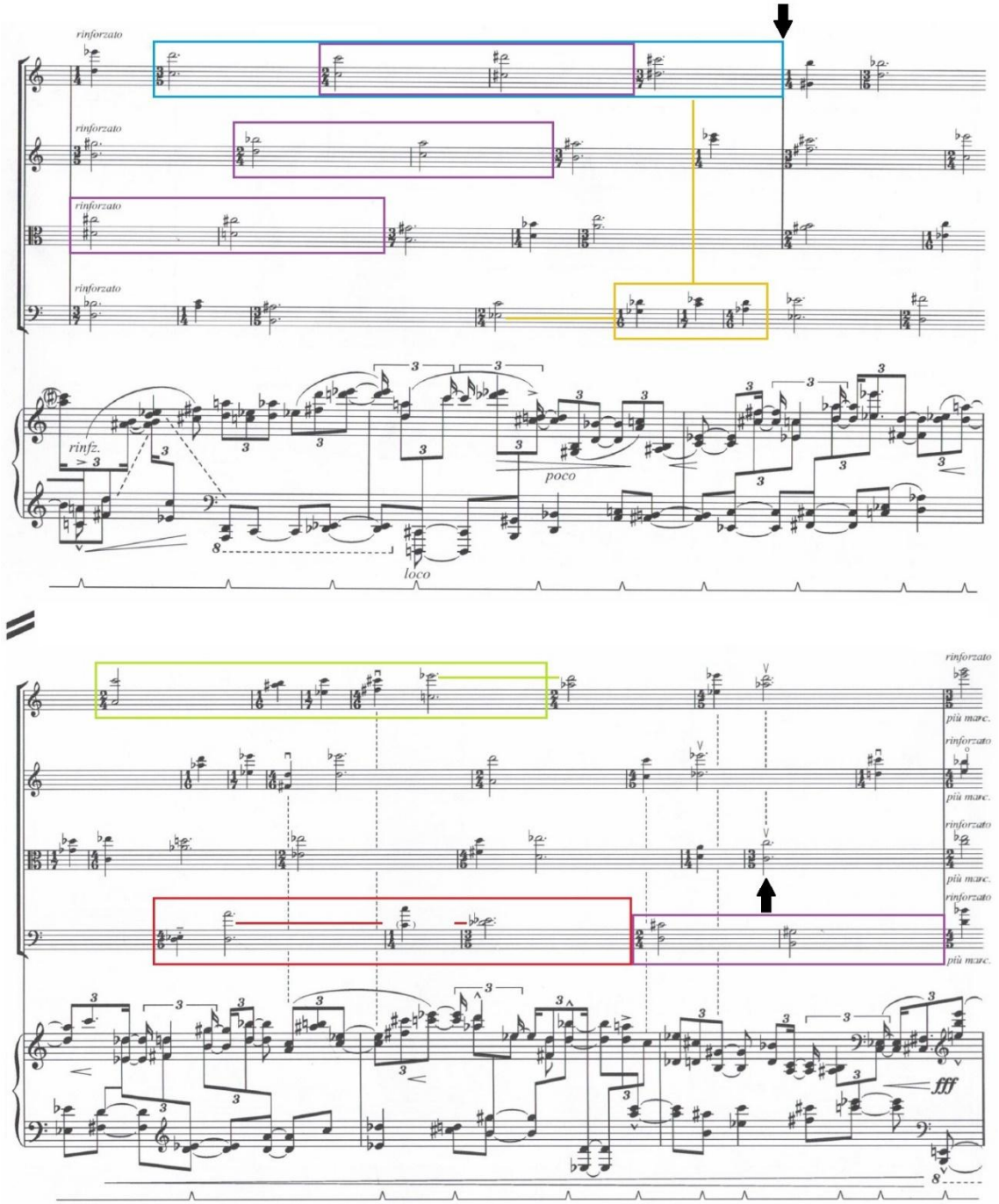
With the inclusion of ***3/7*** bars in the second subsection, Adès adds another procedure, seen in the blue box annotations in Example 5.40. As previously established, ***2/4*** is used as a durational equivalence for 3/6. So, he has ordered the bars ***3/5***, (3/6), ***3/7*** in the blue boxes to enact an artificial acceleration of pulse speed as the note durations become shortened at a 7:6:5 proportional relationship. This artificial acceleration is placed between the quintuplet and sextuplet/triplet pulse speeds. The sequence of tempi in the second subsection is thus:

Quintuplet Rhythms		Acceleration		Sextuplet (Triplet) Rhythms	
4/5	***3/5***	***2/4*** (3/6)	***3/7***	***4/6***	***2/4*** (3/6)

Several new complexities are introduced in the third subsection which simultaneously heighten the feeling of metric dissonance while also, counter-intuitively, injecting more opportunities for rhythmic coordination (see Example 5.41). The third subsection is the first time in rehearsal mark 16 where there are time signatures with ***1*** in the numerator, distinguishing it from the first and second subsections (as that was commonality 5). The single tuplet ♩ attacks up until this point have been entirely in ***4***-numerator bars and so they have contributed to the pulse speed and metric entrainment within each instrumental line. However, the ***1***-numerator bars are used to express particular metric and durational warps in the established pulse speed structures.

Looking first at the blue box at the top of the first system in Example 5.41, the artificial acceleration in pulse speed still occurs. However, Adès has added an extra ***2/4*** bar. This is the first time in rehearsal mark 16 where there are two consecutive bars in a row that have the same time signature, as isolated in the purple boxes. The viola actually has three consecutive bars of ***2/4***. However, Example 5.41 only shows the second and third of these consecutive bars as the first is located at the end of the second subsection (seen previously in Example 5.40).

Example 5.41: Adès, *Piano Quintet* (rehearsal marks 16, third subsection).[310]



The purple box annotations also highlight an oddity in the third subsection: although there is still canonic imitation which is led by the cello, the cello has a two-bar lead compared to the usual one bar displacement. The reason this has happened is if the cello started the subsection with a single ***2/4*** bar, the point of metric coordination (i.e. the downward-pointing arrow) would be shared by all four strings:

[310] Adès, *Piano Quintet*, 22–23.

Vln. 1	***1/4***	***3/5***	***2/4***		***3/7***
Vln. 2	***3/5***	***2/4***		***3/7***	***1/4***
Vla.	***2/4***		***3/7***	***1/4***	***3/5***
Vc	***2/4***	***3/7***	***1/4***	***3/5***	***2/4***

However, a shared bar line across all four strings would signify the start of a new subsection, and so to avoid this, Adès has displaced the cello by two bars, while the remainder of the strings continue with the normal one-bar displacement.

The two consecutive bars of ***2/4*** draw attention to other bars which would be consecutive bars of the same time signature if not for the interference of the ***1***-numerator time signatures. Looking at the red box towards the bottom of the second system, the normal ***4/5-3/5*** rhythmic sequence is interrupted by a ***1/4*** bar. ***1/4*** + ***3/5*** has a total duration of 17/20; ***4/5*** is equivalent to 16/20. The red box would have been two bars of 4/5, however, the $^{5}\!\!\downarrow$ has been fractionally elongated by 1/20 to become a straight $\downarrow$ in duration, thus slightly distorting the proportions so that there is a 17:16 durational ratio between the ***4/5*** and combined ***1/4-3/5*** bars.

The three $^{3}\!\!\downarrow$ $^{7}\!\!\downarrow$ $^{3}\!\!\downarrow$ attacks in the yellow annotated box in the first system have a combined total duration of 20/42. This is 1/42 shorter than the preceding ***2/4*** bar (which has an equivalent duration of 21/42), and is 2/42 longer than the virtually simultaneous ***3/7*** bar (which has an equivalent duration of 18/42). Therefore, the durational ratio between the ***2/4*** bar, the yellow box, and the ***3/7*** bar is 21:20:18. Such close warps of duration are achieved through the OFTSs in this rehearsal mark.

The green box in the second system highlights a rhythmic palindrome: the $\downarrow$ in the ***2/4*** bar is equivalent to the $^{3}\!\!\downarrow\cdot$ in the ***4/6*** bar; the $^{3}\!\!\downarrow$ in the ***1/6*** bar is the same length as the first attack in the ***4/6*** bar; and the ***1/7*** bar acts as the point of reflection. The short-long-long rhythm continues to be maintained between the ***4/6*** and ***2/4*** bars, as annotated by the lone horizontal green line.

One final thing to note about this third subsection is that there is only one rhythmic coordination point between the strings, as seen with the upward-pointing arrow. The remaining dotted lines show rhythmic coincidences between the strings and the *piano* which has not occurred since the beginning of rehearsal mark 16. This is

significant as it indicates how the rhythmic surface of the strings is starting to interact with the consistent ***4/4*** metric structure undergirding this entire rehearsal mark.

Example 5.42(a): Adès, *Piano Quintet* (rehearsal mark 16, fourth subsection).[311]

The fourth and final subsection is the most complex with the most amount of rhythmic and metric processes layered on top of one another (see Examples 5.42(a) and (b)). There are surface level patterns of note. For example, the cello has reverted back to leading the canonic imitation with a displacement of one bar. Also, the first half of the bars in the violin 1 line are segments of the other subsections: ***3/5***, ***4/6***, ***2/4***, ***4/5*** (in the second system of Example 5.42(a)) were the first four bars of the cello's first subsection

[311] Adès, *Piano Quintet*, 23.

(previously seen in Example 5.38); ***3/5***, ***2/4***, ***3/7*** were the last half of the first violin's second subsection (previously seen in Example 5.39); and ***1/4***, ***3/5***, ***2/4*** are found in the middle of the first violin's third subsection (previously seen in Example 5.41).

Example 5.42(b): Adès, *Piano Quintet* (rehearsal mark 16, fourth subsection), continued.[312]

[312] Adès, *Piano Quintet*, 24.

Table 5.10: The order of time signatures in the fourth subsection of rehearsal mark 16.

				(b)				(e)							(g)						(j)	(k)
Vln. 1	3/5	4/6	2/4	4/5	3/5	2/4	3/7	1/4	3/5	2/4	(2/4)	3/7	1/4		3/5	2/4	1/6	1/7	2/4	(2/4)
Vln. 2	4/6	2/4	4/5	3/5	2/4	3/7	1/4	3/5	2/4	(2/4)	3/7	1/4	3/5		2/4	1/6	1/7	2/4	(2/4)	3/5
Vla.	2/4	4/5	3/5	2/4	3/7	1/4	3/5	2/4	(2/4)	3/7	1/4	3/5	2/4	1/6	1/7	2/4	(2/4)	3/5	1/6	2/4
Vc.	4/5	3/5	2/4	3/7	1/4	3/5	2/4	(2/4)	3/7	1/4	3/5	2/4	1/6	1/7	2/4	(2/4)	3/5	1/6	2/4	(2/4)
			(a)				(c)	(d)				(f)			(h)	(i)					

The structural implications of the OFTSs are the truly impressive features of this final subsection. Examples 5.42(a) and 5.42(b) have lettered, downward-pointing arrows which indicate each point of metric coordination (these letters correspond to the letters in Table 5.10). In the second subsection, there was only one shared bar line between two instruments. In the third subsection, there was only one shared bar line between three instruments.

In this final subsection, there are 10 different points of metric coordination shared between a combination of all four string instruments. However, the majority of the time, these shared bar lines are between violins 1 and 2, and viola and cello, returning to the instrument groupings of rehearsal mark 15.

Table 5.10 sets out the order of the time signatures in each string part. The borders of each cell are not accurate representations of the bar durations, and the only times the borders indicate metric coordination/shared bar lines are when they are highlighted as thick, bolded borders (marked with corresponding letters to those of the downward-pointing arrows in Examples 5.42(a) and 5.42(b)).

At shared bar line (g), it appears as though the violins are displaced by an additional bar. The reason for this is because of the short bar durations of ***1/6*** and ***1/7*** in the viola and cello respectively. The viola's ***1/7*** bar in between points (g) and (h) is of particular note: similar to its function as the point of reflection in the rhythmic palindrome of the third subsection, it is also caught here in the middle of the shared bar lines between the upper string lines (i.e. the violins and viola) and the lower string lines (i.e. the viola and cello).

The red text in Table 5.10 highlights bar length equivalences: the combined duration of ***1/6*** and ***2/4***, as established in previous subsections, is equivalent to ***4/6***. This time, Adès makes it very obvious because he has placed the ***1/6-2/4*** bars in the spots where the ***4/6*** bars should have been in the viola and cello lines to fulfil the canonic imitation. It is likely that the reason for this separation into two different bars is so that metric coordination points (j) and (k) could be enacted, particularly (j) as it entails the only coordination point with the piano (although the strings' attack at the beginning of the ***2/4*** bars do not align with any attack in the piano since the piano is in the middle of playing a tied note).

Every other dotted line is a *rhythmic* coordination point between the strings in various combinations. Both (j) and (k) are also the only times in rehearsal mark 16 where violin 1 shares the same bar lines as cello, and they are actually in rhythmic unison in the last bar of the excerpt.

There are many other aspects of this rehearsal mark that make it such an impactful and climactic section of the development, but for the purposes of this project, the commentary has been isolated to the use of OFTSs. There is a complete sense of rhythmic independence between all the instruments, and Adès harnesses this density of rhythmic and metric complexity to build tension and movement.

Conclusion

Adès utilises OFTSs in *Piano Quintet* for a variety of purposes. Primarily, they are used as a means of exploring the boundaries and scope of inter-instrumental and intra-instrumental rhythmic, metric, and tempi proportional relationships, to such an extent that performers should regard this piece as an integral work for investigating the depth and pushing the bounds of proportionality in chamber ensemble relationships. The OFTSs employed also enact corollary effects such as phasing and rhythmic interjection, and they elucidate the notation of specific rhythms and tempi. However, it must be noted that this is all in service of clear communication to the performers. Example 5.43 aptly illustrates this.

At the beginning of rehearsal mark 10, all instruments have a call and response figure that alternates between triplet and quintuplet rhythms. There is then a ***2/4*** bar which Adès equivocates to a ***5/10*** bar; although they would have the same length and

rhythmic feel, he wants to ensure the performers maintain the mindset of quintuplet rhythms, which carries to the end of the system in the ***4/4*** bars. Adès introduces triplet rhythms in the piano at rehearsal mark 11, but it should be noted that the cue line specifies the strings' quintuplet rhythms in the piano's metre.

Example 5.43: Adès, *Piano Quintet* (rehearsal marks 10-11).[313]

[313] Adès, *Piano Quintet*, 14–15.

In this one example, most—if not all—of Adès' reasons for using OFTSs are brought to the fore. The parenthesised ***5/10*** is used for ease of reading, to clearly communicate the rhythms he wants maintained, which will aid performance. There is the effect of phasing between the strings and piano as the piano repeats the same figure in ***4/4*** against the emphasised first beat of each ***9/10*** bar played by the strings.

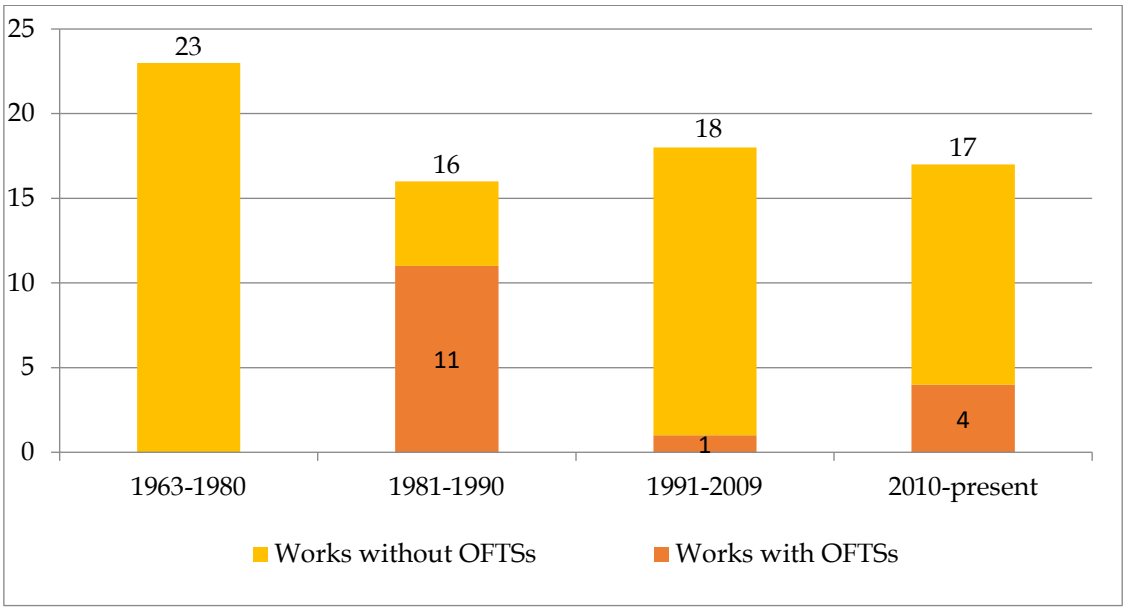
There is a sense of proportionality between the triplet figures in the piano against the strings' quintuplet rhythms (a 6:5 ratio of sorts), as well as an overall proportionality between the duration of the ***4/4*** bars against the ***9/10*** bars (a general 10:9 ratio of bar duration). Furthermore, all of this cannot be achieved without the meticulous inter-instrumental and intra-instrumental relationships between the instrumentalists of the chamber ensemble.

From a preliminary examination of a more recent work, *Concerto for Piano and Orchestra*, it appears that some of the more complex proportions explored in *Piano Quintet* have now been picked up in the *Concerto*, and this provides an avenue for further research. *Piano Quintet* is a tour de force of the conceptual and practical uses of OFTSs within Adès' oeuvre.

Chapter 6: Composer Introduction of Brian Ferneyhough

An overview of Ferneyhough's compositional output is important for understanding the prevalence of OFTSs in his oeuvre. According to the Edition Peters published worklist dated 2022 and The Living Composers Project, Ferneyhough has a total of 74 compositions, but OFTSs are only found in 16 works:[314]

Table 6.1: The total number of Ferneyhough's works in chronological order.



To expound upon the figures in Table 6.1, a few provisos must be addressed. *Carceri d'Invenzione IIb* has been omitted in both the "Works without OFTSs" and "Works with OFTSs" tallies, as it is the isolated solo flute line of *Carceri d'Invenzione II* and thus is considered to be subsumed into the complete work. Also, the scores for *Invention* (1965), *Lawdes Deo* (2017), and *De Ira / Parables of Lucid Dreaming II* (2020) were inaccessible, so they have all been assumed to not contain OFTSs.

Two of Ferneyhough's pieces have minimal use of OFTSs: the Fourth and Sixth String Quartets, both of which feature isolated incidents of the notational device comprising less than 3% of each piece. Six of his works have infrequent use of OFTSs (i.e. less than 25% of the piece and only in specific sections). Seven of his works have frequent use where the notational device is abundant throughout the piece. These are all detailed in Table 6.2 with the percentages rounded to two decimal places.

[314] "Brian Ferneyhough worklist 2022," Issuu, accessed July 27, 2024, https://issuu.com/editionpeters/docs/ferneyhough_worklist_may_2022; Dan Albertson and Ron Hannah, "Brian Ferneyhough," The Living Composers Project, modified January 29, 2019, http://composers21.com/compdocs/ferneyhb.htm.

From both Tables 6.1 and 6.2, it is apparent that Ferneyhough took long breaks from using OFTSs, most notably during the 20-year gap between *Mort Subite* (1990) and String Quartet No. 6 (2010) (with the only exception of *Unsichtbare Farben* (1997-1999) in the middle of this hiatus). String Quartet No. 6 is also one of only two works to feature OFTSs in less than 3% of the piece (the other being String Quartet No. 4 as previously mentioned). For this reason, it has been identified as a work of interest and will be used later in this chapter as a brief analytical example of Ferneyhough's rhythmic and metric practices when involving OFTSs. *Mort Subite* will be examined in depth as a case study piece in chapter 8.

Table 6.2: Frequency of OFTS bars in all pieces with OFTSs.

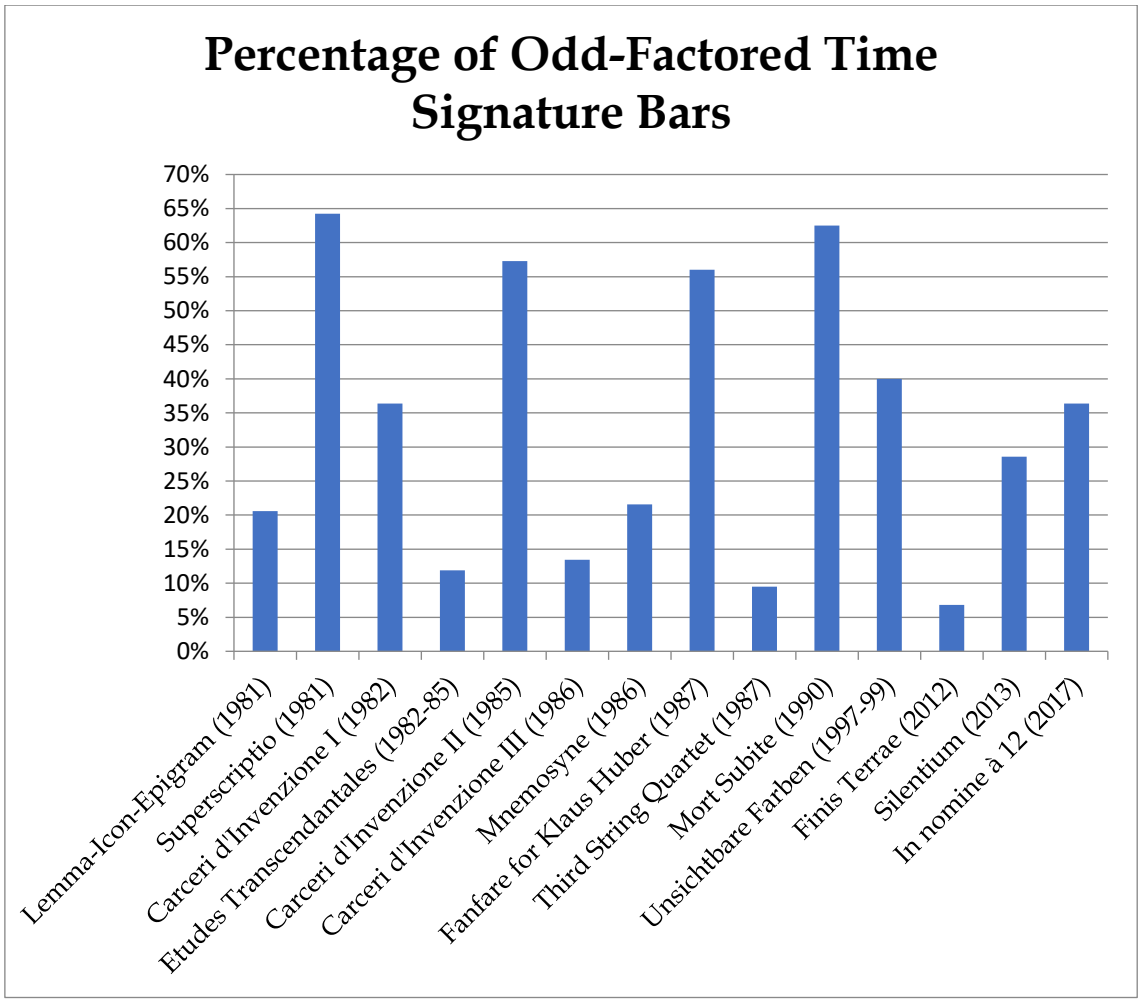
Work	OFTS Bars	Total Bars	Percentage	When OFTSs Occur
Lemma-Icon-Epigram (1981)	36	175	20.57%	Section: 2nd half of piece (from bar 90)
Superscriptio (1981)	140	218	64.22%	Throughout
Carceri d'Invenzione I (1982)	60	165	36.36%	Throughout
Etudes Transcendantales/ Intermedio II (1982-1985)	50	421	11.88%	Section: movements I, II, III, and V (out of 9 total)
Carceri d'Invenzione II (1985)	130	227	57.27%	Throughout
Carceri d'Invenzione III (1986)	22	164	13.42%	Section: mostly at the end (from bar 134)
Mnemosyne (1986)	33	153	21.57%	Section: 2nd half of piece (from bar 77)
Fanfare for Klaus Huber (1987)	14	25	56%	Throughout
String Quartet No. 3 (1987)	20	211	9.48%	Section: at the end (from bar 151)
String Quartet No. 4 (1989-90)	4	195	2.05%	Isolated: at the beginning (up to bar 20)
Mort Subite (1990)	55	88	62.5%	Throughout
Unsichtbare Farben (1997-1999)	64	160	40%	Throughout
String Quartet No. 6 (2010)	9	360	2.5%	Isolated: at the end (from bar 330)
Finis Terrae (2012)	14	206	6.8%	Section: mostly at the end (from bar 171)
Silentium (2013)	18	63	28.57%	Throughout
In nomine à 12 (2017)	20	55	36.36%	Throughout

Ferneyhough has a tendency to confine the placement of OFTSs to particular sections of a piece when the notational device constitutes less than 25% of the bars. Conversely, when OFTSs make up more than 25% of the piece, they pervade the work throughout. Therefore, it is curious that less than half of Ferneyhough's works with the

notational device feature pervasive use of OFTSs when he is one of the few high-profile composers who use it frequently.

Table 6.3 shows that *Superscriptio* and *Mort Subite* contain the highest proportion of OFTS bars of all the works featuring the notational device. *Superscriptio* is also the first piece in Ferneyhough's oeuvre where he uses OFTSs throughout the work. As it is an early solo piece, it provides an appropriate analytical contrast to the later chamber work of String Quartet No. 6, and there is potential to trace the evolution of Ferneyhough's rhythmic, metric, and pre-compositional processes in the comparison.

Table 6.3: The percentage of OFTS bars in all of Ferneyhough's works containing more than 3% of OFTSs.



In half of Ferneyhough's works containing OFTSs, he frames and explains the concept in either the performance or conductor's notes. These explanations differ slightly in wording from one piece to the next, but an example of the most oft-used description can be seen in the performance notes of *Etudes Transcendantales*:

> Unconventional metres (2/10, 6/12, 89/24 etc.) are preponderant in this work. The principle by which conventional metres are derived (as subdivisions of the semibreve) may be applied in every case. For example, 2/10 signifies a bar composed of two beats, each of which is equal to one tenth of a semibreve. All such 'irrational' metres in this work stand in either triplet or quintuplet relationship to the basic metre, and are thus proportionately faster than the latter (1/10 = 1/8 X 0.8). The new beat may be found by working out what proportion of the previous beat should be subtracted. While the overall tempo of the work may to some extent be regarded as a matter of choice, relationships between the tempi within must be strictly observed, and metre changes are to be interpreted precisely. Metronome markings always apply to normal quaver values, even when the first bar to which they apply has an 'irrational' metre.[315]

Note that Ferneyhough uses the term "'irrational' metre" in place of "irrational time signature" (the popularised term for OFTSs) to label the notational device; he does not refer to the musical concept of metre by this term. However, as established in chapter 1, since proportionality is fundamental to the discussion of OFTSs, when the word "metre" is used in this thesis, it refers to the actual concept of musical metre and is not used synonymously with "time signature".

The key points in the *Etudes Transcendantales* performance notes are: 1. The denominators of time signatures attribute specific subdivisions of the 𝅝 to the value of the beat; 2. Odd-factored metres are proportionately faster than their associated 'basic' (i.e. conventional) metres; and 3. The proportional relationships between the tempi of basic and OFTS bars must be strictly observed (even if the overall tempo of the piece may be contingent on personal preference). This last point is especially relevant as it speaks to the multi-functionality of OFTSs.

OFTSs are not only regarded as a notational device that dictates musical metre, or even surface rhythms, but they also affect tempo as well. To change the base tempo while imposing OFTSs will produce a compounded or possibly even nullified effect (depending on the change, as seen later with Example 6.22).

The idea of proportion is embedded in Ferneyhough's explanations of OFTSs: the proportion between the overall 𝅝 and the fraction beat value indicated by the

[315] Ferneyhough, *Etudes Transcendantales*, 6.

denominator; the proportion between OFTSs and basic time signatures; and the proportion between differing tempi. As previously discussed with Adès' works, OFTSs are primarily characterised by means of comparison: the comparison of pulse speeds between odd-factored and conventional time signature bars, as well as metric projection, overall bar duration, tempo, note values and groupings, and so on. Therefore, proportion is fundamental to the conception of OFTSs and is thus pivotal to Ferneyhough's explanations of the notational device.

String Quartet No. 6

Ferneyhough specifies in the performance notes of *Etudes Transcendantales* that his use of OFTSs in that piece are in triplet and quintuplet relationship to the conventional metre. Indeed, the overwhelming majority of the OFTSs throughout his oeuvre match this description. Therefore, there is an abundance of OFTS bars with the denominators ***10***, ***12***, ***20***, and ***24*** (which are all based on 3 or 5 and then multiplied by a power of 2; i.e. time signatures incorporating only one odd factor). As such, examples of any anomalous or rarely used denominators found in works such as String Quartet No. 6, *Carceri d'Invenzione III*, *Finis Terrae*, and *Silentium* are of particular interest and therefore worth analysing.

Ferneyhough's experimentation is evident in both the variety of OFDs he employs as well as his pre-compositional processes. With regard to the former, Ferneyhough tends to notate rhythms with very small note values such as 𝅘𝅥𝅯 , 𝅘𝅥𝅰 , and hemidemisemiquavers. As such, not only are ***16***-, ***32***-, and ***64***-denominators commonly found throughout his works, but any OFD that implies tuplet versions of such small note values is also employed.

Ferneyhough's experimentation through his pre-compositional processes is demonstrated in his own essays and writings, and the ways this is leveraged and applied to his works is examined in the chapter 8's *Mort Subite* case study.[316] He often uses pre-compositional constraints to 'restrict the situation in which [he has] to compose':[317]

[316] Benedict Weisser, "Notational Practice in Contemporary Music: A Critique of Three Compositional Models (Luciano Berio, John Cage, and Brian Ferneyhough)" (PhD dissertation, City University of New York, 1998), 7; as cited by Duncan, "The Concept of New Complexity," 16.
[317] Toop, "*Lemma-Icon-Epigram*," 53, 62.

> I try to set up one or more (usually many more) grids, or sieves, a system of continually moving sieves. . . . This fundamental, undifferentiated mass of volition, of creativity, is necessarily forced to subdivide itself in order to pass.[318]

As we undertake a brief analysis of the uses of OFTSs in Ferneyhough's String Quartet No. 6, it is important to note what makes this piece particularly exceptional amongst his oeuvre. As previously seen in chapters 3-5, Adès' musical textures correspond much more clearly and closely to the beats dictated by the time signature, because he generally places attacks on the implied pulses to sound them out, whereas Ferneyhough tends to obscure the implied pulse. However, this is not the case in String Quartet No. 6, where the pulses of all the OFTS bars are sounded out.

The OFTSs are isolated to the final section: the last 33 bars of the piece. Each of these OFTSs has a different denominator, and therefore there is no recurrence of any tuplet pulse speed as implied by an OFD. This is in stark contrast to Adès' practice of establishing a recurrent tuplet feel based on a particular OFTS pulse (as previously seen in *Traced Overhead* and *Piano Quintet*).

In String Quartet No. 6, Ferneyhough not only writes surface rhythmic attacks to sound out the implied pulse in OFTS bars, but he also prepares and/or continues the pulse speed before/after the OFTS bar. For instance, in Example 6.1, there are two OFTSs. The first is ***2/7*** in bar 330 with a pulse value of 𝅗𝅥. There is a 𝅗𝅥 in a conventional time signature bar on either side of bar 330 to prepare and then continue the 𝅗𝅥 pulse speed. The same is true of the ***5/18*** bar: it is preceded then followed by two triplet semiquavers at both ends.

These elisions of pulse speed blur the boundaries of the OFTS bars: the preparation and follow-through of these tuplet pulses would make the ***2/7*** bar sound like ***4/7***, and the ***5/18*** bar sound like ***9/18***. In turn, these elisions would also have implications on the durations of adjacent conventional time signature bars, making them seem shorter than they really are.

[318] Richard Toop, "Brian Ferneyhough in Interview," *Contact* no. 29 (Spring 1985): 5; as quoted in Toop, "*Lemma-Icon-Epigram*," 62.

Example 6.1: Ferneyhough, String Quartet No. 6 (bars 328-337), violin 1 line.[319]

Example 6.1 only includes the violin 1 line, as this is the only part that sounds out these implied pulses. This is also the only piece in Ferneyhough's oeuvre to contain the denominators ***7*** and ***18*** (which are factorised as 1 × 7 and 2 × 3 × 3 respectively). In fact, this is his only work to contain a variety of unique denominators, and these will be addressed as they are encountered.

The use of ***7*** as the first OFD is important as it immediately stands apart from Ferneyhough's typical usage of OFTSs (which are in triplet and quintuplet relationships with the conventional metre). Seven is the next prime number after five, and it is introduced in its simplest form before it is multiplied later. The ***5/18*** time signature is also distinctive, as ***18*** is the first OFD in the piece to have two different interpretations: either a direct $^{9}\!\!\!

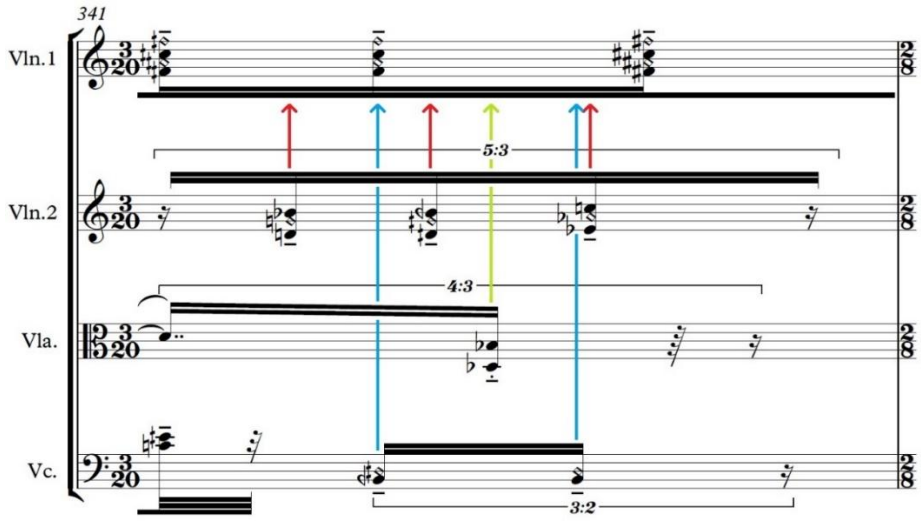
red boxes in Example 6.2). In the green boxes, both the violin 1 and cello lines play the $^{5}\!\!\!

Later in the documentary, he adds:

> I'm frequently asked about why I prefer to write string quartets to many other genres, and apart from the fact that I like doing it, there are other considerations at play, I think, which impinge upon the relationship of contemporary music to society. … The string quartet right from the beginning was always a much more subtle medium for the expression of social relationships: the old image of, you know, four civilised people talking to each other in terms that would not have been unfamiliar to philosophers of the Enlightenment. … it does seem to me there is something about the quartet which is inherently imbricated with what we understand human relationships to be on a highly-evolved level.[322]

The use of OFTSs and nested tuplets within such bars enhances this focus on relationships, as musicians are forced to conceptualise their rhythms in relation to one another. Example 6.3 shows the hocket-like nature of these rhythms as each performer relies on the coordination of the quartet to create the complex surface rhythm:

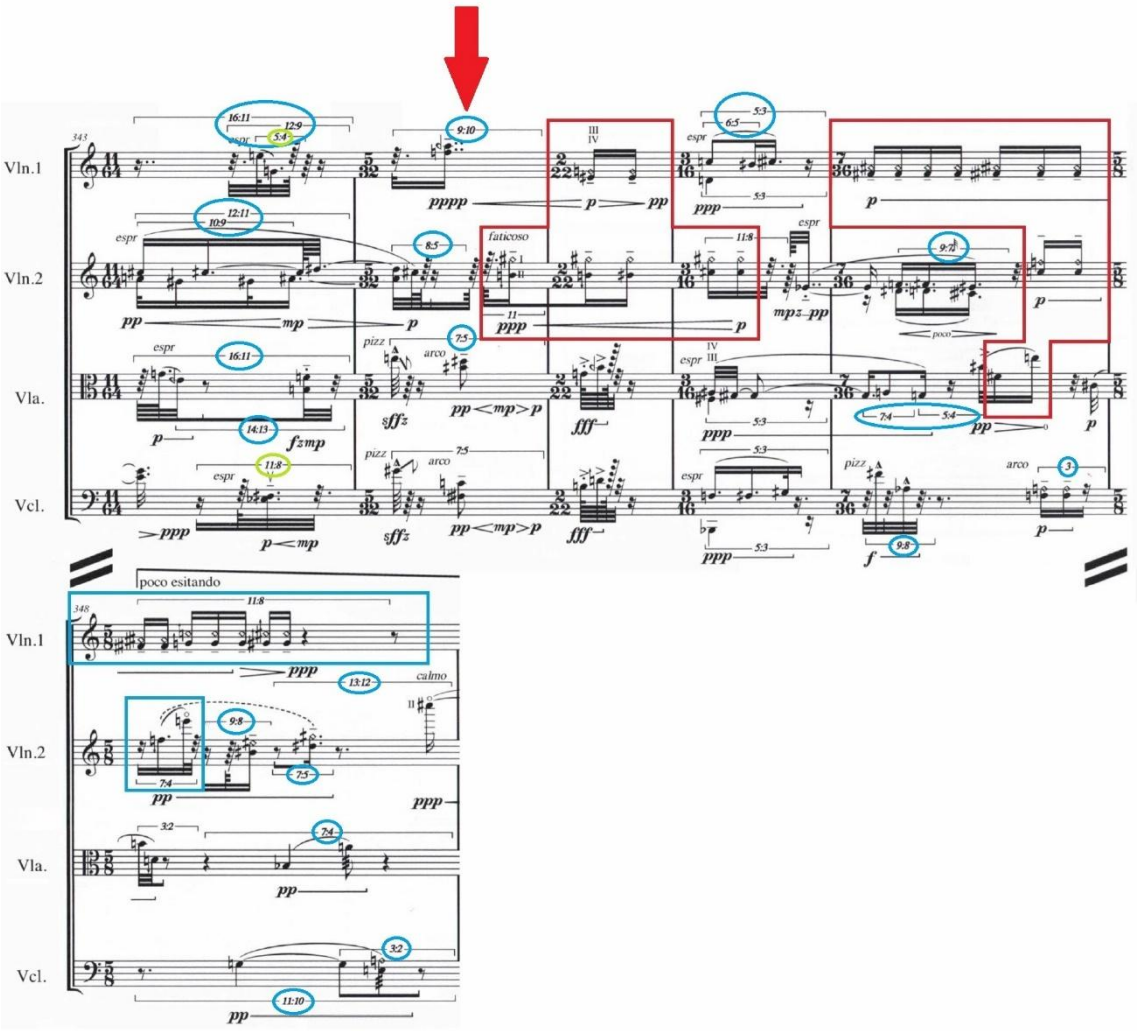
Example 6.3: Ferneyhough, String Quartet No. 6 (bar 341).[323]



The next two OFTSs appear in bars 345 and 347 (see Example 6.4). Again, across Ferneyhough's entire oeuvre, these particular denominators of ***22*** and ***36*** are only found in this piece. Both of these instances are noteworthy but in different ways. Looking at the latter denominator first, the ***7/36*** bar likely involves a notational error.

[322] Ibid.
[323] Ferneyhough, String Quartet No. 6, 33.

Example 6.4: Ferneyhough, String Quartet No. 6 (bars 343-348).[324]



The ***36***-denominator should have a similar treatment to ***18*** from bar 334, as they both involve the interpretational ambiguities associated with ***9***-denominators. As Ferneyhough chose the direct interpretation for ***18***, he should have also used the direct interpretation of $^{9}\!\!\!

of this final section: it is the middle occurrence of the OFTSs (i.e. the fifth of nine OFTS bars). This kind of patterning is a characteristic Ferneyhough device.

The preparation and continuation of the ***2/22*** odd-factored pulse streams are spread across multiple instruments, similar to previous instances of OFTS bars. However, the *faticoso* direction has been omitted in Example 6.4 and does not apply to any future OFTS bars. This excerpt contains the turning point in this final section of the work (i.e. the middle portion of bars 328-360). The ***5/32*** bar 344 (see the arrow annotation) is the midpoint, and it is flanked by bars with the time signatures ***11/64*** and ***2/22***: the former is the only bar in this final section with a ***64***-denominator, which is the largest numerical conventional denominator in this section; and the latter, as previously mentioned, is the middle occurrence of OFTSs.

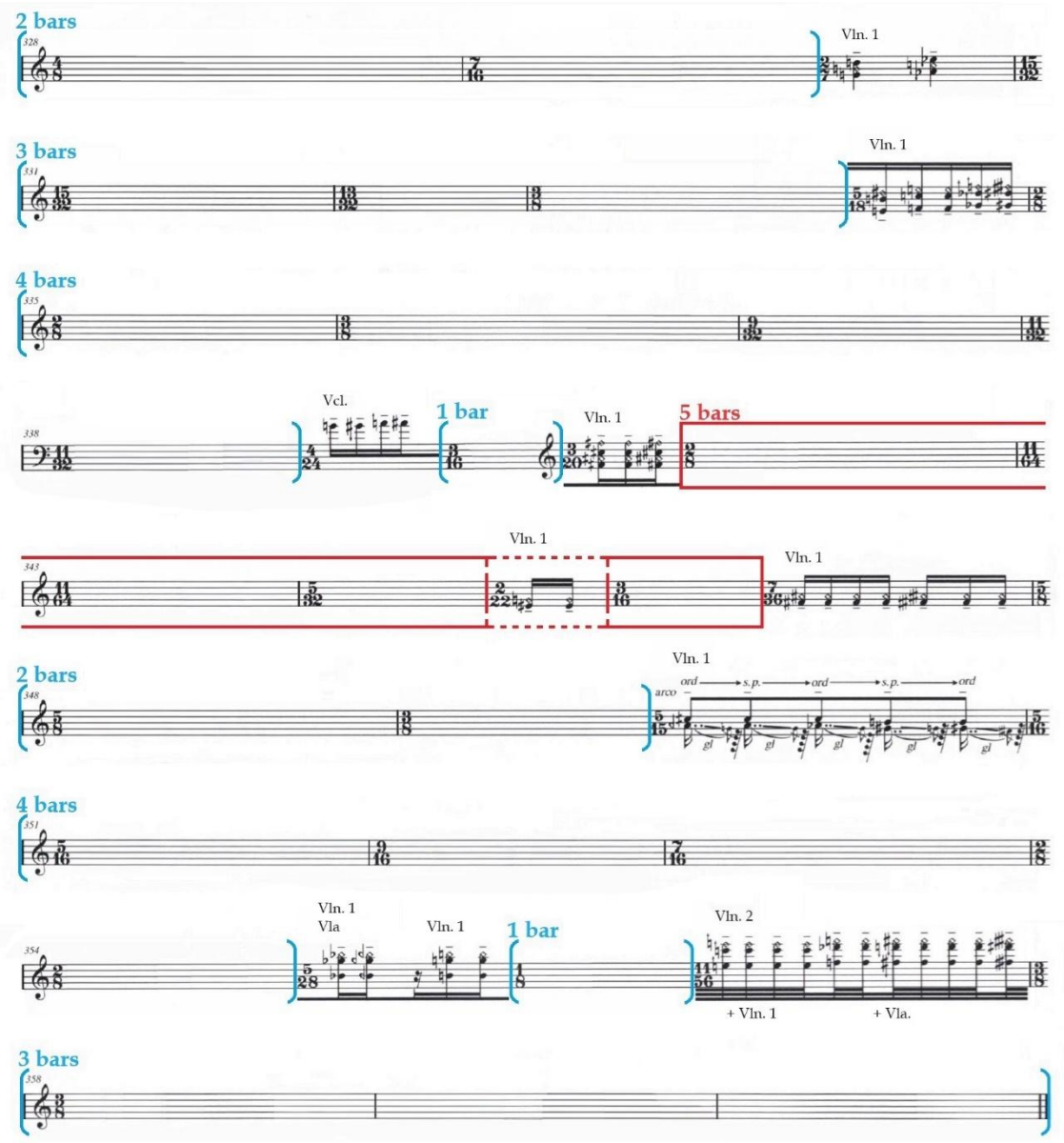
To see the structure of this final section more easily, refer to Example 6.5, where bars 342-346 are annotated in red to show the middle five bars. Aside from the time signatures and bar lines, almost all other information has been excised from this example. The instrumental parts that articulate the pulse of OFTS bars have been included to highlight where the OFTSs are located. In bars such as 355 and 357, not all attacks are played by all instruments listed, so the labels explicate which instrument is playing specific attacks. As it is, the majority of the pulse articulations are found in the violin 1 part. The blue annotations detail how many conventional bars there are between each OFTS (with the exception of the red annotation, which includes the ***2/22*** bar and has already been addressed).

The red box in Example 6.5 does not coincide with Example 6.4. The red box in Example 6.5 shows the middle segment of this final section, and the annotation is framed by the OFTSs ***3/20*** and ***7/36*** bars. This middle 5-bar unit seems analytically tenuous, as it includes an OFTS bar. However, the reason for this grouping is because there seems to be a type of mirroring effect and permutation procedure imposed on these five bars. The middle bar, which is the reflection point of this 5-bar unit, has a ***5*** as the numerator.

As previously addressed, the ***11/64*** and ***2/22*** bars that flank it are distinctive in their own right, but in the context of this grouping, the ***11***-numerator of the ***11/64*** time signature is reflected in the ***22***-denominator of ***2/22*** (as 22 is a multiple of 11). With regard to permutation, each denominator is different in this unit, and the unit would be in descending order of bar length if not for the ***3/16*** bar being reordered to the end (i.e.

from longest to shortest bar length, it should have been ordered ***2/8***, ***3/16***, ***11/64***, ***5/32***, ***2/22***).

Example 6.5: Ferneyhough, String Quartet No. 6 (bars 328-360), selected parts with omissions.[325]



From the uncluttered view afforded by Example 6.5, Ferneyhough is clearly preoccupied with processes of ordering and permutation. In the first half, before the red box, the number of conventional time signature bars to fall between each OFTS is 2, 3, 4, then 1. The midpoint is encapsulated by a distinct 5-bar segment. Then, in the second half, he reorders the number of conventional time signature bars between each OFTS to be 2, 4, 1, then 3.

[325] Ferneyhough, String Quartet No. 6, 32-35.

On a structural level, the groups of conventional time signature bars would have been ordered from 1 to 5 to 1 again, but Ferneyhough has rearranged this order while maintaining the central placement of the 5-bar segment. This process-driven structuring of the final section of the piece is emblematic of Ferneyhough's tendency to engage in pre-compositional processes in general, and he explained his particular process for this work in *Climbing A Mountain*:

> I had been working with what you might call a "sausage slicer" technique where the length of sections would be pre-determined: the rhythmic structure, the instrumentation, and general dramatic flow of each of these sections would be determined but that the other elements which go to make up the musical discourse would not then in advance be determined to the same degree. So, I was working very much on a sort of section-to-section basis and these sections was *[sic]* very small.[326]

Thus, when returning to Example 6.4 and examining the blue-circled tuplets used around the turning point of bar 344, the processes of ordering and permutation are indeed present. In the ***11/64*** bar, the majority of the tuplets are expressed as even-numbered in the time of an odd number (e.g. the ***16:11***- and ***12:9***-tuplets found in the violin 1 line). The two exceptions circled in green are ***5:4***- and ***11:8***-tuplet brackets, which will be encountered in later bars: the former in bar 347 and the latter in bar 346.

Then there is a decrease of tuplet numerical value in the ***5/32*** bar when observing from highest- to lowest-pitched instrument: the nonuplets in the violin 1 line decrease to octuplets in the violin 2 line, which decrease to septuplets in the viola and cello lines (i.e. transitioning from ***9***- to ***8***- to ***7***-tuplets). Although this ordering of tuplets does not necessarily translate to a slower or faster pulse speed since the tuplet brackets span across different overall durations, the numerical ordering is still notable, particularly when it continues to the nested sextuplet and universal quintuplet brackets in the ***3/16*** bar (i.e. ***6***- and ***5***-tuplets). Bars 347-348 are then preoccupied with odd-numbered tuplets as though in response to or mirroring the even-numbered tuplets of bar 343.

It is important to note that none of these tuplets can be felt in the way the pulses of the OFTS bars are articulated. There are so many rests, ties, dotted notes, and notes of very short duration (e.g. hemidemisemiquavers) that it is highly unlikely that these

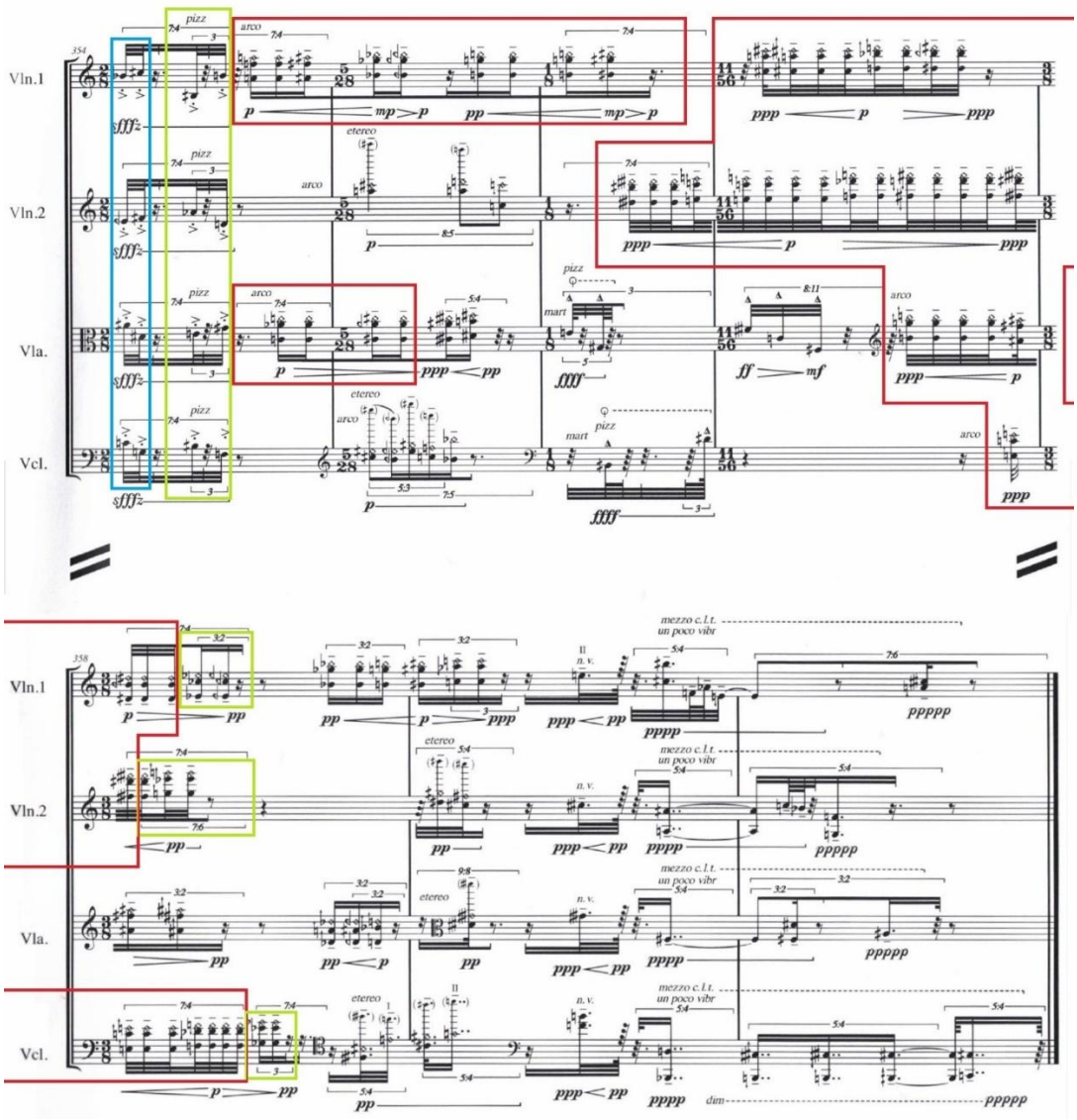
[326] SchAdvStudy, "Documentary."

tuplets would be particularly discernible. The notation of these tuplets and the permuting patterns are far more understandable in light of Ferneyhough's pre-determined rhythmic structure for the benefit of the performer/reader.

The next OFTS encountered is ***5/15*** in bar 350. This is the only instance in this work where nested tuplets of different values are implied by the OFD: ***15*** could be expressed as either universal $^{3}\!\!\!

denominators. Although rare, Ferneyhough does use ***56*** as a denominator in one other work: *Carceri d'Invenzione III*. However, the ***28***-denominator is unique to String Quartet No. 6. As the ***56***-denominator implies double the pulse speed of the ***28***-denominator, there is a sense of an extended septuplet pulse across bars 354-358, especially when the elision of the ***7:4***-tuplet brackets of the ***1/8*** bar in both violin lines enables a smooth transition into the 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 pulse.

Example 6.7: Ferneyhough, String Quartet No. 6 (bars 354-360).[328]

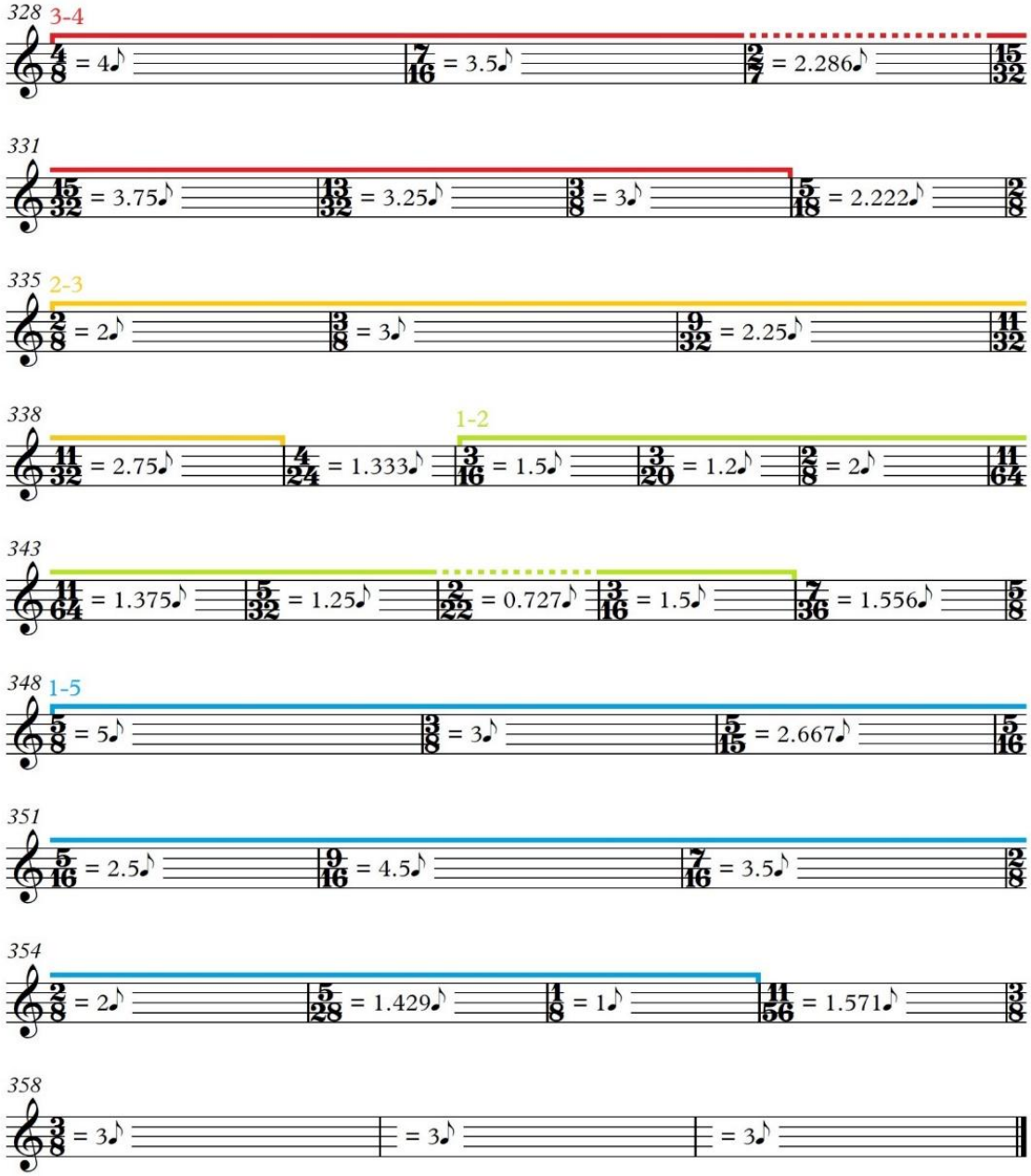


The blue box in bar 354 highlights an early anticipation of the 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯, and it is separated by the first green box, which features a nested triplet. These nested tuplets within septuplets appear again in bar 358 after the odd-factored pulse has been articulated (see the other green boxes). The violin 1 and cello lines both contain nested triplets within septuplets, but violin 2 features the nested septuplet within a septuplet,

[328] Ferneyhough, String Quartet No. 6, 35.

initially seen in the cello of the ***5/28*** bar and also reminiscent of the nested triplets within triplets as implied by the denominators of bars 334 and 347 (see Examples 6.1 and 6.4).

Example 6.8: Ferneyhough, String Quartet No. 6 (bars 328-360), reduction.



As previously mentioned, there are underlying processes of ordering and permutation affecting the structure of this final section.[329] In Example 6.8, each bar's duration has been expressed in terms of number of ♪ (durations not easily rationalised have been rounded to three decimal places). Each coloured bracket delineates a number

[329] Ferneyhough has grouped non-OFTS bars in similar ways in other works: see Toop, "*Lemma-Icon-Epigram*," 80.

of bars that vary in bar duration within a particular range, but the order of the bar lengths is permuted.

All the non-OFTS bars in the red bracket vary in length between 3 and 4 ♪, and they would be ordered from longest to shortest duration if only the 3.5 and 3.75 bar lengths were switched. All bars in the yellow bracket vary in length between 2 and 3 ♪, and the order would be shortest to longest if only the ***3/8*** bar was moved to the end. All the non-OFTS bars in the green bracket vary in length between 1 and 2 ♪ ; the permutation is more marked in this green segment, and it does not contain a ***1/8*** bar as would be expected. All bars in the blue bracket vary in length between 1 and 5 ♪, and interestingly, even the OFTS bars are within this range. The bars in the blue bracket are also organised in two accelerating segments: 5 to 2.5 ♪ (bars 348-351) and 4.5 to 1 ♪ (bars 352-356).

When examining these ranges of bar duration, there is a semblance of the permutation found in Example 6.5. In Example 6.5, the passage is divided into two halves, both of which have permutations of 1-4 bars of conventional time signatures separating the OFTSs; here in Example 6.8, the smaller ranges of bar durations are 3-4, 2-3, and 1-2 ♪ (i.e. between 1-4 ♪ in length). In Example 6.5, the segment dividing the passage consists of five bars; in Example 6.8, the final blue bracket spans 1-5 ♪ of bar durations. The permutation of bar durations is established in multiple layers in this final section.

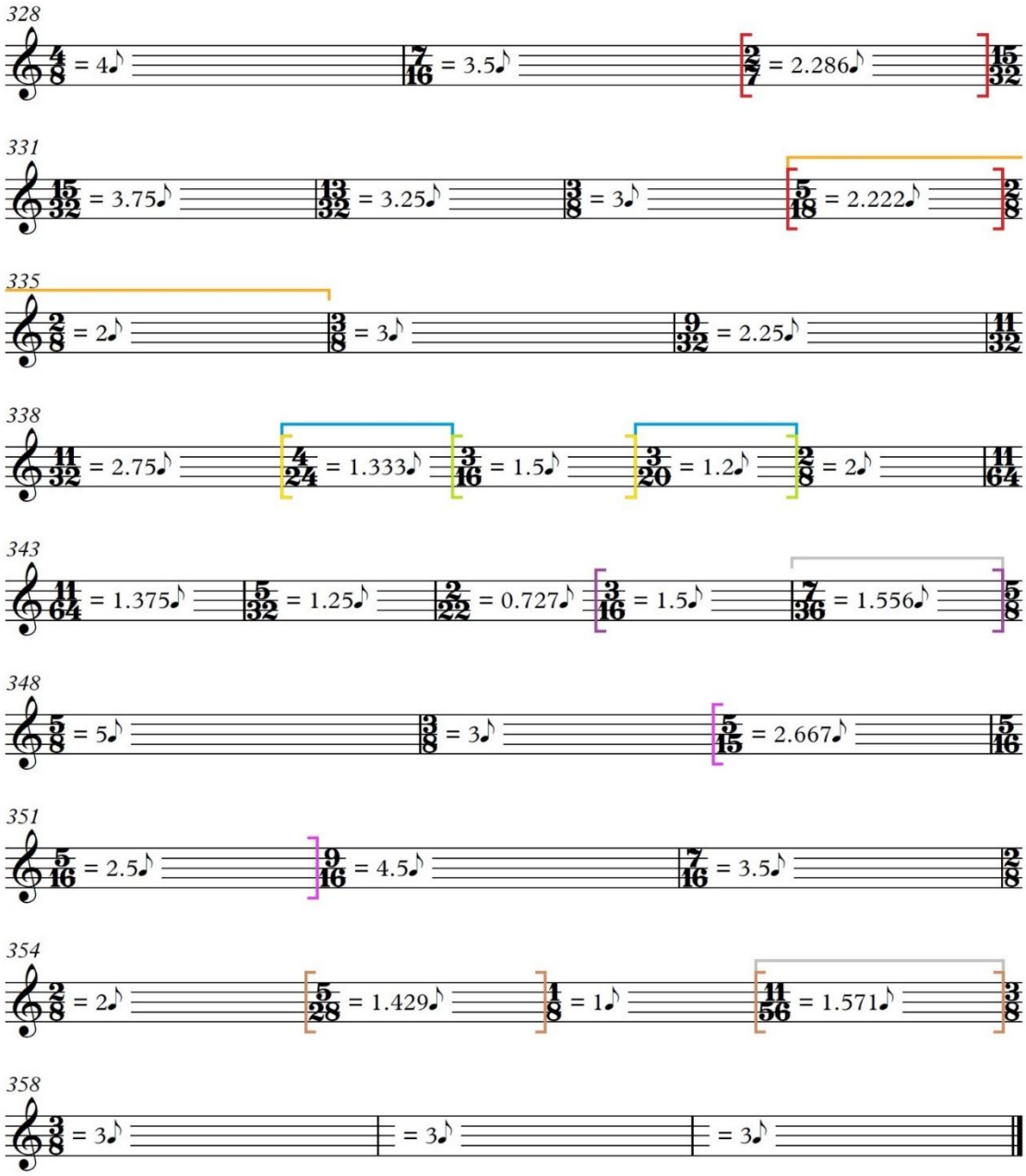
Apart from permutation processes, Ferneyhough also expresses a preoccupation with approximation approaching durational equivalence. Irvine Arditti explained in *Climbing A Mountain*:

> Brian's music is very much about harmony and the melodic lines and microtonal inflections. In so many of the pieces, one has to really look very carefully at what the notes are. This is playing around with certain key pitches, and one note is a microtone above, then you have a normal note, and microtone below, the semitone below, and then microtones around that. And these inflections, I think, are really important in the interpretation of his music to do them accurately.[330]

[330] SchAdvStudy, "Documentary."

This idea of 'playing around with certain key pitches' arguably extends to "playing around" with durations (specifically bar durations, whereby Ferneyhough uses different time signatures to achieve bar lengths of approximate duration, as demonstrated in Example 6.9). As all conventional time signatures have denominators that are powers of two, the relationship between conventional denominators will always be at a ratio with base-2 values or achieve exact equivalence.

Example 6.9: Ferneyhough, String Quartet No. 6 (bars 328-360), reduction.



For example, the ratio between the denominators ***8*** and ***32*** will be a base-2 ratio of 1:4, and the ***4/8*** of bar 328 will be exactly the same duration as a ***16/32*** time signature (which is not found in this passage). Therefore, it is not a coincidence that all the

"approximations" in this passage involve at least one OFTS, and they can all be expressed in the ratio relationships seen in Table 6.4.

Note that the red, blue, and brown brackets in Example 6.9 highlight OFTS "pairs" where the OFTSs are close to each other. The other brackets annotate adjacent bars (i.e. comparing an OFTS to a conventional bar length) except for the grey bracket; the ***7/36*** and ***11/56*** bars are compared because they immediately precede and follow the blue bracket of Example 6.8 (which features bar lengths of varying durations between 1-5 ♪).

Table 6.4: Ratios of all brackets in Example 6.9.

Coloured Brackets	Time Signature (Bar Number)		Ratio	
			Bar Duration in Quavers	Simplified
Red	***2/7*** (330)	***5/18*** (334)	2.286 : 2.222	36:35
Orange	***5/18*** (334)	***2/8*** (335)	2.222 : 2	10:9
Yellow	***4/24*** (339)	***3/16*** (340)	1.333 : 1.5	8:9
Green	***3/16*** (340)	***3/20*** (341)	1.5 : 1.2	5:4
Blue	***4/24*** (339)	***3/20*** (341)	1.333 : 1.2	10:9
Purple	***3/16*** (346)	***7/36*** (347)	1.5 : 1.556	27:28
Pink	***5/15*** (350)	***5/16*** (351)	2.667 : 2.5	16:15
Brown	***5/28*** (355)	***11/56*** (357)	1.429 : 1.571	10:11
Grey	***7/36*** (347)	***11/56*** (357)	1.556 : 1.571	98:99

Apart from the green brackets, all the other bars are close approximations of one another; this is especially true of the grey ratio, where the bar lengths are almost exactly equivalent. The bars of the 5:4 green bracket ratio are included because they underwent a similar process to the pink-bracketed bars, where the numerators of the adjacent bars are shared and the denominators are only slightly modified (i.e. the green-bracketed ***3/16*** and ***3/20*** compared with the pink-bracketed ***5/15*** and ***5/16*** time signatures). These processes of approximation and equivalence will return in the next chapter's discussion of *Superscriptio*.

String Quartet No. 6 illuminates how the proportionality of different bar durations which are not easily commensurable within a regular metrical framework is fundamental to the conception of Ferneyhough's pre-compositional processes relating to the use and placement of OFTSs. The permutation processes established across multiple layers of the musical structure highlight various comparisons between the conventional and OFTS bars: much of the structuring revolves around the sections of

conventional time signatures; and the OFTS bars are used to delimit these sections and are considered exceptional in this regard. The approximation processes specifically pertain to the duration of OFTS bars and how they relate to each other and to conventional bar lengths. The concepts of comparison, relationships, and proportionality are essential to Ferneyhough's use of OFTSs.

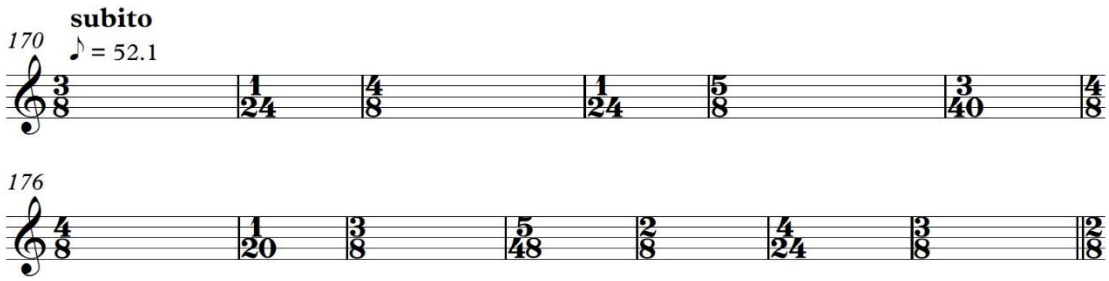
Other Works Featuring Rare Denominators

Just as String Quartet No. 6 provides significant insights into Ferneyhough's processes through its use of anomalous OFDs, a few other works featuring outlying time signatures should also be briefly discussed: *Finis Terrae*, *Silentium*, and *Carceri d'Invenzione III*. These are the only three works in Ferneyhough's oeuvre to feature ***14***-denominators.

Finis Terrae

Finis Terrae is a large vocal and instrumental ensemble piece, and it is similar to String Quartet No. 6 in three key ways: 1. Almost all of its OFTSs are confined to the final section of the work; 2. It features a couple of rarely seen denominators, one of which is unique to *Finis Terrae*; and 3. There is a preoccupation with ordering, patterns, and permutation in the structure and pre-compositional processes. Some excerpts from *Finis Terrae*, such as Example 6.10(a), have omitted all musical information except the time signatures to better elucidate the structure of each passage.

Example 6.10(a): Ferneyhough, *Finis Terrae* (bars 170-182), with omissions.[331]



Finis Terrae has a total of 206 bars, but almost all the OFTSs are found in the final section, from bar 171 onwards. In Example 6.10(a), conventional time signatures alternate with OFTSs. The conventional time signature bars are patterned to increase then decrease in bar duration (e.g. going from ***3/8*** to ***5/8***, then back down to ***2/8***, before

[331] Ferneyhough, *Finis Terrae*, 35-36.

an exceptional slight uptick back to ***3/8***). Meanwhile, the OFTS denominators have triple or quintuple relationships with the conventional time signatures.

The OFTSs feature a doubling pattern in their denominators and therefore a halving pattern of the pulse speeds. The $^{3}\!\!\diamond$ pulse implied by the ***24***-denominator is halved to become $^{3}\!\!\diamond$, which is implied by the numerically doubled denominator of ***48***. The $^{5}\!\!\diamond$ implied by the ***20***-denominator is halved in duration to become $^{5}\!\!\diamond$ as inferred by the numerically doubled ***40***-denominator. The numerators of the OFTSs would be a permutation of ***1-5*** except there is no "***2***". This may potentially explain why there are two ***1/24*** time signatures towards the beginning to imply ***2/24***, so it is speculated that the numerators of the OFTSs have been reordered to be [***2***]-***3-1-5-4***.

Much like he did in String Quartet No. 6, here Ferneyhough articulates the pulse of the OFTS bars and often prepares or continues these bars with further sounded attacks of the same tuplet duration. However, as there are substantially more vocal and instrumental lines compared to the string quartet, the surrounding tuplets played or sung by other parts greatly muddy these attacks, often making them difficult to discern as the actual pulse articulations of the time signature in the midst of surface rhythmic ambiguity.

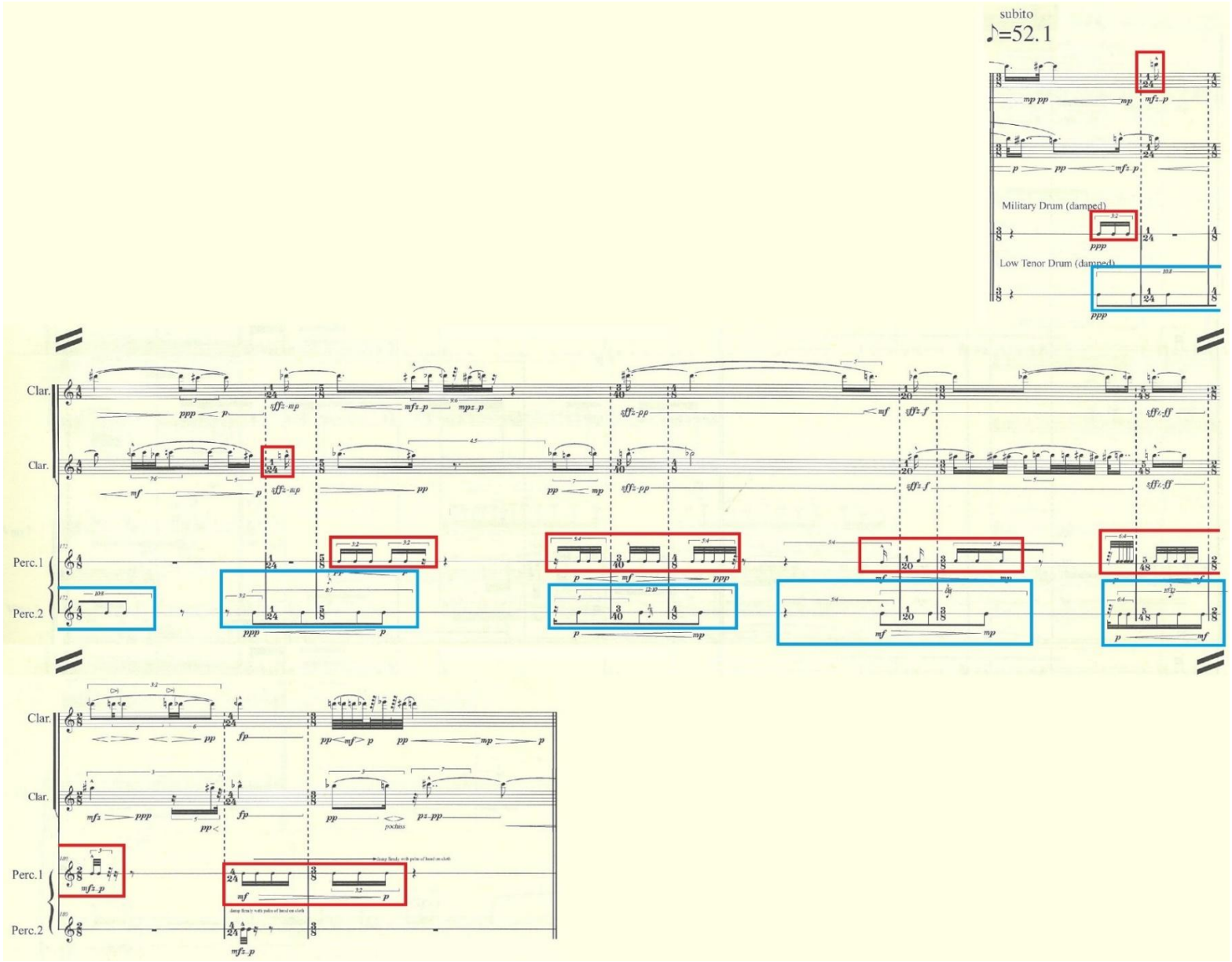
The lines of clarinets 1 and 2 as well as percussion 1 and 2 are featured in Example 6.10(b); this is the same passage as Example 6.10(a) with the surface rhythms now included. The articulations of the tuplet pulse of OFTSs are boxed in red and are mostly carried by the percussion 1 line. The other parts omitted from this example (the flute, oboe, and violins 1 and 2) generally play in rhythmic unison with either clarinet 1 or 2 during the OFTS bars, so their inclusion was deemed unnecessary. The blue boxes highlight the counter-rhythm consistently played in the percussion 2 line against the odd-factored pulse, thus obscuring it and its significance.

The notation of the percussion 2 line is difficult to decipher upon first inspection, and the following discussion regarding Example 6.10(b) was drawn from a conversation with Elliott Gyger in a supervision meeting. This difficulty is partly due to the notational errors throughout the percussion 2 line: it often omits the necessary rest notation needed to account for the remaining duration of some bars. In bar 172, a triplet quaver rest should be inserted after the ***10:8***-tuplet. With bars 174, 176, and 178, the rests notated in the percussion 1 line should also be included in the percussion 2 line.

The percussion 1 part anchors the percussion 2 line. In fact, percussion 1 rhythmically and metrically anchors all the other instruments throughout this excerpt. With the exception of bar 172, percussion 1 consistently anticipates the pulse speed of the OFTS bars by playing the tuplet pulse before the associated OFTS bar, thus rhythmically preparing all other instruments for their coordinated attack on the downbeat of each OFTS bar. Furthermore, apart from bar 171, percussion 1 always articulates the pulse of the OFTS bar and continues it after the OFTS bar. This is the same technique used in String Quartet No. 6, where Ferneyhough prepares and continues an OFTS's tuplet pulse.

So, when reading the percussion 2 line, its rhythms are in direct reference to the percussion 1's tuplet pulses. For example, with bars 170-172, percussion 2 has a ***10:8***-tuplet, which refers to 10-in-the-time-of-8 $^{3}\!\!\!

Example 6.10(b): Ferneyhough, *Finis Terrae* (bars 170-182), selected parts.[332]



[332] Ibid.

However, although the rhythms Ferneyhough attempts to write go against the notation in Example 6.10(b), it is also inconceivable *without* the notation, because there is no other way one could capture all the parts simultaneously and coherently within a metrical framework. To demonstrate, Example 6.10(c) is a renotation of both percussion lines with alternating bars of rests and notes. The original percussion 1 line, along with the original time signatures and bar lines, has been preserved in the top staff for ease of comparison.

Example 6.10(c): Renotation of the percussion lines of Example 6.10(b).

Bars 174 and 178 of the renotation are especially complex with ***120***- and ***240***-denominators, which do not provide particular aid in reading the rhythms or durations as they are impractically small pulse units. The complexity of the notation in bars 170-182 demonstrates the limitations but also necessity of such notational processes and invites future innovation to resolve these discrepancies.

A few bars later, there is a new section with a different pattern involving OFTSs: bars 188-200 are a development of the previous section, where OFTSs alternate with conventional time signatures. This time, though, OFTSs generally alternate with conventional time signature *pairs*. Also, there is again an increase then decrease of conventional time signature bar lengths (transitioning from ***2/8*** to ***5/8***, then back to ***2/8***). However, in this instance, when the conventional bar lengths increase, each pair is interpolated with a ***32***-denominator bar.

The patterns of time signatures can be analysed as follows:

1. As previously established in Example 6.10(a):
   a) Conventional time signatures increase then decrease.

2/8	***3/8***	***4/8***	***5/8***	***4/8***	***3/8***	***2/8***

   b) Conventional time signatures alternate with OFTSs (replicating the previous pattern seen in bars 170-182).

O	***2/8***	O	***3/8***	O	***4/8***	O	***5/8***	O	***4/8***	O	***3/8***	O	***2/8***

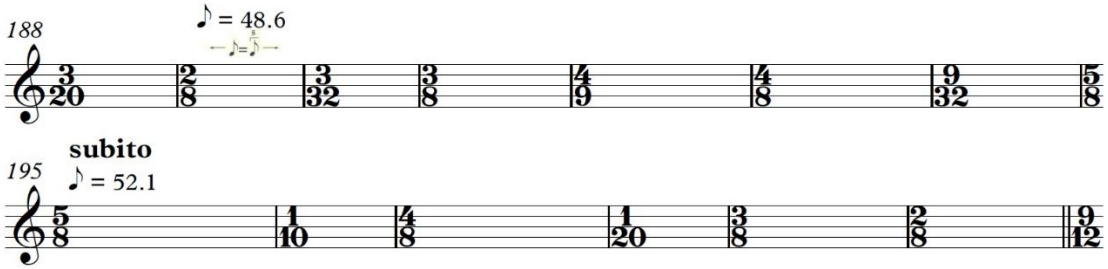
2. For the passage under consideration, bars 188-200, this pattern is elaborated by two further steps:
   a) Pairs of conventional time signature bars alternate with OFTSs (with the exception of the second ***4/8*** bar 197, which does not pair with another conventional time signature).

3/20	***2/8***	***3/8***	***4/9***	***4/8***	***5/8***	***1/10***	***4/8***	***1/20***	***3/8***	***2/8***

   b) As conventional time signature bars increase in duration, the pairs are interpolated with ***32***-denominator time signatures.

3/20	***2/8***	***3/32***	***3/8***	***4/9***	***4/8***	***9/32***	***5/8***	***1/10***	***4/8***	***1/20***	***3/8***	***2/8***

Example 6.11(a): Ferneyhough, *Finis Terrae* (bars 188-200), with omissions.[333]



[333] Ferneyhough, *Finis Terrae*, 37-38.

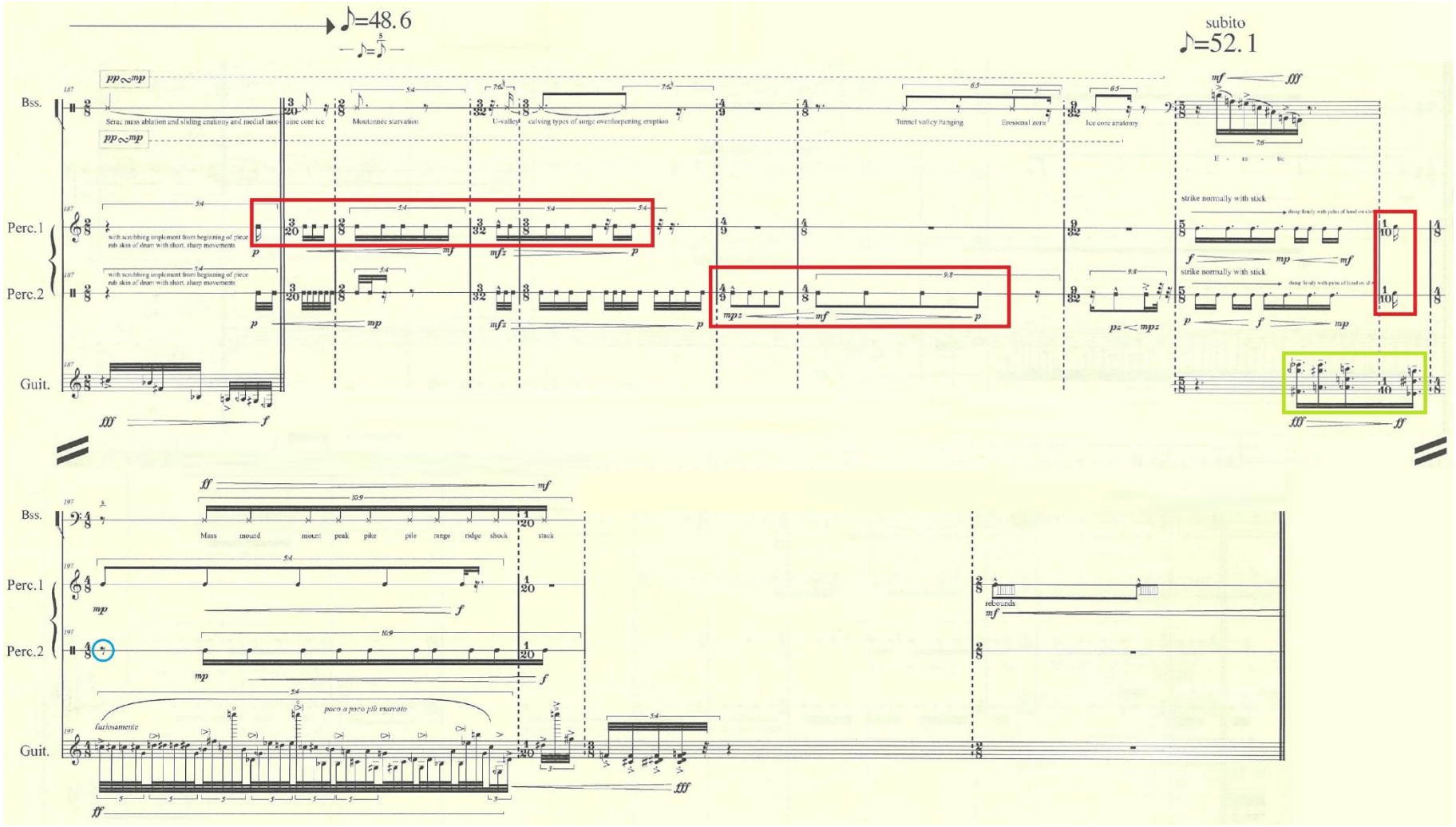
This is the only instance of ***9*** being used as an OFD in Ferneyhough's oeuvre, making this passage unique. The other OFDs are based on quintuplet pulses, so it is curious that a ***9***-denominator is used in bar 192 to imply $^{9}\!\!\diamond$ which are ***9:8***-tuplet $\diamond$, as confirmed in the following bar 193 when the $\diamond$ have a ***9:8***-tuplet bracket as seen in Example 6.11(b). They are not $^{3}\!\!\diamond$ which are instead derived from nested $^{3}\!\!\diamond$; i.e. ***9:4***-tuplet $\diamond$.[334] Examining the progression in bars 191-193, the bar lengths gradually lengthen from ***3/8*** to ***4/8***: bar 191 has a duration of 3 $\diamond$, followed by approximately 3.556 $\diamond$ in the ***4/9*** bar 192, then 4 $\diamond$ in bar 193. The three bars are at a 27 : 32 : 36 ratio.

The tempo change at bar 195 marks the halfway point of this segment, signalling the decrease in conventional time signature bar lengths as well as the absence of the ***32***-denominators until the end of bar 200. Initially in the first half of the excerpt, the percussion 1 and 2 lines articulate the tuplet pulses of the ***3/20*** and ***4/9*** OFTSs (see the red boxes in Example 6.11(b)). In both percussion lines, a direction is given at bar 187 that they are to play 'with scrubbing implement from beginning of piece[;] rub skin of drum with short, sharp movements'. With this direction in mind, it is debatable how easily the pulse articulations will be heard, especially when five of the six voices are speaking text in rhythms that do not align with the percussion (see Example 6.11(c)).

Unfortunately, when the surface rhythms are examined in the score of Example 6.11(b), several notational errors are introduced, and these further obscure Ferneyhough's intended rhythms.[335] The guitar rhythms of bars 195-196 (see the green box) do not equate to ***5/8*** and ***1/10***. This is because the $\diamond$. durations in bar 195 continue into bar 196, but if this was the case, a conventional dotted crotchet rest added to four $\diamond$. would be equal to a ***6/8*** bar, not the duration of ***5/8*** and ***1/10*** (which is 0.2 $\diamond$ shy of a ***6/8*** bar). It is possible that the durations in the ***1/10*** bar are inflected by the OFD, but that would result in unevenly spaced events, which is improbable due to Ferneyhough's painstaking notation of the percussion 2's evenly-spaced rhythmic onsets in the earlier bars 170-182 (see Example 6.10(b)).

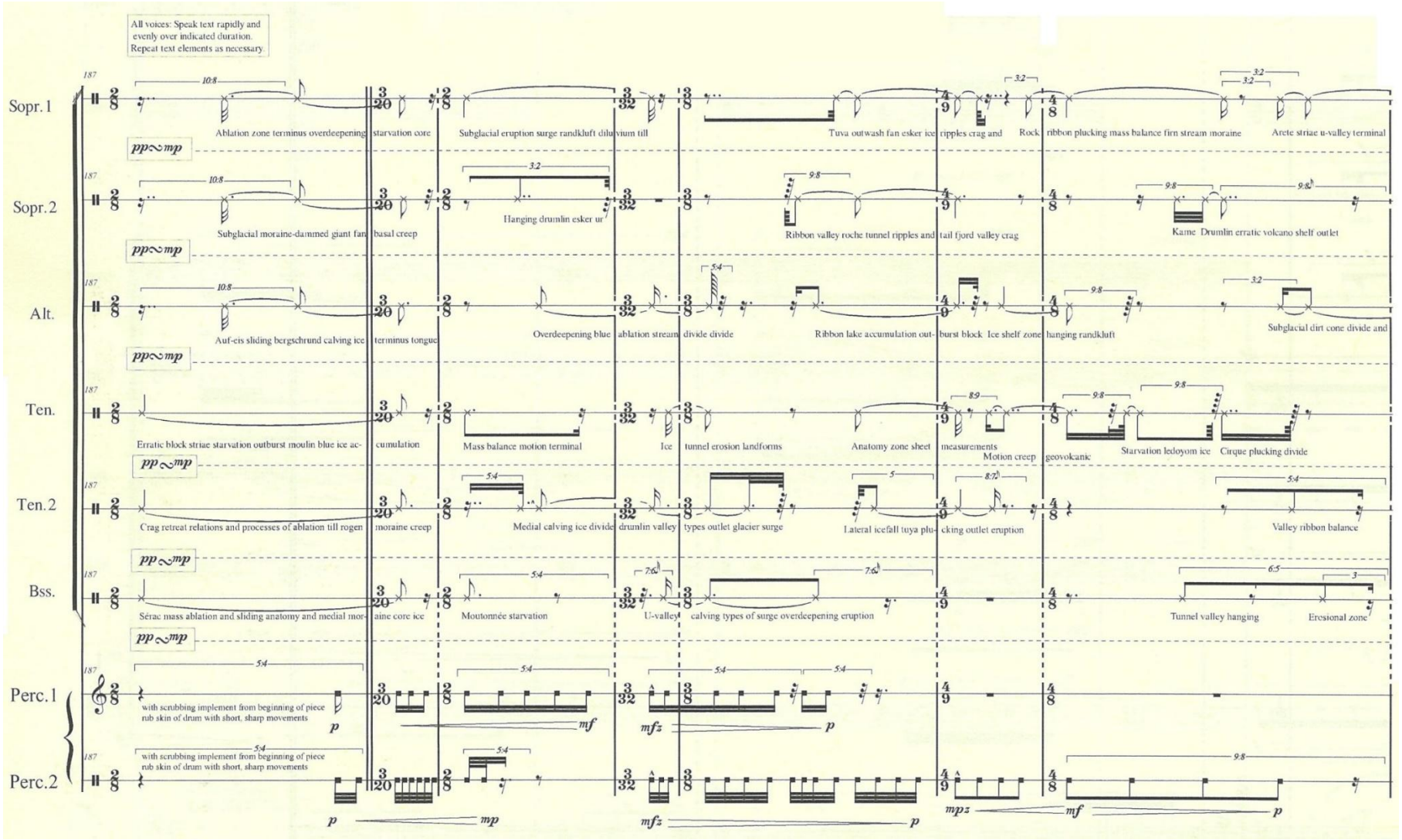
[334] For more information on the difference between ***9:8***-tuplet $\diamond$ vs ***9:4***-tuplet $\diamond$, refer to the discussion surrounding ***9***-denominator OFTSs in chapter 2, specifically regarding Example 2.23.
[335] Key, "Pan-Rational," 265-266.

Example 6.11(b): Ferneyhough, *Finis Terrae* (bars 187-200), selected parts.[336]



[336] Ferneyhough, *Finis Terrae*, 37-38.

Example 6.11(c): Ferneyhough, *Finis Terrae* (bars 187-193), voices and percussion lines.[337]



[337] Ferneyhough, *Finis Terrae*, 37.

The guitar's final 𝅘𝅥𝅯. in the ***1/10*** bar is not equivalent to a conventional 𝅘𝅥𝅯. but rather a straight 𝅘𝅥𝅯 tied to a quintuplet quasihemidemisemiquaver (i.e. a 1/160th note, or a quintuplet 1/128th note). These two bars could be renotated as demonstrated in Example 6.11(d) where the actual rhythm is complexly notated in the main staff while a smaller "i.e." staff shows the intended rhythm (similar to the strategy Adès employs in his second *Mazurka* for piano).[338]

Other notational errors in Example 6.11(b) include the ***1/10*** bar, where percussion 1 and 2 should play a 𝅘𝅥𝅯, not a 𝅘𝅥𝅯. At the beginning of bar 197, the bassoon's quaver rest has a quintuplet bracket over it; the percussion 2 quaver rest at the same point should also have that quintuplet bracket (see the small blue circle).

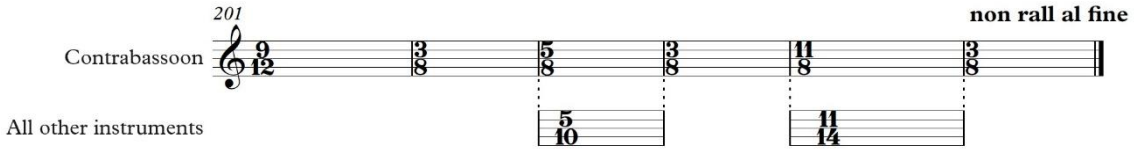
Example 6.11(d): Renotation of the guitar lines in bars 195-196 (i.e. the green-boxed annotation in Example 6.11(b)).

In the last six bars of the piece, OFTSs alternate with ***3/8*** bars (see Example 6.12(a)). There are two different permutation procedures imposed on the numerators and denominators of the OFTSs: with the numerators, they are ordered to be ***9-5-11***, omitting ***7***; with the denominators, the expected ascending order of ***10-12-14*** is rearranged to ***12-10-14***. The reason for this is to enable an acceleration of pulse speed, going from triplet to quintuplet to septuplet 𝅘𝅥𝅯.

When the conventional time signatures are included, all numerators are odd-numbered and all denominators are even-numbered. This is not particularly surprising, because even-numbered numerators would be simplified to result in the prime-numbered numerators seen in Example 6.12(a), and Ferneyhough does not use many odd-numbered denominators due to his propensity to use small rhythmic note values.

[338] Adès, *Mazurkas for Piano*, 4.

Example 6.12(a): Ferneyhough, *Finis Terrae* (bars 201-206), with omissions.[339]



The original score of bars 201-206 (see Example 6.12(b)) contains a peculiarity where the contrabassoon has conventional time signatures in bars 203 and 205 while all the other instruments have OFTSs. This is reproduced in Example 6.12(b). When examined with the surface rhythms as in Example 6.12(b), those bars in the contrabassoon consist entirely of rests. Due to this, it is likely that the conventional time signatures of ***5/8*** and ***11/8*** were misprints.

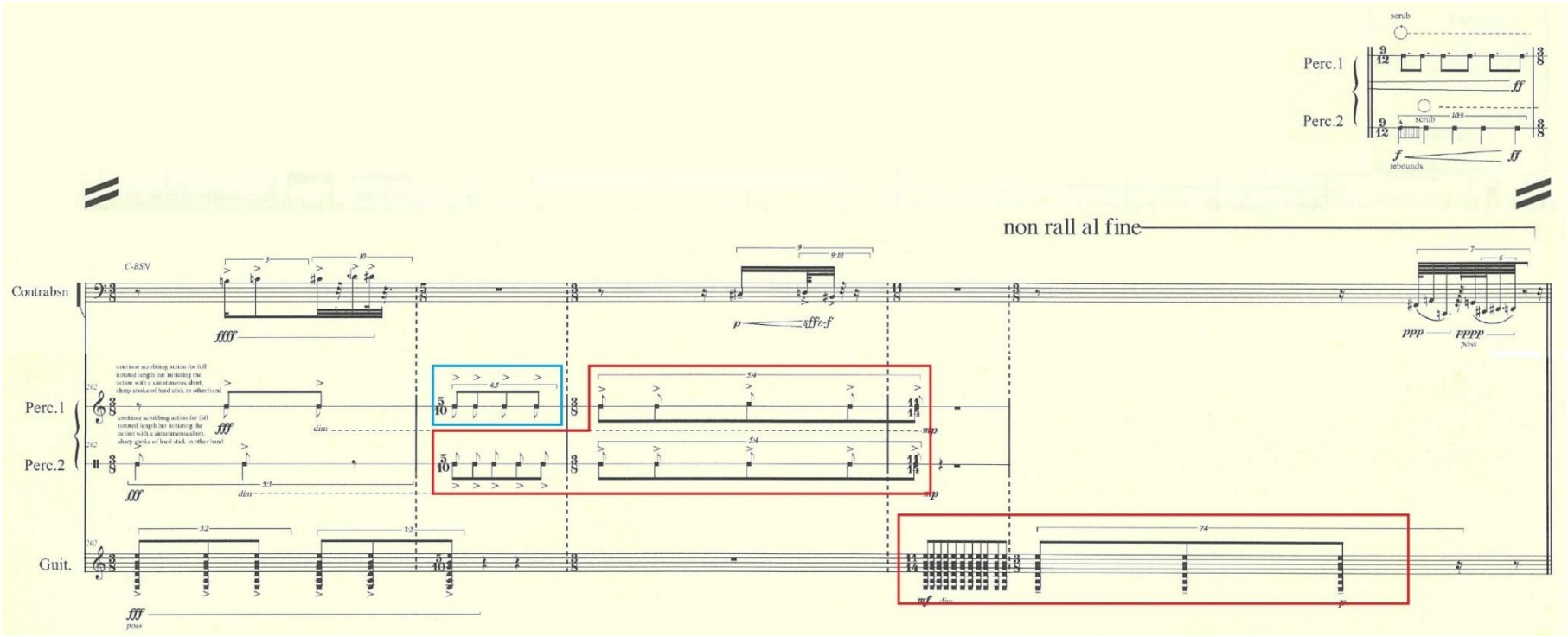
Also, the final ***7:4***-tuplet ♪ that falls in the percussion 1 and 2 lines of bar 205 should actually sound between the first and second ^{7}♪ notes of the guitar's ***11/14*** bar; the notations of these surface rhythms are misaligned in bar 205. In the same bar, percussion 1 is missing the crotchet rest it requires to match percussion 2.

Although the ^{5}♪ of bar 204 provide a continuation of the quintuplet pulse of the ***5/10*** bar as articulated by percussion 2 (see the red box), the ***4:5***-tuplet of percussion 1 in bar 203 completely counteracts the odd-factored pulse (see the blue box). In fact, the ***4:5***-tuplet acts against the ***5/10*** bar, effectively making it a ***4/8*** bar. This sort of nullification of OFTSs by way of surface rhythm notation will be encountered again when Phases IV and V are discussed in the *Mort Subite* case study chapter. The other red box highlights the continuation of the ^{7}♪ pulse in the guitar line.

Although *Finis Terrae* does contain articulations of OFTS pulses as well as preparatory/continuation tuplets, the dense texture of the piece with all its counter-rhythms greatly obscures these articulations, especially when compared to String Quartet No. 6. Despite all the rhythmic discrepancies and notational complications, the piece features processes of permutation and patterns of alternation in the placement of OFTSs within the structure of its final section.

[339] Ferneyhough, *Finis Terrae*, 38-39.

Example 6.12(b): Ferneyhough, *Finis Terrae* (bars 201-206), selected parts.[340]



The primary focus of the OFTS usage is not so much about the particular bar lengths or tuplet rhythms they produce; rather, the significance is found in the location of these bars in service of the predetermined structure outlined by pre-compositional procedures. This structure, in turn, draws attention to the relationship between odd-factored and conventional time signature bars as they interact in alternating patterns, once again incorporating the idea of comparison into the conception and use of OFTSs.

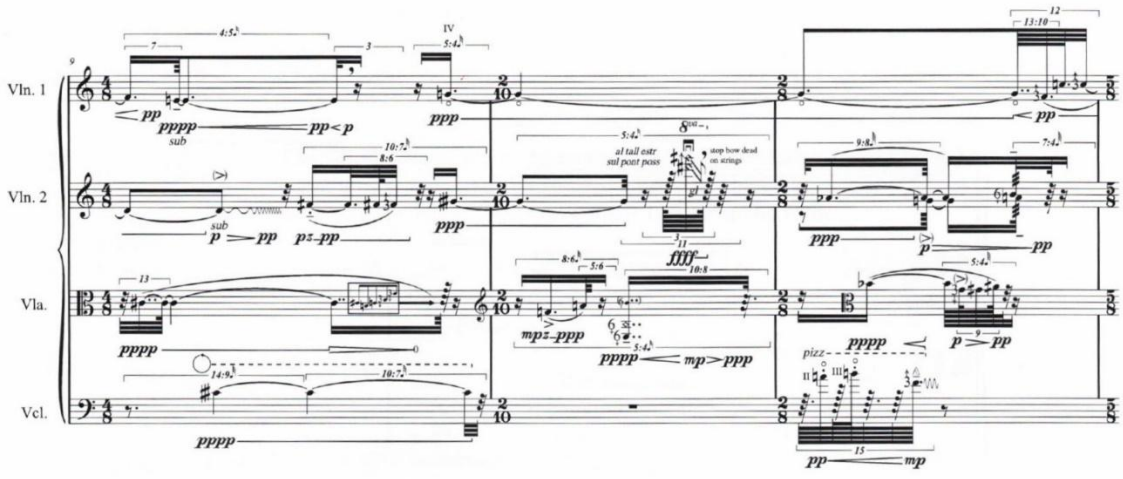
[340] Ibid.

Silentium

Silentium is another string quartet premiered by the Arditti Quartet; in fact, Ferneyhough specifically composed it for the ensemble's 40th birthday. Ferneyhough explains in the front matter of the score that he based the work 'on the plainchant fragment 'factum est silentium in coelo' which evokes the heavenly battle in which the Archangel Michael defeats Lucifer in the form of a dragon'.[341] He uses several musical techniques to depict this battle in the midst of the heavenly silence, one of which is the placement of OFTSs to highlight changes in the musical landscape.

In the first nine bars of the piece, there are many long held notes with at least one instrument playing at all times, and the dynamics range from ***pppp*** to ***p*** (with rare spikes of ***ppz***, ***pz***, ***mpz***, and even a singular ***mf***). It is a very drawn and quiet opening to the work. However, the first appearance of an OFTS at bar 10 heralds the first instances of several musical developments: it contains the first ***ffff*** note, found in the violin 2 line of Example 6.13, which provides a shocking startle after such a quiet opening. The ***ffff*** note is also the first *glissando* note/chord of the piece; and it is also the first bar with a universal tuplet spanning the entire length of the bar.

Example 6.13: Brian Ferneyhough, *Silentium* (bars 9-11).[342]



This last detail is curious: with the previous nine bars, all the long and tied notes held across bar lines leave little discernible indication of the metre of the work, let alone the bar lengths or even surface rhythms involved. *Silentium* is not like String Quartet No.

[341] Brian Ferneyhough, *Silentium* (London: Edition Peters, 2013), preface.
[342] Ferneyhough, *Silentium*, 2.

6 where the tuplet beats implied by the OFD are articulated on the surface. The numerator of each time signature is not discernible from the articulated rhythms alone.

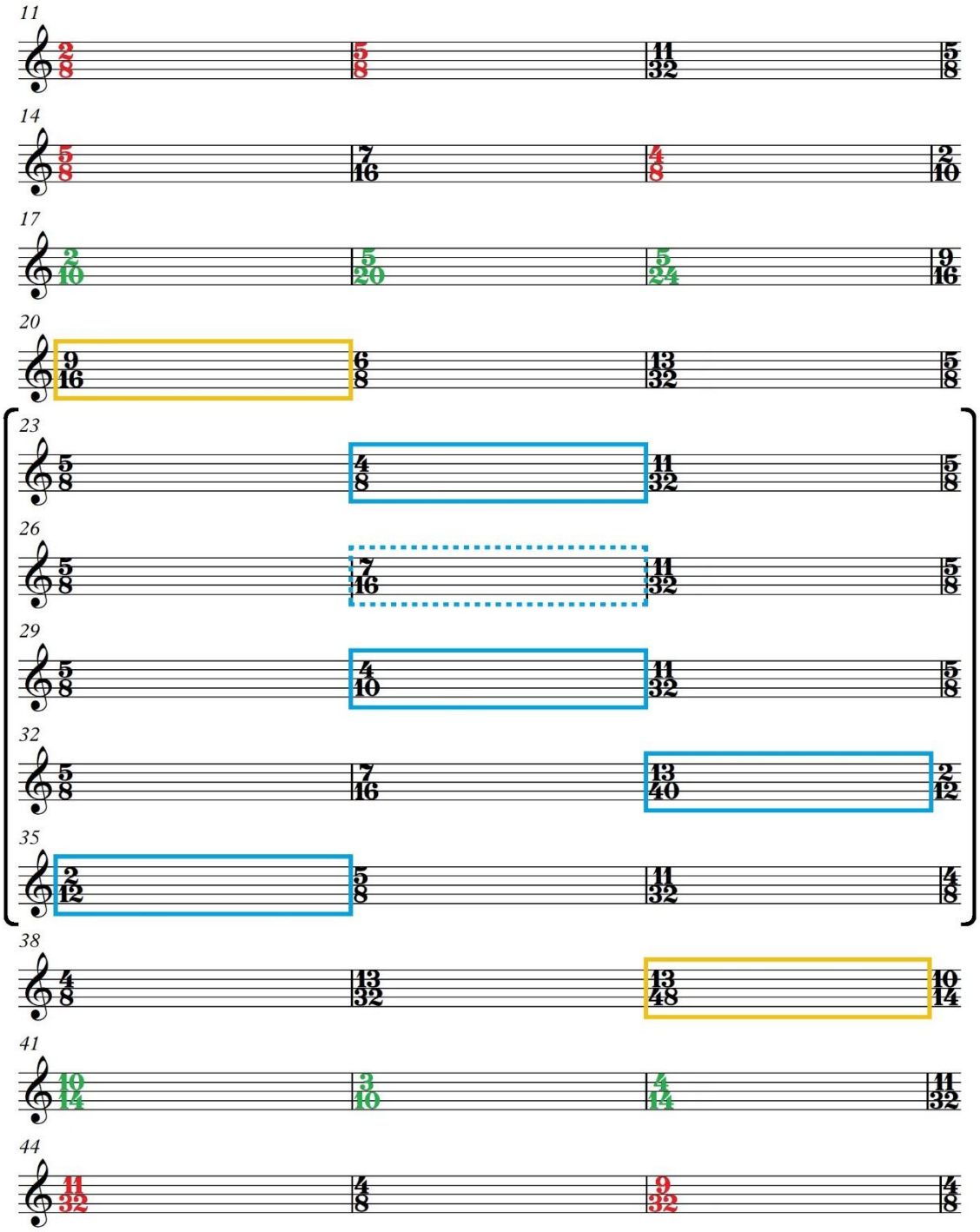
So, it is noteworthy that Ferneyhough not only imposes a universal ***5:4***-tuplet over the ***2/10*** bar, but then he has double nested tuplets within these universal tuplets (***5:6*** nested within ***8:6*** in the viola line and an ***11***-tuplet nested within a triplet in the violin 2 line, effectively imposing four layers of tupleting on certain rhythms within the bar). It may be postulated that these tuplet notations do not serve a real rhythmic function but instead provide a way to highlight the introduction of new musical elements and developments.

Bar 10 also instigates a series of three-bar units from bar 11 to 46 where there are processes of permutation at play (though they are likely a result of several layers of pre-compositional processes, because the final ordering of bars does not directly explain the reasons for the permutations). Example 6.14 omits the contents of the passage apart from the time signatures, as the three-bar units are made apparent in the structural use of the time signatures, not on the musical surface.

There is a mirroring structure somewhat evident in Example 6.14. The three bar units are isolated in each system. The passage is bookended by three-bar units where two bars of each unit share the same denominator (these time signatures are annotated in red). Moving inward, the next three-bar units are entirely OFTSs (annotated in green). Then, there are three-bar units containing ***8***- and ***32***-denominators with one bar that differs (in the case of bar 20, its denominator is ***16***, compared to bar 40 with its ***48***-denominator, both annotated in yellow). Incidentally, ***48*** is divisible by 16.

Then, in the centre of the passage within the black brackets, there are five three-bar units that feature a change of one time signature in each system (highlighted in blue boxes). Generally, ***5/8*** and ***11/32*** remain consistent with the other time signature changing, but it is speculated that the base three-bar unit is bars 26-28, as the ***7/16*** recurs later and the ***11/32*** changes to ***13/40*** at bar 34 instead (hence why the ***7/16*** bar 27 is annotated with a dotted blue bar, as it is speculated to be part of the base three-bar unit).

Example 6.14: Ferneyhough, *Silentium* (bars 11-46), with omissions.[343]



Bars 35-37 are particularly anomalous as the ***5/8*** bar is moved to the middle of the three-bar unit and the time signature change is located at the beginning of the unit instead (this is perhaps to accommodate for what appears to be structural inconsistency). For this passage to be truly structurally symmetrical, there would need to be another three-bar unit at the end where two bars share the same denominator (like the other red time signature systems, so that there are two systems bookending the passage).

[343] Ferneyhough, *Silentium*, 2-6.

However, it appears Ferneyhough has replaced one red bookending three-bar unit for a blue-boxed/black-bracketed central three-bar unit instead.

From the overview of Example 6.14, there are clearly processes of permutation manifesting in the structure of this passage. However, it is not particularly clear which pre-compositional processes Ferneyhough used to achieve these permutations of time signature and bar ordering. What is apparent is his use of OFTSs to introduce new elements to develop the piece. Ferneyhough uses the rarely seen ***14***-denominator to bookend two key moments in the piece. The first is seen in bars 41-43 where the first instance of absolute silence is situated between two ***14***-denominator bars:

Example 6.15: Ferneyhough, *Silentium* (bars 41-43).[344]

Up until bar 41, at least one instrument has been playing at all times. When the rest at the very end of the ***10/14*** bar melds into the rest at the beginning of the ***3/10*** bar, the silence is profound, and Ferneyhough uses the unusual ***14***-denominator bar to enact this. Then, immediately after bar 43, the climax of the piece occurs:

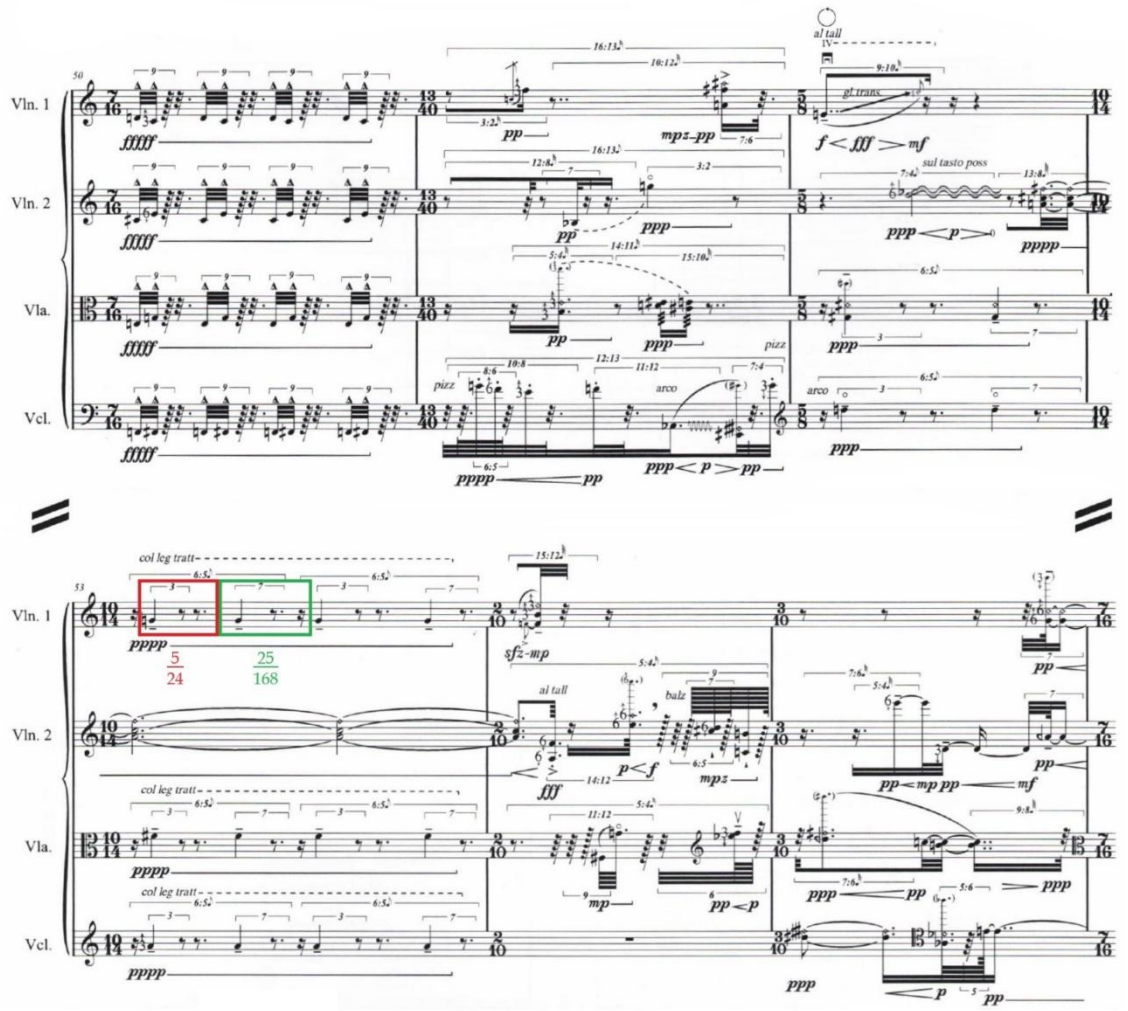
[344] Ferneyhough, *Silentium*, 5.

Example 6.16: Ferneyhough, *Silentium* (bars 44-52).[345]

The four consecutive bars of ***ffff*** chords within a relatively stable metric framework provide a dramatic contrast to the rest of the piece. Note that the climactic bars 47-50 are all in conventional time signatures. The passage of Example 6.16 is immediately preceded and followed by ***14***-denominator bars, as bar 43 is in ***4/14*** (see Example 6.15) and bar 53 is in ***10/14***:

[345] Ferneyhough, *Silentium*, 6.

Example 6.17: Ferneyhough, *Silentium* (bars 50-55).[346]



When comparing bar 50 to bar 53, they share four groups of unison attacks separated by rests, and they both have tuplet rhythms. However, apart from the stark difference in dynamics, the attacks in bar 53 are not actually evenly spaced: the duration between the nested $\overset{3}{\text{♩}}$ onset and the nested $\overset{7}{\text{♩}}$ onset is ***5/24*** (see the red box of Example 6.17); and the duration between the nested septuplet and the nested triplet is 25/168 (see the green box), meaning there is a 7:5 ratio between the red and green durations. It is also curious that Ferneyhough wrote bar 50, with the odd ***7*** as the numerator, to contain four equally spaced groups of attacks, whereas bar 53, with the even ***10*** as the numerator, contains unequally spaced attacks.

Ferneyhough uses OFTSs as a means to introduce and highlight key musical developments throughout *Silentium*. Through the textures and drawn-out rhythmic content, it is clear that the OFDs are not primarily used to dictate the absolute bar lengths. Rather, the OFDs—and especially ***14***-denominators—are used as notational

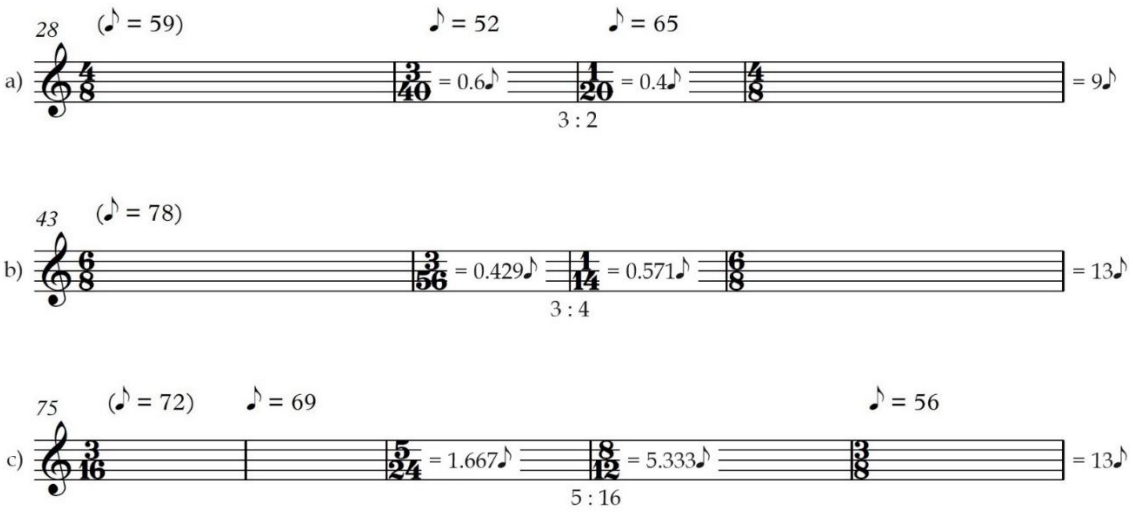
[346] Ferneyhough, *Silentium*, 6-7.

markers in the structure of the piece to draw the performer's eye to musical oddities and changes.

Carceri d'Invenzione III

Carceri d'Invenzione III, like *Finis Terrae*, is a large ensemble piece; it was written for 15 wind instruments and percussion. In this case, OFTSs are not confined to a particular section of the piece and instead permeate the work. Only select excerpts will be briefly analysed as concentrated examples of Ferneyhough's compositional process in this piece (specifically the first three occurrences of OFTSs).

Example 6.18: Brian Ferneyhough, *Carceri d'Invenzione III* (bars 28-31, 43-46, and 75-79), with omissions.[347]



Example 6.18 features bars 28-31, 43-46, and 75-79, with each system constituting the different groups of bars. The example omits all notation except tempo markings, time signatures, and bar lines to highlight the structure of these excerpts. To clarify, the tempo markings are above the staves as per usual. However, specific bar durations are annotated within bars, and these bar durations are expressed in terms of number of ♪ to make the OFTSs consistent with the conventional time signature pulse units.

For systems (b) and (c), the bar durations are rounded to three decimal places, as they represent bar lengths that are not easily rationalised. The overall durations of each system are annotated at the end of the corresponding staves (e.g. bars 28-31 of system

[347] Brian Ferneyhough, *Carceri d'Invenzione III* (London: Edition Peters, 1986), 9-10, 12, and 21-22.

(a) have a total duration of nine 𝅘𝅥𝅯). The ratios under each staff refer to the proportional relationships between the bar durations of the relevant OFTS bars.

A pattern emerges from these excerpts. In Example 6.18(a), the two OFTS bars are framed by the same conventional time signature: ***4/8***. The OFDs are both based on the same odd factor but the latter accommodates a simplified OFTS: in the (a) system, bar 30 could have been notated as ***2/40***; bar 45 in the (b) system could have been notated as ***4/56***; and bar 78 in the (c) system could have been notated as ***16/24***. However, all these OFTSs have been renotated to their simplest form (except for the ***8/12*** of bar 78, which could have been simplified to ***2/3***, but Ferneyhough generally does not use ***3***-denominators).

As the OFDs of each system are based on the same odd factor, the bar durations can be compared as ratios (see Example 6.18). Furthermore, the OFTS bars are actually equivalent to whole 𝅘𝅥𝅯 in duration when they are combined.

In the (a) system, there is a 3:2 ratio between the OFTS bars, with an overall 20 : 3 : 2 : 20 ratio if the conventional time signatures are taken into account, and the ratio could be simplified to 4 : 1 : 4 if the odd-factored bars were combined (into ***5/40***, the equivalent of ***1/8*** in duration). In the (b) system, there is a 3:4 ratio, with an overall 42 : 3 : 4 : 42 ratio, simplified to 6 : 1 : 6 (when the odd-factored bars are combined into ***7/56***, the equivalent of ***1/8***). In the (c) system, there is a 5:16 ratio, with an overall 9 : 5 : 16 : 9 ratio assuming the two ***3/16*** bars are combined, simplified to 3 : 7 : 3 (when the odd-factored bars are combined into ***21/24***, the equivalent of ***7/8***).

Table 6.5: The ratios in Example 6.18.

	OFTS Bars Ratio	Overall Ratio	Combined Duration of OFTS Bars	Simplified Overall Ratio
a)	3:2	20 : 3 : 2 : 20	1𝅘𝅥𝅯	4 : 1 : 4
b)	3:4	42 : 3 : 4 : 42	1𝅘𝅥𝅯	6 : 1 : 6
c)	5:16	9 : 5 : 16 : 9	7𝅘𝅥𝅯	3 : 7 : 3

Once again, Ferneyhough uses OFTSs to enact certain durational equivalences, but this time, he incorporates proportionality *within* these equivalences, not *between* them as he does with String Quartet No. 6 (see Table 6.4 for comparison). That is to say, in String Quartet No. 6, OFTS bars were compared to other bars of durational equivalence,

and therein arose the proportionality. However, here in *Carceri d'Invenzione III*, the combination of OFTS bars are equivalent in length to whole ♪ durations, and within these pairs of OFTS bars which constitute the equivalent duration, proportionality may be found. Essentially, String Quartet No. 6 highlights *inter*-equivalence proportionality whereas *Carceri d'Invenzione III* features *intra*-equivalence proportionality.

In Example 6.18(b), ***14*** is the only OFD divisible by only one power of 2 (i.e. not divisible by 2 × 2 or 2 × 2 × 2). Furthermore, (b) is the only system to not have a tempo change superimposed on the passage. In the (c) system, there are tempo marks enforced on the conventional time signature bars. In the (a) system, the opposite is true, where the tempo marks are enacted upon the OFTSs, which is more significant as it negates the effects on tempo that the OFTSs would inherently impose on the music.

It seems that Ferneyhough had a particular pre-determined process for the structure and order of the bars/pattern of time signatures and then layered other surface considerations such as rhythm and tempo on top of the structure.[348] This is evidenced by the lack of articulation of the implied OFTS pulse (which is unlike String Quartet No. 6 and *Finis Terrae*).

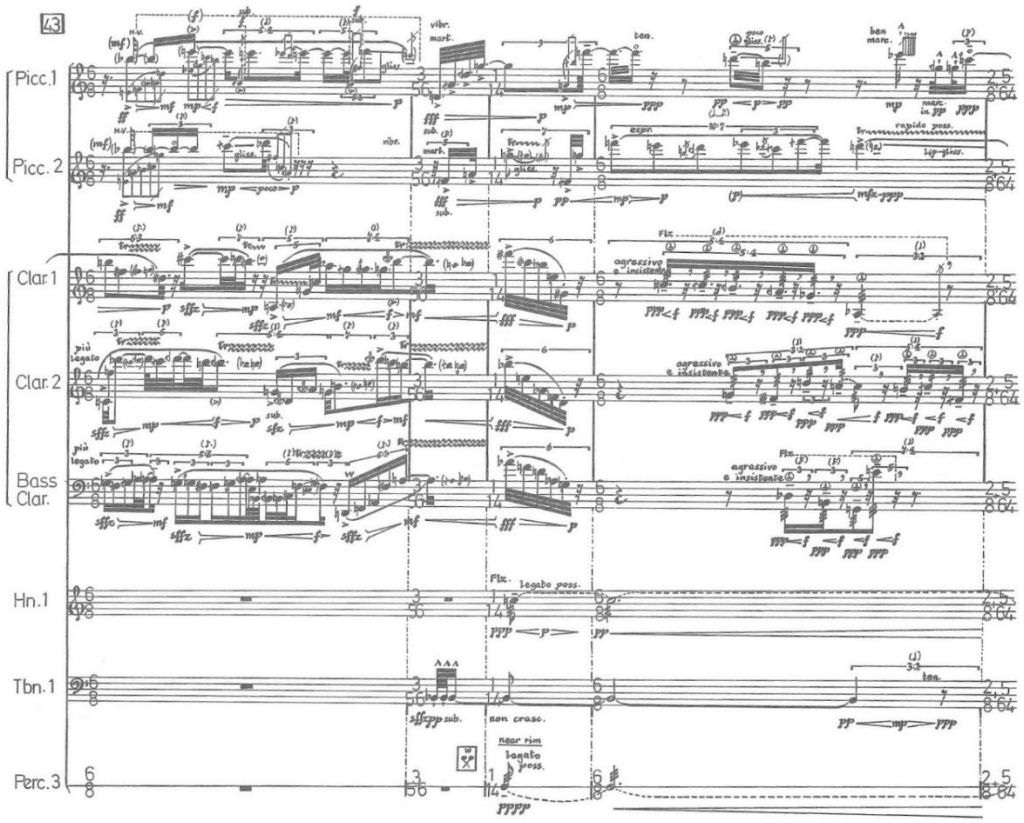
The bars of Example 6.19 correspond to the (b) system of Example 6.18. As seen above, Ferneyhough notates rhythms that obscure the time signatures. The septuplet rhythms implied by the OFDs are complicated by nested tuplets and held notes, but even the numerators are concealed by the number of attacks notated, such as the four dotted septuplet hemidemisemiquavers in the piccolo 1 line contravening the ***3/56*** of bar 44, or the five nested ^{6}𝅘𝅥𝅯 of the clarinets obscuring the ***1/14*** of bar 45. Certainly, the conventional time signatures do not provide any clear articulations of the ***6/8*** ♪ pulses.

This seeming divorce from—or disregard of—the time signature when notating surface rhythms is actually standard practice for Ferneyhough. Indeed, articulating the odd-factored pulse (as seen in String Quartet No. 6 and *Finis Terrae*) is an exception to his rule; it is far more common for Adès to do so than Ferneyhough. The brief excerpts (Examples 6.18 and 6.19) from *Carceri d'Invenzione III* provide a concentrated snapshot into Ferneyhough's pre-compositional process of the placement of OFTSs: in these instances, the use of these OFTSs do not clearly relate to tempo, surface rhythms, or even

[348] Toop, "*Lemma-Icon-Epigram*," 56.

pulse streams, but rather they have more to do with Ferneyhough's pre-compositional process of structuring and patterning the order of bars and time signatures.

Example 6.19: Ferneyhough, *Carceri d'Invenzione III* (bars 43-46), selected parts.[349]



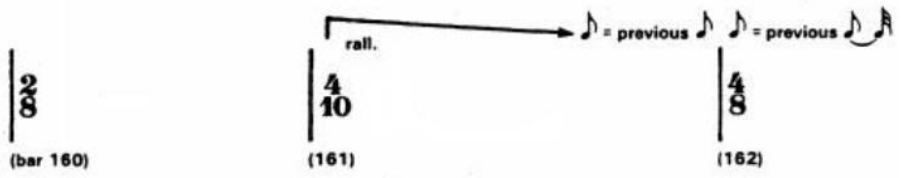
Ferneyhough does make a point to differentiate OFTSs from tempo change markings; they are not synonymous according to the performance notes of *Carceri d'Invenzione III*. This is because there can be a simultaneous change in *both* the time signature and the tempo indication:

> The new beat may be determined by working out what proportion of the current beat must be subtracted in each case. Such changes should be regarded as metre modification, and not as changes of tempo. When a new tempo designation and an irrational metre occur simultaneously, the tempo indication refers only to the background quaver beat; the irrational beat is therefore to be played at the requisite proportion faster.
>
> The tempi in this piece are constructed according to three different scales of values, and should be regarded as absolute in their mutual interaction. Thus if the initial tempo is changed, all subsequent tempi must be changed in proportion.[350]

[349] Ferneyhough, *Carceri d'Invenzione III*, 12.
[350] Ferneyhough, *Carceri d'Invenzione III*, performance notes.

Ferneyhough's differentiation of time signature-dictated pulse speed and overall tempo indication hearkens back to Example 4.16 in chapter 4: Adès superimposes a *rallentando* on bars 98-100 of *Traced Overhead*, which already experience a proportional notated deceleration due to the pulse speeds of the tuplets as implied by the OFTSs. In this regard, time signatures are used to gauge the speed of local rhythms whereas tempo markings affect the universal speed of the piece.

This is made even more apparent in *Carceri d'Invenzione I* where Ferneyhough employs a 'metric *rallentando*'. Similar to the above explanation, Ferneyhough uses the tempo indications as a means of dictating the 'basic tempo' (i.e. the tempo observed in conventional time signature bars), and the tempo of OFTS bars would then be calculated in proportion to the basic tempo:

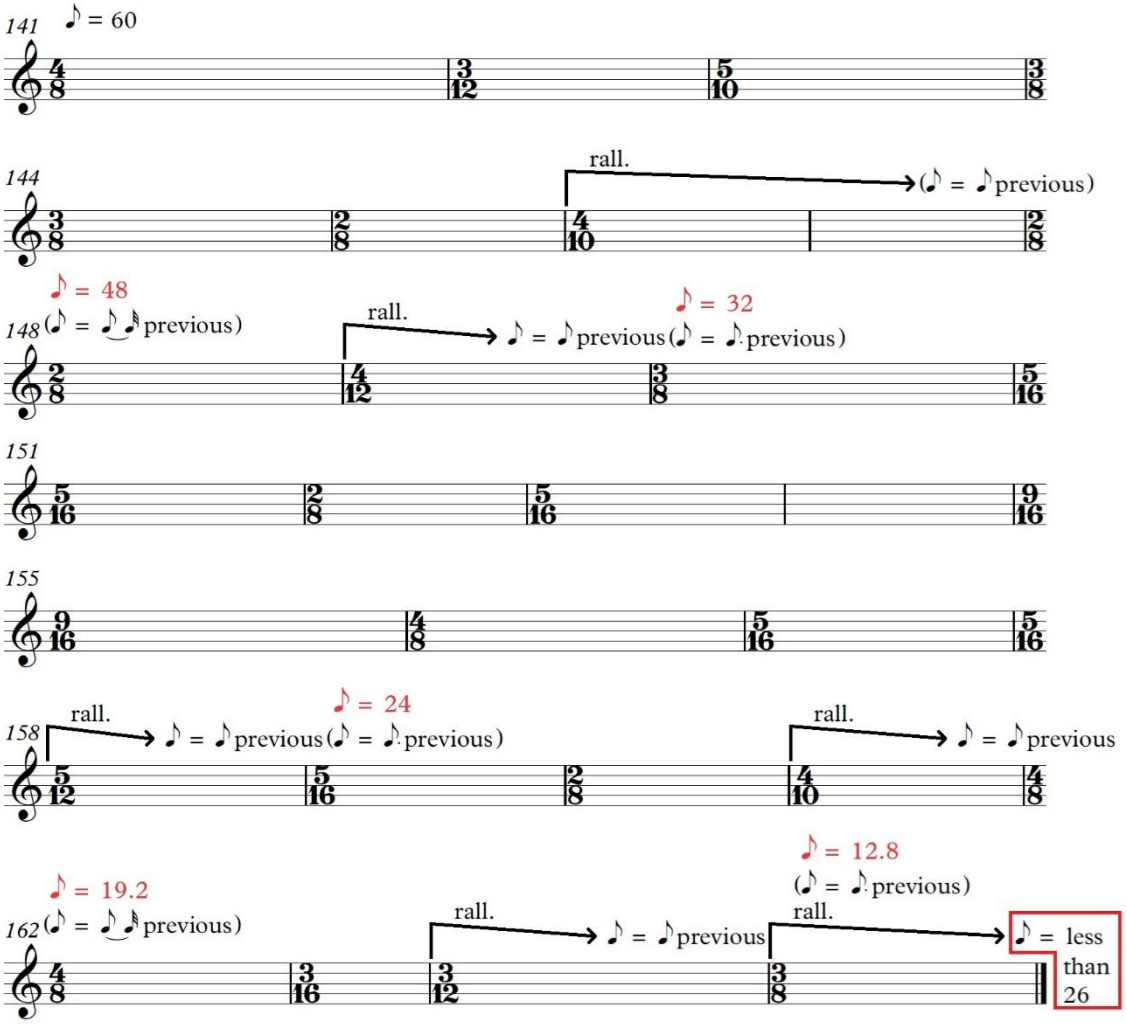
> At the end of the work (bars 146-165) the following notation for what may be termed a *metric rallentando* combines these two aspects [of tempo and metre]:
>
> 
>
>
> This means that the initial quaver beat of the 4/10 should slow down at such a rate that, at the very end of the bar, it has reached an absolute tempo equal to that of the quaver beat in the previous bar (2/8). It follows that, in order to maintain the necessary proportion between the 4/10 and the following 4/8, the latter will be 1.25 times as long as the former. With each successive rallentando of this type the basic tempo (from which all other values are calculated) becomes slower to an extent proportional to the type of *irrational* bar preceding it. Each time the process repeats exactly, with the exception that a new, slower *basic* tempo is used as a point of reference for all proportions.[351]

Parenthetically, there may be a misprint at the end of *Carceri d'Invenzione I* where this metric *rallentando* is used. The red text in Example 6.20 indicates each step of the metric modulation sequence, and a more accurate final tempo marking would be either "♪ = less than 13" or "𝅘𝅥𝅯 = less than 26". As all previous tempo markings were based on the ♪ , "♪ = less than 13" would be the most appropriate option here. Also, the metric *rallentando* notation could have been clarified if, in bar 162 for example, Ferneyhough

[351] Brian Ferneyhough, *Carceri d'Invenzione I* (London: Edition Peters, 1982), conductor's notes.

had written "(5 = previous)" instead of "(=)", as that would relate back to the ***10***-denominator in bar 161.

Example 6.20: Brian Ferneyhough, *Carceri d'Invenzione I* (bars 141-165), with omissions.[352]



In any case, the use of this metric *rallentando* is an intricate combination of musical processes whereby the tempo is informed by the proportional relationship of the overall bar durations between the immediately preceding and superseding bars, and vice versa. To superimpose tempo changes onto OFTSs is, in a sense, to nest tempi, as OFTSs already imply tempo changes/metric modulations; this would be akin to the procedure imposed on surface rhythms when tuplets are used within OFTSs, making them nested tuplets by default.

The exception to this would be the superimposition of tuplets and tempi that would *negate* the OFTS. For examples of tuplets with negating effects, refer to Examples 6.12(b) and 6.17 as well as the discussion of Phases IV and V of the *Mort Subite* case study

[352] Ferneyhough, *Carceri d'Invenzione I*, 35-38.

in chapter 8. Tempo marks that would negate OFTSs would be metric modulation directions. For example, if transitioning from **2/8** to **4/10**, it would require a $^{5}\!\!\!

Up until this point, I have attempted to avoid hypothesising about the perceptibility of OFTSs for the listener as that is beyond the scope of this project.[356] However, as Ferneyhough's commentary about his conceptualisation of the bar continues, he specifically makes mention of audible perceptibility. Therefore, I will engage with concepts of audible perception insofar as Ferneyhough does:

> Whilst the impulse-structure and its audibility are clearly variably perceptible in concrete compositional situations, I maintain that enough of a correspondence is maintained in the middle to long term to enable the flow of space/density ratios demonstrated capable of carrying the main weight of formal organization. According to this principle, degrees of compression, distortion, convergence or mutual interference are calculable in respect of the degree to which the sense of clock time is supported or subverted by the specific tactility of impulse density setting the 'inner clock' of a particular metric space. Expressions of ratio relationships and proportionally-related structures are, in essence, expressed by means of different categories of perceptual mechanism. While it might be argued that the mental association of durational ratios with impulse-density ratios may not be intuitively immediate, it would seem that a careful integration and contextualization of these informational strands can lead to a clear sense of structural inter-reference.[357]

Since bars are delimited spaces with the capacity to contain sounds and 'musical processes', the idea of proportionality is introduced very early in this conception as Ferneyhough pits the concepts of "objective" 'clock time' against the musical metric 'inner clock'. He also compares the density ratios of metric impulses and articulated attacks from one bar to the next, as well as the overall durations of each bar.

Ferneyhough's assertion here is that the subtlety of cognitive perception is exploited over the piece's relatively long period of time.[358] He presents the notion that the mind is able to be guided in associating the 'durational ratios with impulse-density

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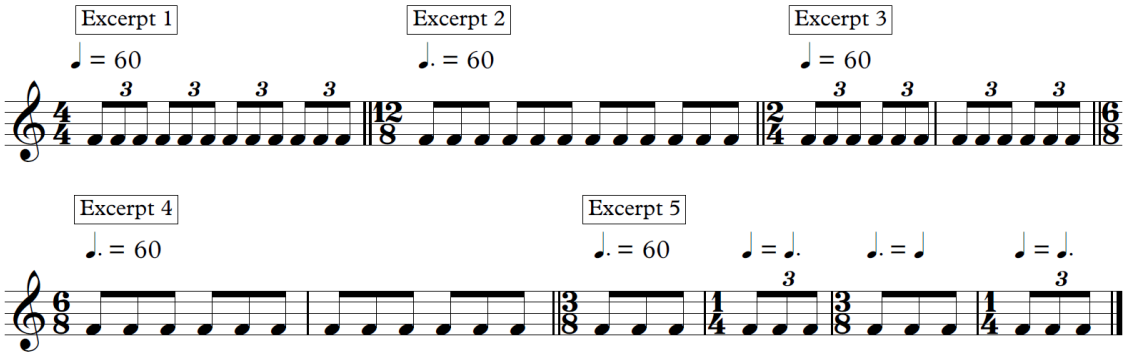
[356] For more information on perception studies, see Albert S. Bergman, *Auditory Score Analysis: The Perceptual Organization of Sound* (Cambridge: MIT Press, 1990); Thomas Clifton, *Music as Heard: A Study in Applied Phenomenology* (New Haven: Yale University Press, 1983); Peter Desain and Luke Windsor, *Rhythm: Perception and Production* (Lisse: Swets & Zeitlinger Publishers, 2000); London, *Hearing in Time*; Thomas J. Tighe and W. Jay Dowling, eds, *Psychology and Music: The Understanding of Melody and Rhythm* (New Jersey: Lawrence Erlbaum Associates Publishers, 1993); David Lewin, "Music Theory, Phenomenology, and Modes of Perception," *Music Perception* 3, no. 4 (1986): 327-392.
[357] Ferneyhough, "Duration and Rhythm," 52.
[358] See also Toop, "*Lemma-Icon-Epigram*," 59.

ratios' through the 'flow of space' of formal musical organisation by means of 'structural inter-reference'. However, this assertion is contestable. Metre—and pulse streams in general—can be notated by a variety of methods to achieve the same result:

Example 6.21: Different notations of the same pulse speed.



From aural perception alone, a listener may not be able to conclusively identify the notation methods used to visually express the simple musical ideas above. However, Example 6.21 may be an over-simplification. In conventional contexts where one may find any of the above notations employed, except for Excerpt 5, the choice between one and another will be determined by additional elements not present here: accent patterns, recurrent phrase lengths, cross-rhythms laid against the pulsing 𝅘𝅥𝅯 or ^{3}𝅘𝅥𝅯 notes, motion to or from other metres or metrical patterns, and even cultural/genre expectations. The choice would be based on what is most compatible with the overall field of rhythmic and metrical activity, not just the one layer of pulse as written here.

However, there are contexts in which it truly would be impossible for a listener to discern what notation was written to visually symbolise the complex rhythmic ideas a composer such as Ferneyhough may want to explore. This will be discussed in more detail when equivalent bar lengths are addressed in the upcoming *Superscriptio* and *Mort Subite* chapters.

Ultimately, the score is necessary for absolute confirmation of the association between durational ratios and the impulse-density ratios (let alone the time signature(s) utilised). Of course, performers may attempt to distinguish between the above excerpts by way of varying accent and phrasing, and the score itself will have imminent ramifications on the performer, but one could argue that without the broader context of the piece, these differences may still be too subtle to distinguish the five excerpts from one another, especially between Excerpts 1 and 2 or between Excerpts 3 and 4.

To add further complication, unlike Adès, who generally notates musical attacks on the pulse as implied by the time signature, Ferneyhough writes with such complexity that the listener may find the task of aurally identifying the pulses of the given time signature to be a challenge. This is true even in pieces containing only conventional time signatures, and Ferneyhough's propensity to change time signature with almost every bar only complicates matters further.

In more extreme cases, his written pitches/figures and musical attacks work against the implied pulses, and for all intents and purposes, he negates the effect of the time signature in the corresponding bar. A prime example of this is at the beginning of the clarinet and vibraphone's fourth phase in *Mort Subite* (see Example 6.22).

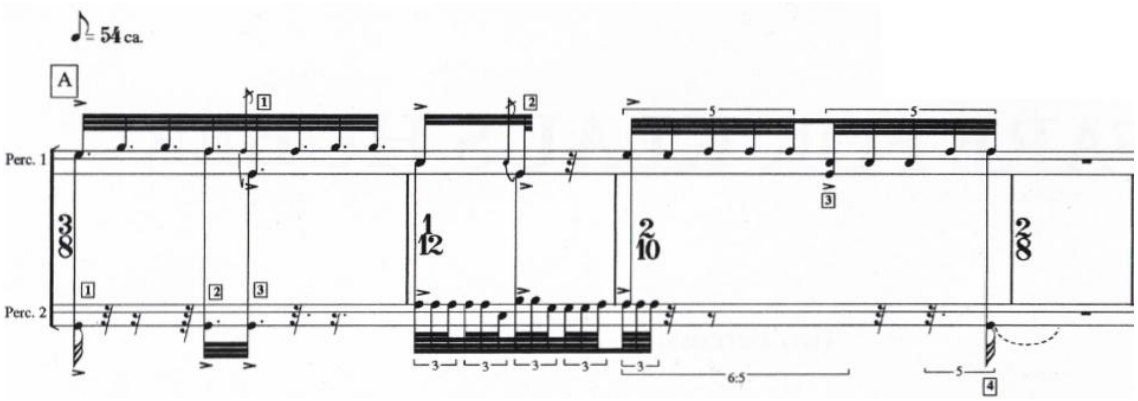
Ferneyhough has set ***5/10*** as the time signature of the clarinet and vibraphone's first bar in Phase IV but counteracts the implied five $^{5}\!\!\!

density ratios' through the 'flow of space' of musical 'structural inter-reference'.[360] In the preface and performance notes of *Superscriptio*, he provides the following insight:

> Formally, *Superscriptio* is built up of interlocking observations of a dense network of precomposed metric and proportional relationships. Notable, perhaps, in this connection is the introduction and extensive employment of such unusual bar-lengths as 3/10, 4/24, 5/20 etc. Variations in texture and momentum are achieved by means of distortion of the complex patterns created by the mobile juxtaposition of such values, as well as by the gradual de-synchronisation of bar-length gestural shaping, dynamic levels and rhythmic density. …
>
> Bar lines should invariably be regarded as marking instantaneous alterations of beat length. No rubato should be incorporated at any point since many of the work's effects depend upon the degree of synchronisation between metric and other compositional principles obtaining at any given juncture.[361]

Ferneyhough speaks of 'bar-length gestural shaping', and it is evident throughout his scores that he generally utilises the bar as a notational device to delineate phrases and gestural units. He often goes further and also uses beaming in the rhythmic notation to achieve a similar effect, which explains why many of the time signatures he uses make up very small bar durations, so that the small note values being used like demisemiquavers would utilise beams. A simple example is found in the opening section of *Fanfare for Klaus Huber*:

Example 6.23: Brian Ferneyhough, *Fanfare for Klaus Huber* (page 1).[362]



[360] Ferneyhough, "Duration and Rhythm," 52.
[361] Ferneyhough, *Superscriptio*, preface and performance notes.
[362] Brian Ferneyhough, *Fanfare for Klaus Huber* (London: Edition Peters, 1987), 1.

In Example 6.23, Ferneyhough uses three bars to delineate three different rhythmic gestures. This is typical in his works, although he does at times intentionally write against this expectation (like in *Superscriptio*, which will be discussed in the next chapter).

Furthermore, Ferneyhough often allows gestural units to bleed into adjacent bars. In the *Fanfare for Klaus Huber* excerpt, for example, the second percussionist's gesture in the ***1/12*** bar elides with the ***2/10*** bar, though it should be noted that Ferneyhough maintains the nested triplet pulse speed of the ***2/10*** notes by way of the nested triplet bracket within the larger ***6:5***-tuplet bracket.

An argument could be made that, since there is generally a high correlation between Ferneyhough's written musical gestures and the notated bars, it is hypothetically conceivable that the listener could aurally distinguish the written bars. This is because they would be listening for discrete gestural units and therefore assume an association between the gestures and the absolute durations of each bar (i.e. the durational ratios).[363]

Furthermore, it could be hypothesised that Ferneyhough's scores are not only instructional for performers but that they also act as a guide for listeners to follow along. Many—likely *most*—performances of Ferneyhough's works are experienced via recordings, like the majority of music consumption in the modern era. Assuming this is the case, the listener could experience the exact same performance repeatedly with the score on hand. It may be fair to conjecture Ferneyhough's intended readership for his scores encompasses performers, audiences, music analysts, and other composers, especially given the fact that he has written a slew of essays analysing his works and scores.

By contrast, it could be argued that Adès notates his scores with the primary intention to aid performers, as he is one himself, utilising notation to communicate how best to approach the performance of his pieces.[364] It seems that Adès intends for the audible result of his music to be more apprehensible and understandable to the listener upon first hearing.

[363] See Toop, "*Lemma-Icon-Epigram*," 59.
[364] Adès and Service, *Full of Noises*, 67; Belling, "Thinking Irrational," 37; Key, "Pan-Rational," 295.

This is not to say that the audible result is irrelevant in Ferneyhough's works, but for a full experience of Ferneyhough's music, it could be argued that the audible result should be complemented with a close study of the score. Therefore, although listeners cannot conclusively identify the associations of 'durational ratios with impulse-density ratios' through aural perception alone, the 'sense of structural inter-reference' can be formed in a combined approach of listening and score study.

In his writings quoted thus far, Ferneyhough has mentioned the idea of distortion in reference to both time and musical patterns, i.e. situations where the perception of clock time is reinforced or undermined due to the felt impulse density compared to the 'variations in texture and momentum [which] are achieved by means of distortion of the complex patterns created by the mobile juxtaposition of such values'.[365] OFTSs are primary mechanisms for these rhythmic and metric distortions.

This is more easily perceived within a metric framework that experiences little change in the impulse density and tempo parameters, but even so, as Ferneyhough argued, 'a careful integration and contextualization of these informational strands can lead to a clear sense of structural inter-reference'.[366] Therefore, the perception of rhythmic and metric distortion should not be only confined to contexts where the metric framework experiences little change, and this will be investigated in further detail with the *Superscriptio* and *Mort Subite* case studies.

[365] Ferneyhough, "Duration and Rhythm," 52; Ferneyhough, *Superscriptio*, preface.
[366] Ferneyhough, "Duration and Rhythm," 52.

Chapter 7: *Superscriptio* Concentrated Example

The final work to examine before the *Mort Subite* case study is *Superscriptio*. Not only do OFTSs feature throughout this solo piccolo piece, but Ferneyhough specifically utilises time signatures and other rhythmic and time-related notational devices to develop the structure of the work.

Ferneyhough uses the descriptor 'de-synchronisation' (and implicitly 'synchronisation') in the preface of *Superscriptio* to clarify the proportional relationships explored in the piece, where musical parameters come in and out of alignment due to the 'dense network of precomposed metric and proportional relationships'.[367] By doing so, he also draws connections between metre and 'other compositional principles' such as 'bar-length gestural shaping, dynamic levels and rhythmic density'.[368]

Rhythmic density is of particular interest in light of Ferneyhough's earlier discussion around the relationship between durational and impulse-density ratios, as well as the 'compression, distortion, convergence [and] mutual interference' that feature in both Ferneyhough and Adès' works containing OFTSs.[369]

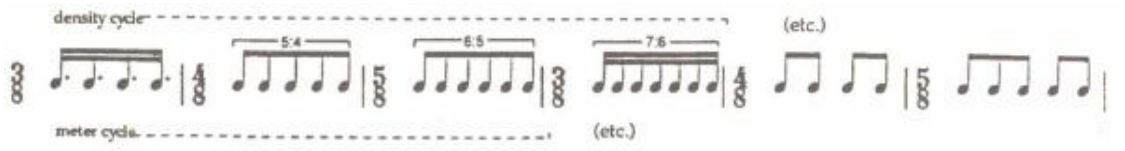
Ultimately, in pieces that utilise OFTSs, Ferneyhough is concerned with the relationship between the 'absolute duration' of a bar and the 'quantity of discrete impulses in a given time-space', and what then happens when these two facets are decoupled.[370] Assuming a bar can contain only one type of density-expression, and the absolute duration of each bar remains consistent, a ratio of 4:5, for instance, can be expressed between bars in the parameter of impulse density alone (as seen in the below example provided by Ferneyhough).

Example 7.1: Ex. 2 from Ferneyhough's essay on "Duration and Rhythm as Compositional Resources," 53.[371]

[367] Ferneyhough, *Superscriptio*, preface.
[368] Ibid.
[369] Ferneyhough, "Duration and Rhythm," 52.
[370] Ferneyhough, "Duration and Rhythm," 52-53.
[371] Ferneyhough, "Duration and Rhythm," 53.

However, if both parameters of absolute duration and impulse density of each bar were treated as independent factors being expressed through independent musical processes, there would be much greater potential for more intricate and complex proportional relationships as well as 'variously related ratio expressions'.[372] At times, Ferneyhough utilises a cyclic structure to exploit the potential for the decoupling of absolute bar duration from the impulse density, because this naturally leads to 'progressively transforming [bar] durations' and even, at times, the effect of phasing between two (or more) musical parameters:[373]

Example 7.2: Ex. 4 from Ferneyhough's essay on "Duration and Rhythm as Compositional Resources," 54.[374]

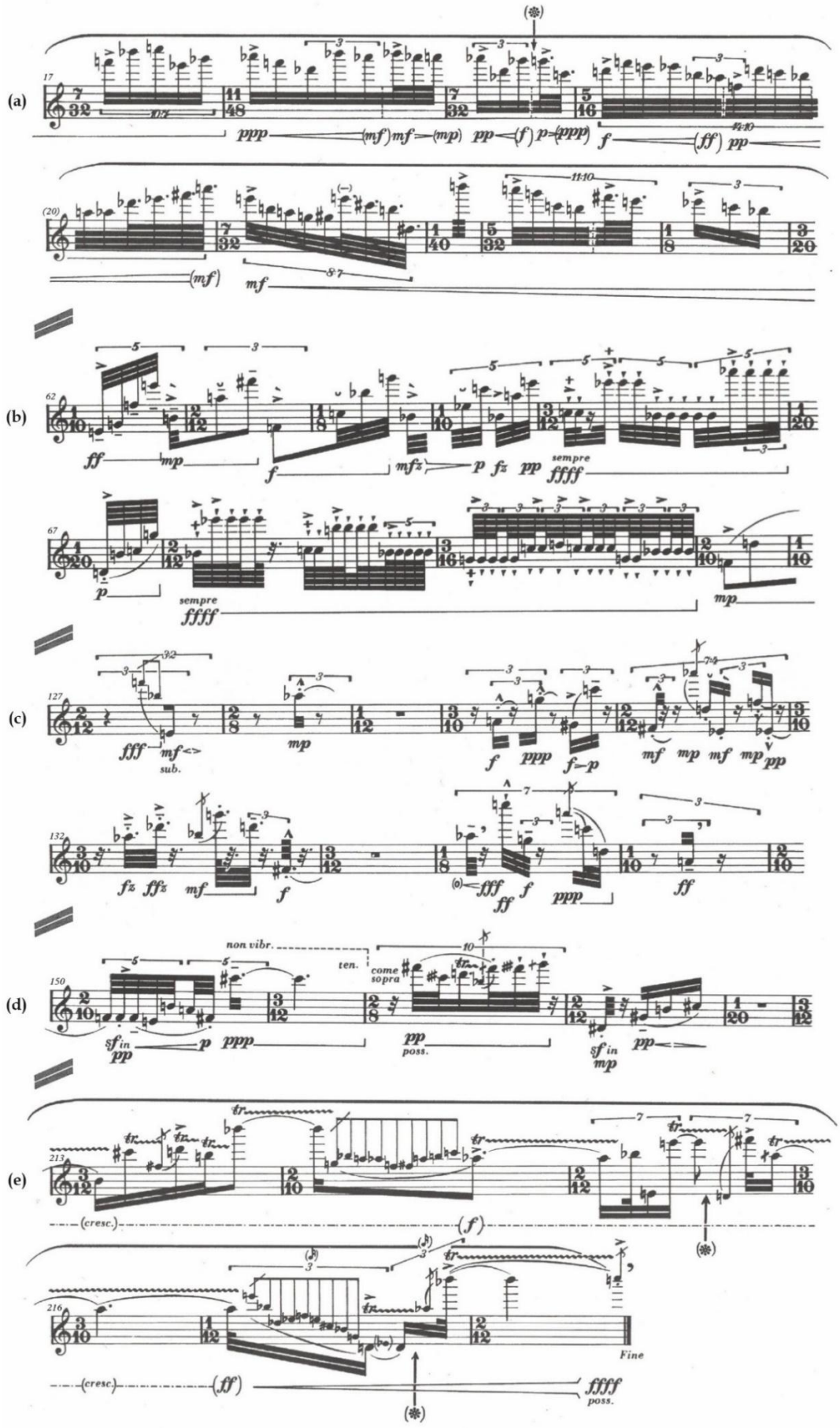


Notice how the bars cycle between three distinct time signatures: ***3/8***, ***4/8***, and ***5/8***. However, the impulse densities cycle between four distinct quantities: 4, 5, 6, and 7 notes. So, in the first bar, there is a 3:4 ratio (between absolute bar duration and impulse density); the second bar contains a 4:5 ratio; the third bar 5:6; and the fourth 6:7 (because of the 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 impulse values). In the final two bars, the phasing temporarily synchronises to 4:4 and 5:5 ratios as the two parameters temporarily align, but of course, as the cycle continues, the two parameters will later de-synchronise and form new ratio relationships.

This specific cycle of de-synchronisation will be explored in the next chapter with *Mort Subite*, whereas a general de-synchronisation is used as a process in *Superscriptio*. Before specific examples are given with regard to de-synchronisation and other processes found in *Superscriptio*, as a general overview and broad demonstration of the use of OFTSs to enact musical development, it should be noted that such developments can be observed only through visual cues in the score (see Example 7.3).

[372] Ibid.
[373] Ibid. For Ferneyhough's use of cyclic structures, see also Toop, "*Lemma-Icon-Epigram*."
[374] Ferneyhough, "Duration and Rhythm," 54.

Example 7.3: The five stages of musical and notational development in *Superscriptio* as exemplified in relevant excerpts.[375]



[375] Ferneyhough, *Superscriptio*, 1, 3, 5, 6, and 8.

Theoretically, *Superscriptio* could be approximately delineated into five rough sections characterised by increasing complexity as the work progresses. This is a similarity shared with *Mort Subite*, as it too is laid out in distinct sections that get progressively more complex. However, *Mort Subite* is explicitly structured in clearly demarcated Phases that correspond to the increasing complexity. *Superscriptio*, on the other hand, is not so clearly delineated, so the bar numbers attributed to certain sections are approximate.

In the first two pages, which cover bars 1-61, gestural shaping is contained within each bar, and there are, at most, three different types of note durations within each bar (see the (a) systems of Example 7.3). In the next two pages of the score, which cover bars 62-112, these gestures begin to bleed into adjacent bars, as evidenced by the beaming across bar lines, and there is a preoccupation with repeated notes of short duration (see the (b) systems). In bars 113-142, single and double grace notes are introduced along with bars of rest (see (c)). Ferneyhough then interchanges the bars of rest with tied notes instead in bars 143-171 (see (d)). In approximately the final two pages of the piece, which cover bar 172 onwards, trills and multiple-grace-note gestures are added on top of the bars of rest and tied notes to create a sense of musical dispersion and erasure (see (e)).[376] Each of these five stages of development can be seen in the snapshots featured in Example 7.3 for illustrative purposes.

Now that the development of *Superscriptio* has been summarised, we can examine how Ferneyhough exploits the general de-synchronisation of absolute bar durations and impulse densities to establish structural patterns, which he then uses to develop the music throughout the piece. In the first page of the score (see Example 7.4), only three of the 24 bars contain impulse densities that correspond to the bar duration, and they are all one note in ***1***-numerator bars (i.e. bars 8, 13, and 22, annotated in pink boxes). With every other bar, Ferneyhough has specifically divorced the impulse density from the bar duration, and it is clear he has done this intentionally when the bars annotated with the brackets are examined.

The bar pairs in the red brackets (bars 2-3 and 11-12) feature three attacks in the first bar followed by a ***3***-numerator time signature in the second bar of each pair. The bar pairs in the blue brackets (bars 6-7 and 9-10) feature two impulses in the first bar

[376] For other uses of rhythmic 'decay', see Toop, "*Lemma-Icon-Epigram*," 86.

followed by ***2***-numerators in the second bar of each pair. There seems to be somewhat of a mirroring effect with the red- and blue-bracketed bar pairs as they transition from a red bracket to a blue bracket, then a blue bracket to a red bracket, with a pink bar in the middle as the point of reflection.

Between the other two pink bars (bars 13 and 22), there are two other patterns. The bar pair in the yellow brackets features five attacks in bar 19 and a ***5***-numerator in bar 20. The green bracket is even more intricate, with bar 14 featuring seven impulses, which are reflected in the ***7***-numerator of bar 15; however, the pattern continues where bar 15 has 10 attacks, which corresponds to the ***10***-*denominator* of bar 16. Ferneyhough adds another level to the pattern by involving an OFD. He complicates the de-synchronisation of impulse densities from absolute bar durations by correlating the impulse densities of one bar to the absolute bar duration of the following bar.

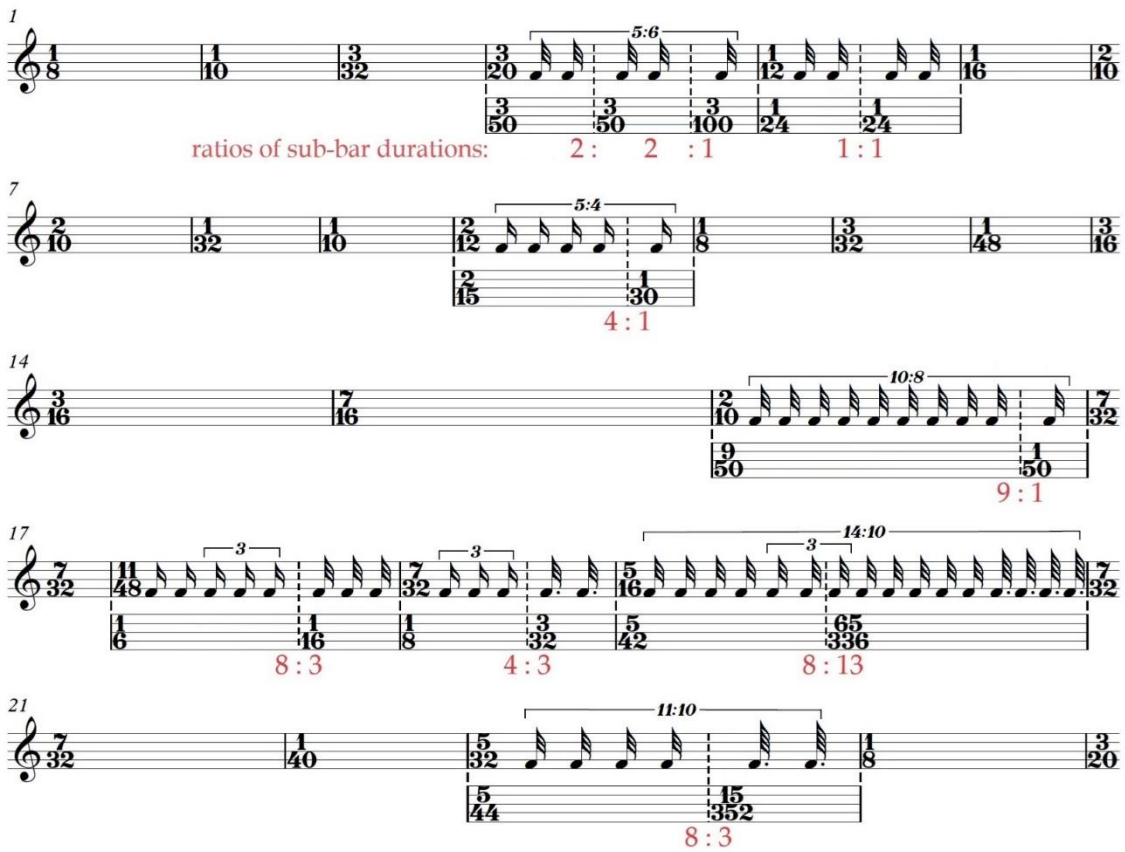
Example 7.4: Ferneyhough, *Superscriptio* (page 1).[377]

[377] Ferneyhough, *Superscriptio*, 1.

Furthermore, when examining the bars subdivided by dotted bar lines, we see that Ferneyhough de-synchronises the impulse densities from the proportional *sub-bar* durations. In other words, the proportional sub-bar durations are not explicitly expressed by the notated time signatures, but the ratios are instead inferred by the dotted bar lines and the accents placed on the first attack of each subsection. After each dotted bar line in Example 7.4, there is an accented note to delineate the subdivisions.

These sub-bar durational ratios are annotated in red (see Example 7.5), and the simplified sub-bar durations are explicated in the time signatures of a second corresponding staff under the main staff. The rhythmic attacks are included in the main staff to demonstrate how the impulse densities de-synchronise from the proportional sub-bar durations as the excerpt progresses.

Example 7.5: Ferneyhough, *Superscriptio* (page 1), with omissions.[378]



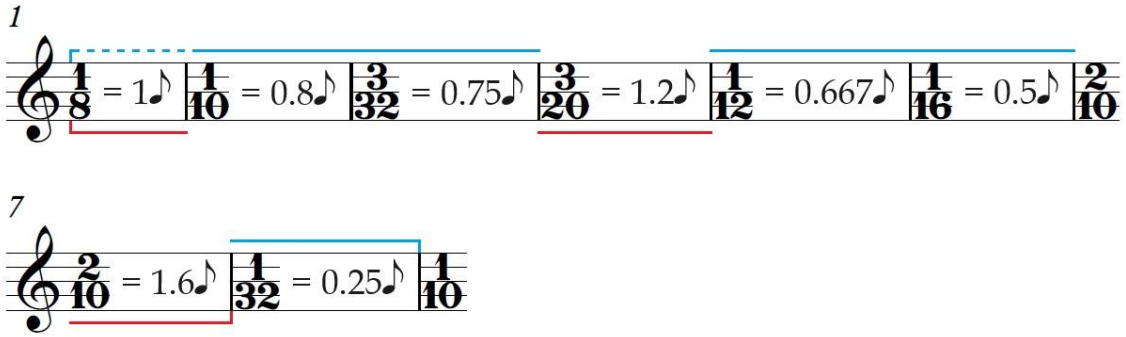
Bar 4 is the first subdivided bar, and the number of surface attacks corresponds to the subdivision ratio: 2 : 2 : 1. In the next bar, there is a 2:1 ratio between the impulse density and the proportional sub-bar durations, as there are two attacks in each equal-length subsection, before bars 10 and 16 return to synchronicity. In the final two systems

[378] Ibid.

of Example 7.5, the de-synchronisation occurs in conjunction with more complex rhythms and sub-bar durations which become increasingly complicated. The sub-bar durations of bar 20 is particularly difficult to rationalise, because Ferneyhough has placed the subdivision between the second and third nested ^{3}𝅘𝅥𝅯 notes. He not only de-synchronises the impulse density from the bar durations as explicated by the notated time signatures, but he also explores the concept further by drawing attention to the related proportions of implied durations of subsections.

Looking closer, Ferneyhough's preoccupation with ordering and rearrangement is seen as early as the first eight bars of the piece. There are two different processes occurring simultaneously in this short excerpt: the bars annotated with the continuous blue bracket (see Example 7.6) show a gradual shortening of bar lengths whereas the bars annotated with the red bracket show a gradual lengthening of bar lengths. (For consistency, the bar durations in Example 7.6 have been represented in terms of quavers.) However, instead of placing these two gradations consecutively, he has nested the gradual lengthening process within the gradual shortening process.

Example 7.6: Ferneyhough, *Superscriptio* (bars 1-8), with omissions.[379]



Not only do these patterns of ordering affect bar durations; they also extend to impulse densities, as seen in Example 7.7 where the surface rhythmic attacks oscillate between four and six onsets:

[379] Ibid.

Example 7.7: Ferneyhough, *Superscriptio* (bars 30-40a).[380]

Example 7.8: Ferneyhough, *Superscriptio* (bars 20b-29 and 52-61).[381]

Ferneyhough also integrates all these techniques concurrently. Example 7.8 compares bars 24-26 against bars 56-58 (see the red boxes). All these bars have three attacks each, and a pattern emerges where the numerators are ordered as ***1-3-3*** while the

[380] Ferneyhough, *Superscriptio*, 2.
[381] Ferneyhough, *Superscriptio*, 1-2.

denominators are ordered conventional, odd-factored, conventional, which then affects the pulse speeds of each bar:

Table 7.1: Comparison of note values of bars 24-26 against bars 56-58 of *Superscriptio*.

Bar Number	Time Signature	General Note Value	Note Duration as a Fraction	Pulse Speed
24	***1/8***	^{3}𝅘𝅥𝅯	1/24	168 BPM
25	***3/20***	^{5}𝅘𝅥𝅯	1/20	140 BPM
26	***3/32***	𝅘𝅥𝅯	1/32	224 BPM
56	***1/16***	^{3}𝅘𝅥𝅯	1/48	336 BPM
57	***3/12***	^{3}♪	1/12	84 BPM
58	***3/64***	Hemidemisemiquaver	1/64	448 BPM

The pulse speeds in Table 7.1 are calculated assuming that the base tempo direction of ♪ = 56 at the beginning of the piece applies to these bars. With both 3-bar segments, Ferneyhough orders the pulse speeds so that the slowest pulse speed is in the middle (in the ***3/20*** and ***3/12*** bars respectively) and the fastest pulse speeds are at the end (in the ***3/32*** and ***3/64*** bars respectively).

The bar duration ratio becomes steeper in the second 3-bar segment: bars 24-26 have a 20 : 24 : 15 combined ratio of bar durations (i.e. bars with the time signatures of ***1/8*** : ***3/20*** : ***3/32***); however, bars 56-58 have a much steeper durational proportion of 4 : 16 : 3 (or, for easier comparison to bars 24-26, 20 : 80 : 15; i.e. bars with the time signatures of ***1/16*** : ***3/12*** : ***3/64***). When comparing the 3-bar segments side by side, it is clear that the durations of the bookending bars 24 and 26 are halved when they appear in bars 56 to 58 (i.e. ***1/8*** and ***3/32*** become ***1/16*** and ***3/64*** respectively). However, the middle ***3/20*** bar actually lengthens to ***3/12***, which results in bars 56-58 having a steeper combined ratio of durations.

On top of this, there is a complicating factor: unlike bars 56-58, where the note durations remain consistent within each bar, the notes in bars 25-26 each have different durations. In bar 25, the three notes are chronologically ordered: a nested ^{5}𝅘𝅥𝅯 with a duration of 1/25; a ^{5}𝅘𝅥𝅯 represented fractionally as 1/20; and a nested ^{5}𝅘𝅥𝅯. as 3/50 (i.e. a pattern of lengthening note durations with a combined durational ratio of 4 : 5 : 6). In bar 26, the inverse is true where the three notes are arranged in order of shortening note durations: 𝅘𝅥𝅯. as 3/64; 𝅘𝅥𝅯 as 1/32; and hemidemisemiquaver as 1/64 (with a combined ratio of 3 : 2 : 1). Ferneyhough incorporates two layers of ordering when bars 24-26 are

compared against bars 56-58: firstly, in a structural sense, by using the time signatures and thus durational proportion of bars 56-58 to reflect bars 24-26; and secondly, by using asymmetrical note values to create a progression of durational elongation then contraction on the rhythmic surface of bars 25-26.

There is a tangential question as to why Ferneyhough used the time signatures ***1/8*** and ***1/16*** in bars 24 and 56 instead of ***3/24*** and ***3/48*** (to indicate three ^{3}𝅘𝅥𝅯 and three ^{3}𝅘𝅥𝅰 respectively). The other bars discussed thus far all have ***3*** as the numerator, and the denominators specified the pulse value of each bar. So, why not in bars 24 and 56? Ferneyhough, as he is wont to do, has established a few pre-compositional constraints for *Superscriptio*.[382] There are only seven different numerators and 10 different denominators that he uses throughout the piece (all of which are detailed in Table 7.2).

With regard to these specific numerators and denominators, of the total 218 bars of the work: there are no numerators larger than ***5*** after bar 56 (and no numerators larger than ***3*** from bar 195 onwards); and there are no denominators larger than ***24*** after bar 147 (and no denominators larger than ***16*** from bar 174 onwards). It is clear that Ferneyhough is numerically condensing the time signatures and placing gradually greater restrictions on the variety of time signatures used as the music develops. The process of erasure seen in the fifth and final stage of the work, touched on at the beginning of this chapter, is implemented through time signatures as well.

Table 7.2: Number of bars in each time signature in *Superscriptio*.

Denominators	**Numerators**						
	1	***2***	***3***	***4***	***5***	***7***	***11***
8	16	12		2			
10	18	29	8	1			
12	9	25	19	5	2		
16	8		18		3	1	
20	3		5				
24	3		6		1		
32	2		5		3	4	
40	1					1	
48	1		1			1	1
64			2		1	1	

[382] Toop, "*Lemma-Icon-Epigram*," 53, 62.

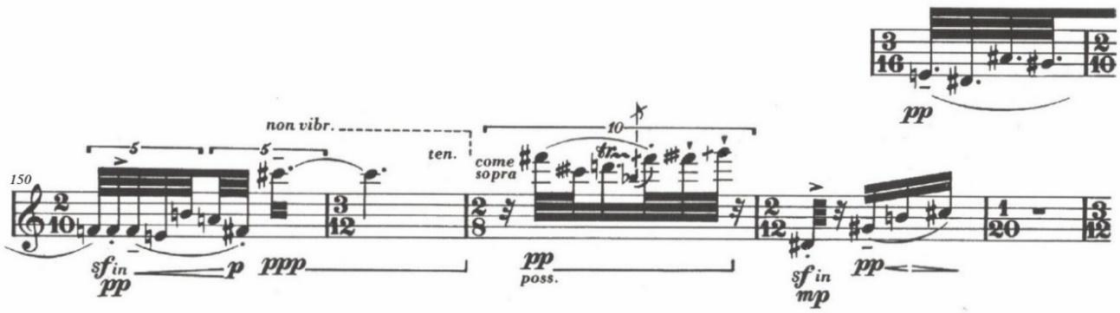
Apart from ***1*** and ***4***, every other numerator is a prime number. All the denominators range from ***8*** to ***64***, and they are either conventional denominators or only contain one odd factor of 3 or 5. Additionally, every time signature used in the piece is in its most simplified version, hence why ***3/24*** was not used for bar 24, nor ***3/48*** for bar 56 (as they can be simplified to ***1/8*** and ***1/16*** respectively).

The numerators ***2*** and ***4*** are used when the simplification of a time signature would not adhere to the specified denominators. For instance, refer back to Example 7.8: there is a bar of ***4/12*** in the penultimate system. This could theoretically be simplified to ***1/3***; however, ***3*** is not one of the distinct denominators Ferneyhough utilises in this work. Similarly, the ***2/10*** and ***2/12*** time signatures in the final system of the same excerpt could be simplified to ***1/5*** and ***1/6*** respectively, but this would contravene the same rule. Therefore, he only uses time signatures that work within these pre-compositional restrictions. This results in some oddities like bars 24 and 56, and it also demonstrates how his pre-compositional processes influence his use of time signatures.

Bar Length Equivalence

There is one exception to the rule that "every time signature used in the piece is in its most simplified version", and it arises through Ferneyhough exploring a specific peculiarity in the use of OFTSs: bar length equivalence as enabled by different time signatures. This exploration often affects the structure of certain sections within *Superscriptio*. As a simple example, bars 151-152 (see Example 7.9) are of the same duration but have been designated two different time signatures (i.e. ***3/12*** and ***2/8*** respectively).

Example 7.9: Ferneyhough, *Superscriptio* (bars 149-154).[383]



[383] Ferneyhough, *Superscriptio*, 6.

Both bars are a ♩ in duration each; combined, they would be a 𝅗𝅥 in duration. The two bars could have been combined as one bar under a ***1/2*** or ***2/4*** conventional time signature, especially since neither bar contains any surface articulations corresponding to the pulse value as implied by their respective denominators (i.e. the ***3/12*** bar does not contain three ^{3}♪ attacks and the ***2/8*** bar does not have two straight ♪ attacks). However, apart from the fact that the time signatures ***1/2*** or ***2/4*** would contravene the pre-compositional restrictions Ferneyhough has imposed on his choice of time signatures, there is a pattern applied to the structure of this section as currently notated.

The ***2/8*** bar would be more accurately notated as ***5/20*** considering the ***10***-tuplet bracket (i.e. the ***20***-denominator would preserve the quintuplet rhythms while ***5/20*** would produce an equivalent bar duration of ***2/8***). However, note the sequence of time signatures from bar 149: ***3/16***, ***2/10***, ***3/12***, ***2/8***. The numerators alternate between ***3*** and ***2***, and the denominators of each alternating time signature signal a deceleration of pulse speed: the 𝅘𝅥𝅯 pulse of ***3/16*** slows to a ^{3}♪ in ***3/12***; the ^{5}♪ pulse of ***2/10*** slows to a straight ♪ in ***2/8***. Furthermore, the denominators specifically slow to the next available denominator as per the pre-compositional restrictions (refer back to Table 7.2).

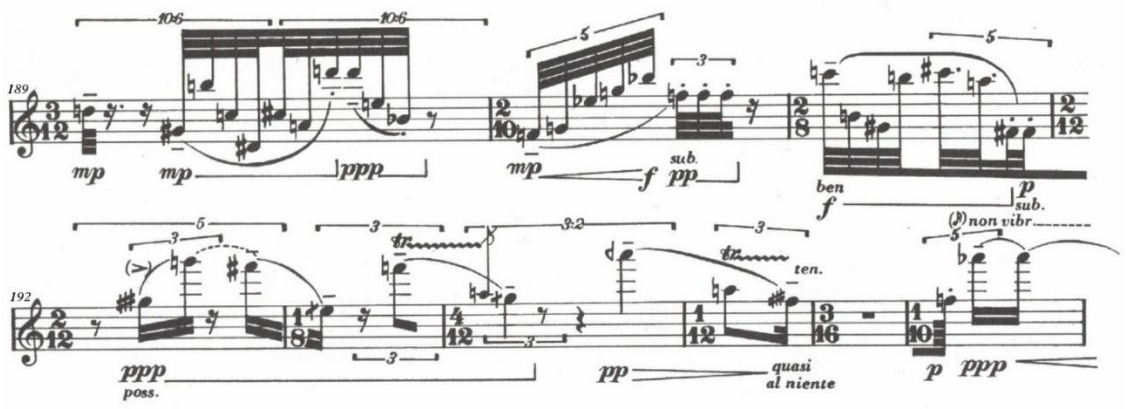
Of course, none of these pulse speeds are actually articulated on the surface of the music, as Ferneyhough continues to explore the de-synchronisation of impulse density and absolute bar duration, but the structure of the music has been impacted by the restrictions he has placed on his choice of time signatures. The above example of bar length equivalence speaks to his preoccupation with the underlying processes.

In the next example, ***3/12*** and ***2/8*** are used again, but this time they are separated by a ***2/10*** bar, so the bar length equivalence is less apparent since they are not adjacent (see Example 7.10(a)). It seems unusual that bar 189 would be notated with a ***3/12*** time signature when the bar has universal ***10***-tuplet brackets; it lends itself more to a ***5/20*** or even ***10/40*** time signature.

With the following ***2/10*** and ***2/8*** bars, they are bipartitioned through the use of differing tuplet rhythms, making the durations of the two ^{5}♪ and two straight ♪ durations of their respective time signatures discernible. The three ^{3}♪ pulses of the ***3/12*** bar, on the other hand, are obscured by the surface rhythms. However, the absurdity of

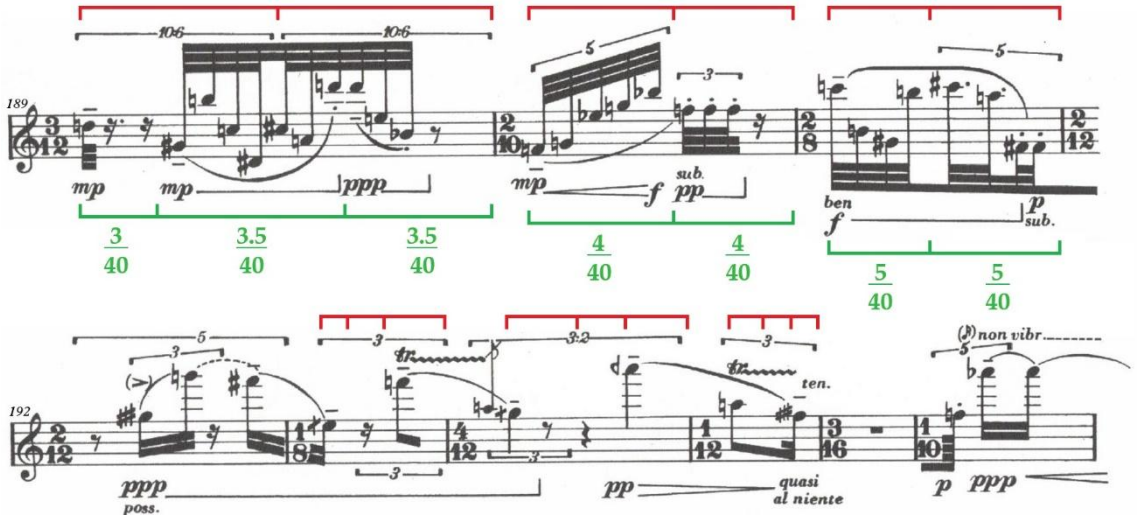
the notation gives the reader insight into the fact that Ferneyhough is preoccupied with more than merely accommodating particular tuplet rhythms.

Example 7.10(a): Ferneyhough, *Superscriptio* (bars 189-197).[384]



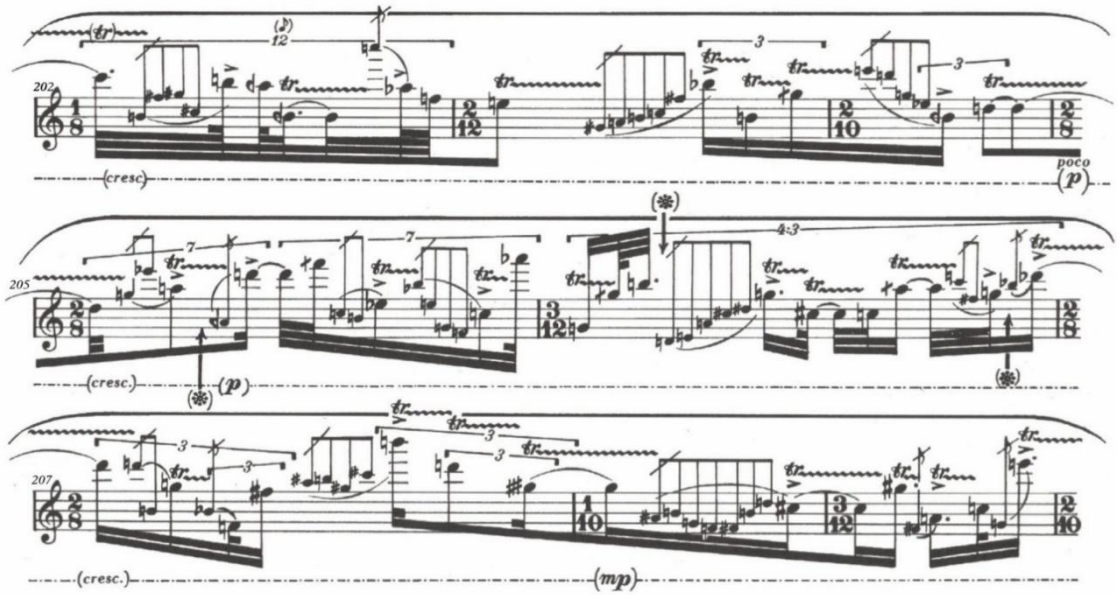
In this instance, Ferneyhough draws particular attention to the pulse speeds as indicated by the denominators. There is a steady deceleration of pulse speed from bar 189 to 191 as the pulse speed transitions from $^{3}\!\!\!

Example 7.10(b): Ferneyhough, *Superscriptio* (bars 189-197).[385]



Ferneyhough's preoccupation with ordering and rearrangement returns in the final instance of ***2/8–3/12*** bar equivalence. This is the only time in the work where there are three consecutive bars of ***2/8*** and ***3/12***, with a ***3/12*** bar situated between two ***2/8*** bars (see Example 7.11). The most pertinent question regarding this section is why he did not simply notate three ***2/8*** bars in a row, especially when each bar is bisected.

Example 7.11: Ferneyhough, *Superscriptio* (bars 202-209).[386]



Bar 205 is divided into two septuplets. Bar 206 has a universal ***4:3***-tuplet bracket, effectively nullifying the ***3***-numerator to make it an even number. Bar 207 is bisected

[385] Ibid.
[386] Ferneyhough, *Superscriptio*, 8.

into two triplets. The ***3/12*** bar could have easily been notated as a ***2/8*** bar with the added bonus of no tuplet bracket required; if the rhythms in bar 206 were halved and the ***4:3***-tuplet bracket was omitted, the 2/8 time signature could have been used. However, when the numerators and denominators of Example 7.11 are tabulated, the pattern becomes clearer:

Table 7.3: Breakdown of time signatures in bars 203-209 of *Superscriptio*.

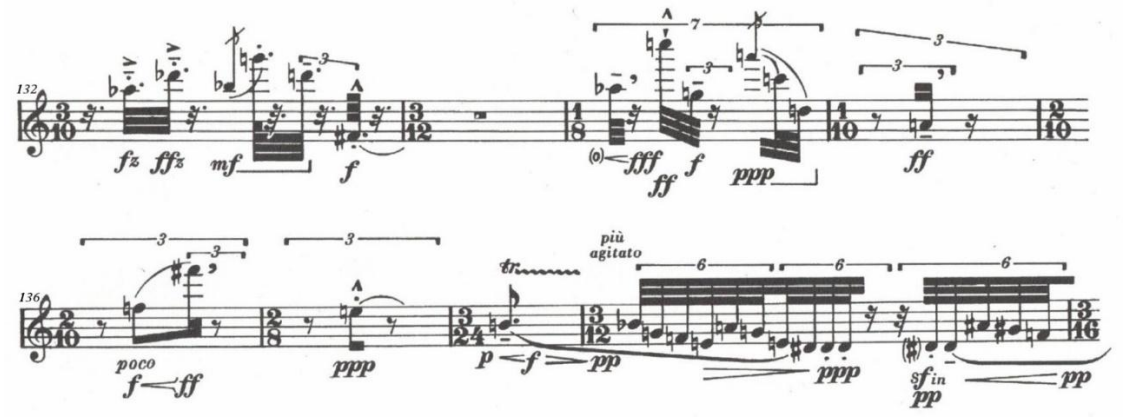
Bar Number	Time Signature	Numerator	Denominator	Notes
203	***2/12***	***2***	***12***	Deceleration of pulse speed Sum of numerators = 6 (***2*** + ***2*** + ***2***)
204	***2/10***	***2***	***10***	
205	***2/8***	***2***	***8***	
206	***3/12***	***3***	***12***	Reflection point
207	***2/8***	***2***	***8***	Acceleration of pulse speed Sum of numerators = 6 (***2*** + ***1*** + ***3***)
208	***1/10***	***1***	***10***	
209	***3/12***	***3***	***12***	

Bar 206 acts as a reflection point, where the denominators of the three following bars mirror the denominators of the three bars before, thereby enacting a chronological sequence of deceleration then acceleration of pulse speeds. The numerators in the three prior bars are all ***2*** (for a combined total of 6). The numerators in the three bars after also equal 6 when combined, but this time, Ferneyhough uses a different combination of numerators to achieve the same total (i.e. ***2*** + ***1*** + ***3***).

Before bar 206, the focus is on the changing denominators due to the same numerator throughout bars 203-205. After bar 206, the focus is on the changing numerators. The fact that there are two ***2/8*** bars and two ***3/12*** bars in this one excerpt indicates that Ferneyhough is utilising various underlying processes, as it would otherwise be strange to notate bars of the same duration with different time signatures in such close proximity.

Up until this point, only one bar-pair has been discussed: ***3/12*** and ***2/8***, which must have a durational ratio of 1:1 as they are equivalent in length. Ferneyhough introduces the ratio of 2:1 in the next example:

Example 7.12: Ferneyhough, *Superscriptio* (bars 132-139).[387]



As already discussed, ***3/12*** is equivalent to ***2/8***, so when it is placed adjacent to the ***1/8*** bar in the first system of Example 7.12, a 2:1 durational ratio is established. Looking at the surrounding context, it becomes evident why Ferneyhough chose ***3/12*** instead of ***2/8*** in bar 133 despite the fact that it is a bar of rest: the previous bar has a time signature of ***3/10***, which shares the same numerator; so again, the pulse speed is the focus as it accelerates from $^{5}\!\!\diamond$ in the ***3/10*** bar to $^{3}\!\!\diamond$ in the ***3/12*** bar. Then, in bars 134-135, the same pattern occurs: ***1/8*** and ***1/10*** share the same numerator, and the pulse speed accelerates from straight $\diamond$ to $^{5}\!\!\diamond$.

In the second system, the bar equivalences are flipped: bar 137 uses the ***2/8*** time signature (instead of ***3/12***), and bar 138 uses the ***3/24*** time signature (instead of ***1/8***). There is still a 2:1 durational ratio, made more apparent by the fact that the ***3/24*** bar is followed by a ***3/12*** bar. Bars 137-139 are similar to bars 189-191 from Example 7.10(a) in the sense that the ***2/8*** and ***3/12*** bars of the same duration are separated by a different time signature.

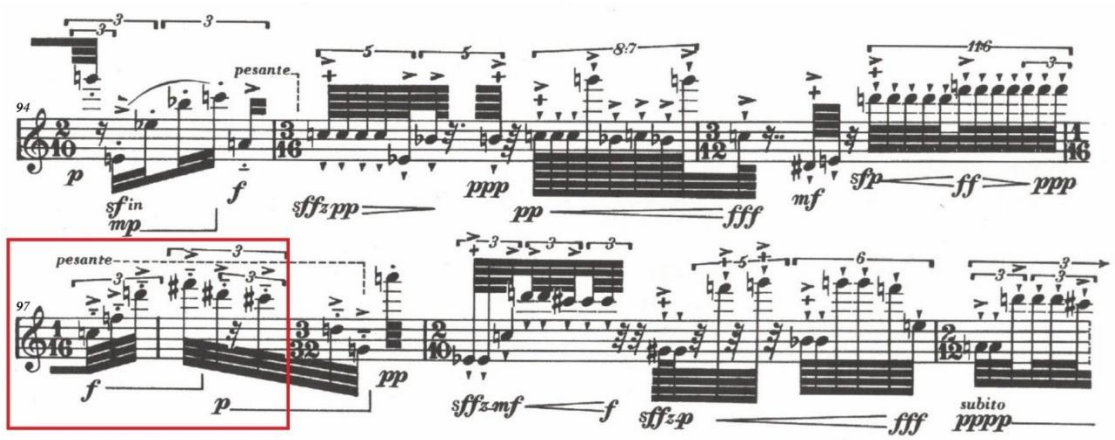
In contrast to the accelerating pulse speeds of the first system in Example 7.12, the bars with the same numerator in the second system feature a deceleration: the $^{5}\!\!\diamond$ pulse of ***2/10*** decelerates to a straight $\diamond$ in ***2/8***; and the $^{3}\!\!\diamond$ of ***3/24*** decelerates to a $^{3}\!\!\diamond$ pulse in ***3/12***. The focus on the changing pulse speeds continues even in the next bar, which has not been included in Example 7.12 but can be seen at the very end of the system: the straight $\diamond$ pulse of ***3/16***.

[387] Ferneyhough, *Superscriptio*, 5.

Although Ferneyhough wants to utilise a 2:1 ratio with regard to the absolute bar durations, by using different time signatures resulting in bar length equivalences, he is able to draw out other relationships concerning pulse speed between bars with the same numerator. This hearkens back to the principles that governed Birtwistle's *Silbury Air* in chapter 1, where he used the pulse labyrinth to show the type of metric modulation he wanted to employ. By exploiting only one notational device (OFTSs), Ferneyhough brings attention to multiple proportions and relationships across different layers of the music.

Ferneyhough also incorporates bar length equivalences by way of *not* changing the time signature in adjacent/subsequent bars. This is quite rare in *Superscriptio* where almost every bar features a time signature change. There are only four instances of adjacent bars sharing the same time signature, and the first occurs in bars 97-98 (see the red box in Example 7.13):

Example 7.13: Ferneyhough, *Superscriptio* (bars 94-101a).[388]



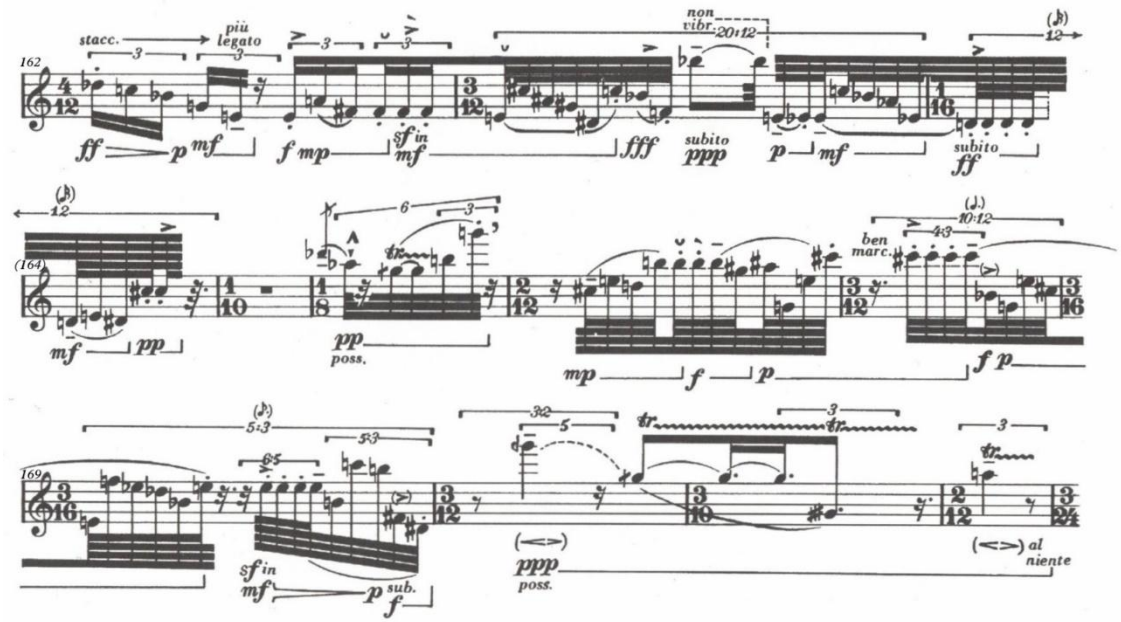
The proportional relationship between the time signatures of ***3/12*** and ***1/16*** is 4:1. Note that the ***1/16*** is shared across two bars. It could be argued that the bar durations up until this point in the piece have been dictated by a change of pulse speed as implied by the time signature denominator. So, in a sense, the red box could be interpreted as a combined ***1/8*** bar, thus making the ratio 2:1 between ***3/12*** and "***1/8***". On the other hand, there is already an established 1:2 relationship between the denominators of bars 97-98 and bar 99 (i.e. 16:32 = 1:2).

[388] Ferneyhough, *Superscriptio*, 4.

With that said, the 1:2 proportion is only between the denominators, not the bar durations, and Ferneyhough does not even notate surface rhythmic attacks according to the pulse speeds as implied by the denominators (i.e. he does not notate straight 𝅘𝅥𝅯 in the ***1/16*** bars to contrast against the straight 𝅘𝅥𝅰 of the ***3/32*** bar). As the rhythms are currently notated, the more accurate denominator to encapsulate ^{3}𝅘𝅥𝅰 in bars 97-98 would have been ***48***, so the time signature could have been ***3/48***. All in all, at rare occasions throughout this work, Ferneyhough uses one time signature for two or even three consecutive bars. This has the effect of introducing ambiguity into the interpretation of bar length equivalence and thus the interpretation of proportional relationships.

The 4:1 ratio is properly seen in bars 163-164, where he again uses ***3/12*** and ***1/16*** time signatures. However, the surrounding context is worth exploring in detail, as it provides an excellent example of how Ferneyhough switches focus from bar duration to pulse speed with his use of time signatures. Whenever the denominator remains the same while the numerator changes, he draws attention to the difference in bar duration: this occurs between bars 162-163 with the ***4/12*** and ***3/12*** time signatures (i.e. a 4:3 durational ratio), and again in bars 167-168 with the ***2/12*** and ***3/12*** time signatures (i.e. a 2:3 durational ratio).

Example 7.14: Ferneyhough, *Superscriptio* (bars 162-172).[389]



[389] Ferneyhough, *Superscriptio*, 6.

Whenever the numerator remains the same while the denominator changes, he draws attention to the difference in pulse speed (as detailed in Table 7.4). This switching of focus is akin to much of the evolution of metric modulation discussed previously in chapter 1. Example 7.14 demonstrates the flexibility of OFTSs to simultaneously determine multiple musical parameters other than metre.

Table 7.4: Breakdown of notable pulse speed changes in Example 7.14.

Bar Number	Time Signature	Pulse Speed	Notes
164	1/16	Semiquaver	Deceleration
165	1/10	Quintuplet quaver	
166	1/8	Straight quaver	
168	3/12	Triplet quaver	Acceleration (bars 168-169 only)
169	3/16	Semiquaver	Deceleration
170	3/12	Triplet quaver	
171	3/10	Quintuplet quaver	

Thus far, the ratios 2:1 and 4:1 have been observed with bar length equivalence, and Ferneyhough goes on to combine these proportions. Bars 144-145 (see Example 7.15) contain the second instance in *Superscriptio* of two consecutive bars with the same time signature. At first glance, the time signature ***3/24*** is equivalent to ***1/8***, and the ***3/48*** of bar 146 is equivalent to ***1/16***, so there would be a combined 2 : 1 : 4 ratio between the time signatures ***3/24***, ***3/48***, and ***2/8***. However, similar to Example 7.13, the two consecutive bars of ***3/24*** introduce some interpretational ambiguity as they could be combined to be ***3/12*** in total bar duration. Thus, the ***3/48*** bar could be interpreted as being surrounded by two bars of the same duration (as ***3/12*** and ***2/8*** are equivalent in length).

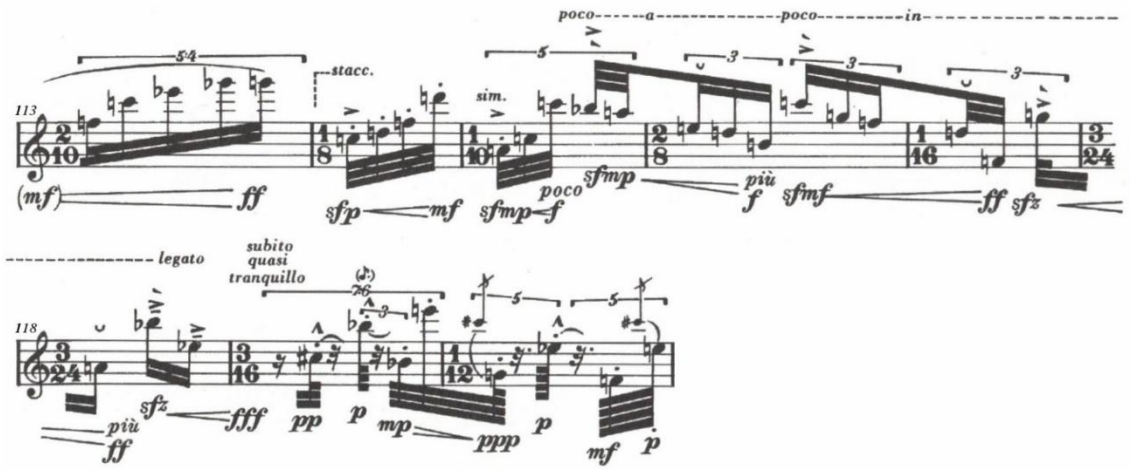
Example 7.15: Ferneyhough, *Superscriptio* (bars 144-149).[390]

An unambiguous instance of the combined 4 : 1 : 2 is seen properly in bars 116-118 (see Example 7.16), where there is a sequence of ***2/8*** followed by ***1/16*** and then ***3/24***.

[390] Ibid.

Here, ***1/16*** is used instead of ***3/48***. What is especially noteworthy in this excerpt is that, unlike all the other examples of bar length equivalence discussed thus far, the surface rhythms are actually significant in these bars. Triplet rhythms are used throughout all three bars: six $\overset{3}{\text{𝅘𝅥𝅯}}$ attacks are played in the ***2/8*** bar, then three $\overset{3}{\text{𝅘𝅥𝅯}}$ in ***1/16***, and finally three 𝅘𝅥𝅯 in ***3/24***. So, Ferneyhough explicates the 4 : 1 : 2 ratio of the bar durations while simultaneously addressing the changes of pulse speeds.[391]

Example 7.16: Ferneyhough, *Superscriptio* (bars 113-120).[392]



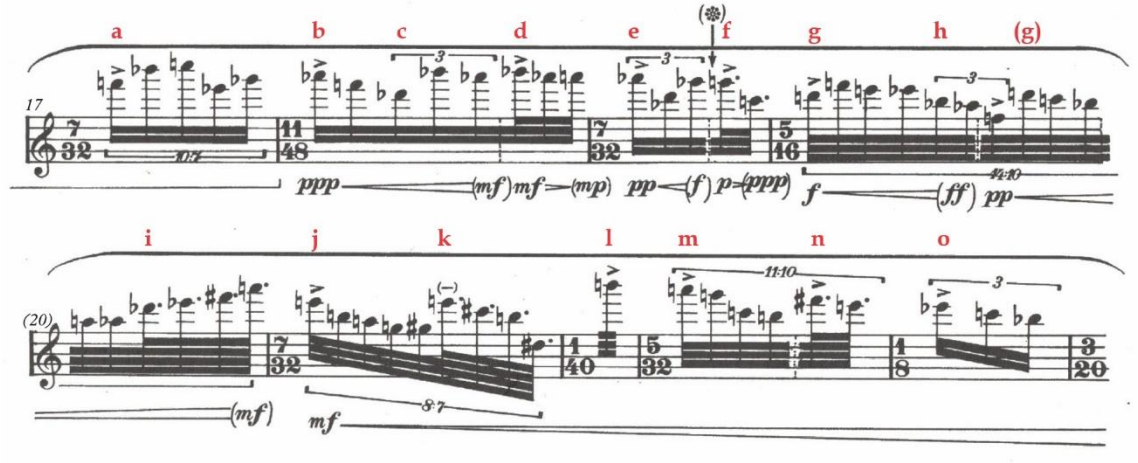
By placing particular pre-compositional restrictions on the choice of time signatures used throughout the work, Ferneyhough is able to explore patterns and proportions through different relationships of bar length equivalences and pulse speeds, especially when utilising various OFTSs.

Similar Bar Lengths

Adjacent to bar length equivalences is similar bar lengths: bars with *almost* the same duration as each other. In Example 7.17, all three ***7/32*** bars are clearly of the same duration, and the fact that they alternate with bars that have time signatures containing differing denominators is noteworthy (the procedure of alternation will be addressed in the next subsection of this chapter). However, the *similar* bar lengths are actually between ***7/32*** and ***11/48***. The ***7/32*** bar is 1.75𝅘𝅥𝅯 long, and ***11/48*** is 1.833𝅘𝅥𝅯 long. This is a difference of 0.083𝅘𝅥𝅯 which, if calculated with the initial metronome mark of 𝅘𝅥𝅯 = 56ca., equates to 0.089 seconds (all figures rounded to three decimal places).

[391] Ferneyhough has explored similar ratios in other works: see Toop, "*Lemma-Icon-Epigram*," 80.
[392] Ferneyhough, *Superscriptio*, 5.

Example 7.17(a): Ferneyhough, *Superscriptio* (bars 17-24).[393]



The exact limitations of the bars are not obvious when actually performed, as the bar subdivisions, accent placements after the dotted lines, and relatively narrow melodic contour obscure where the downbeat of each bar is located. Furthermore, the speed of the surface rhythms fluctuates within each bar, giving no clear indication as to when the bar changes (see Table 7.5).

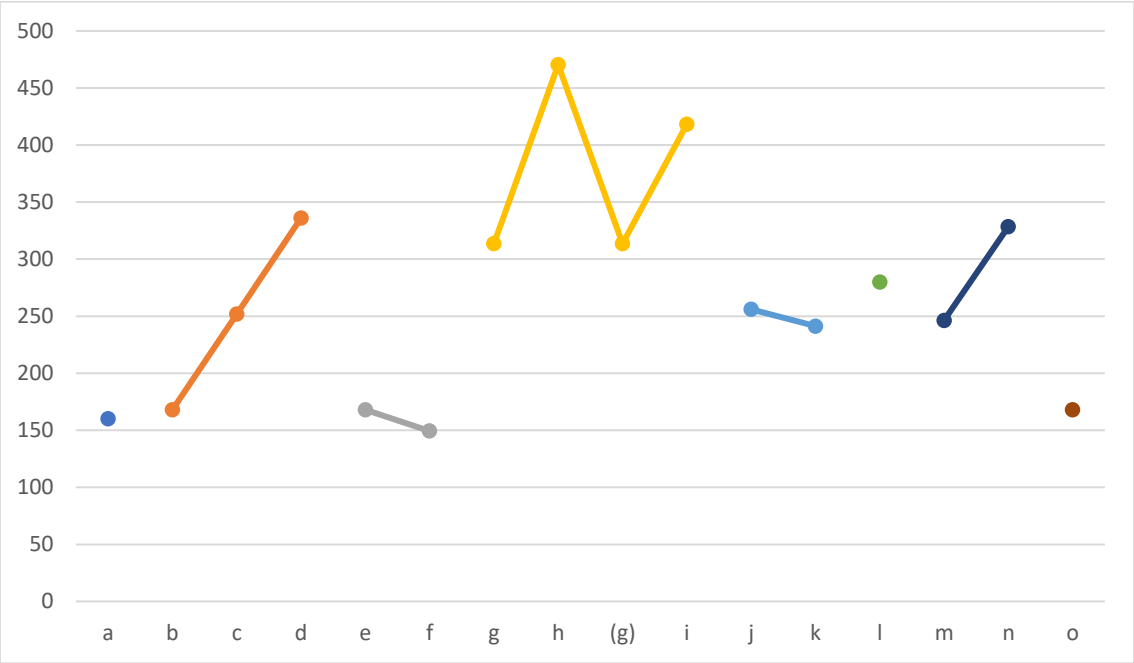
Table 7.5: Breakdown of note durations in bars 17-24 of *Superscriptio* (all numbers rounded to three decimal places).

Bar Number	Time Signature	Reference Point	Duration in Quavers	Duration in Seconds	Pulse Speed (BPM)
17	7/32	a	0.35♪	0.375	160
18	11/48	b	0.333♪	0.357	168
		c	0.222♪	0.238	252
		d	0.167♪	0.179	336
19	7/32	e	0.333♪	0.357	168
		f	0.375♪	0.402	149.333
20	5/16	g	0.179♪	0.191	313.6
		h	0.119♪	0.128	470.4
		(g)	(0.179♪)	(0.191)	(313.6)
		i	0.134♪	0.143	418.133
21	7/32	j	0.219♪	0.234	256
		k	0.164♪	0.176	341.333
22	1/40	l	0.2♪	0.214	280
23	5/32	m	0.227♪	0.244	246.4
		n	0.17♪	0.183	328.533
24	1/8	o	0.333♪	0.357	168

[393] Ferneyhough, *Superscriptio*, 1.

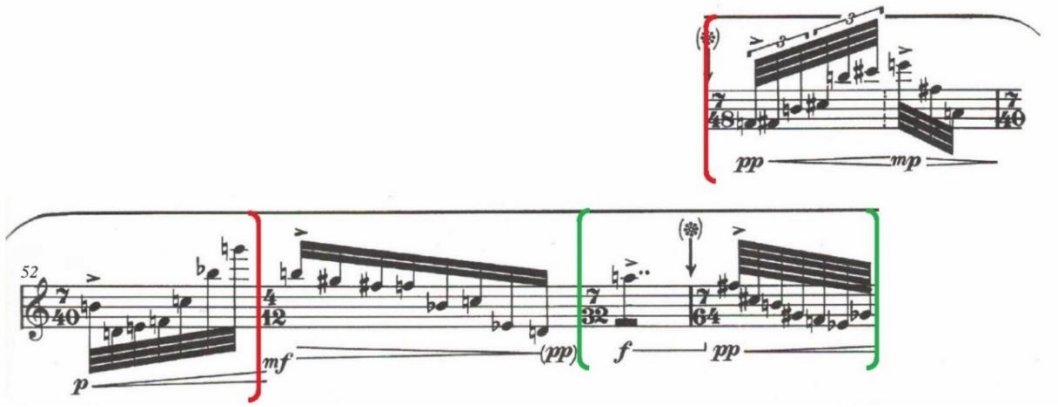
Example 7.17(b) shows the pulse speed changes within each bar, where each different coloured dot or line indicates the same bar. For example, the yellow line indicates all the pulse speed fluctuations of bar 20 of Example 7.17(a)/Table 7.5. Therefore, it is likely this instance of similar bar lengths is an outcome of one or more underlying processes Ferneyhough has implemented onto the notation.

Example 7.17(b): Pulse speed in BPM of each reference point in Example 7.17(a)/Table 7.5.



There are eight instances of time signatures with 7-numerators: the first half are located within bars 15-21, three of which are seen in Example 7.17(a); and the second half appear in Example 7.18. Whereas the 7-numerator time signatures alternate with other numerators in bars 15-21, they instead form pairs in bars 51-55 (see the red and green brackets):

Example 7.18: Ferneyhough, *Superscriptio* (bars 51-55).[394]



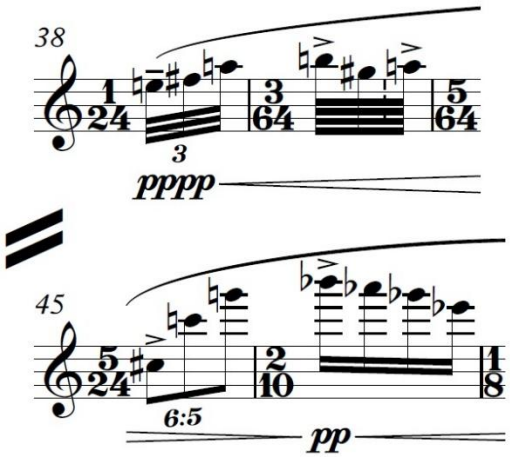
[394] Ferneyhough, *Superscriptio*, 2.

By pairing these bars, Ferneyhough draws attention again to the difference of pulse speed as dictated by the denominators and, by extension, the difference between the absolute bar durations. As expressed by the ***48***- and ***40***-denominators in bars 51-52, there is a 6:5 ratio between the ^{3}𝅘𝅥𝅯 and ^{5}𝅘𝅥𝅯 pulse speeds (and therefore a 5:6 ratio of the absolute bar durations). There is also a simple 1:2 ratio between the 𝅘𝅥𝅯 and hemidemisemiquaver pulse speeds of bars 54-55 (and therefore a 2:1 ratio of the absolute bar durations).

However, when the bar pairs are taken together, there are similar bar lengths across this annotated section: the total duration of the red-bracketed bars 51-52 is 2.567𝅘𝅥𝅮/2.75 seconds; bar 53 is 2.667𝅘𝅥𝅮/2.857 seconds long; and the total duration of the green-bracketed bars 54-55 is 2.625𝅘𝅥𝅮/2.813 seconds. With a 0.1𝅘𝅥𝅮/0.107 second difference at most between all three segments, there seems to be an underlying intention to draw a comparison between these similar durations, and Ferneyhough achieves this by using the same numerators to pair bars together into comparable units.

There are two final instances of similar bar lengths yet to be addressed, and both involve nested tuplet rhythms in bars with ***24***-denominator time signatures. Due to this similarity, these two instances have been collated in Example 7.19:

Example 7.19: Ferneyhough, *Superscriptio* (bars 38-39 and 45-46).[395]



Bar 38 is 0.333𝅘𝅥𝅮 in length whereas bar 39 is 0.375𝅘𝅥𝅮 long, creating a difference of only 0.042𝅘𝅥𝅮. The similarity in duration is heightened when the individual note durations are compared: the nested ^{3}𝅘𝅥𝅯 in the ***1/24*** bar is 0.111𝅘𝅥𝅮 in duration, whereas the

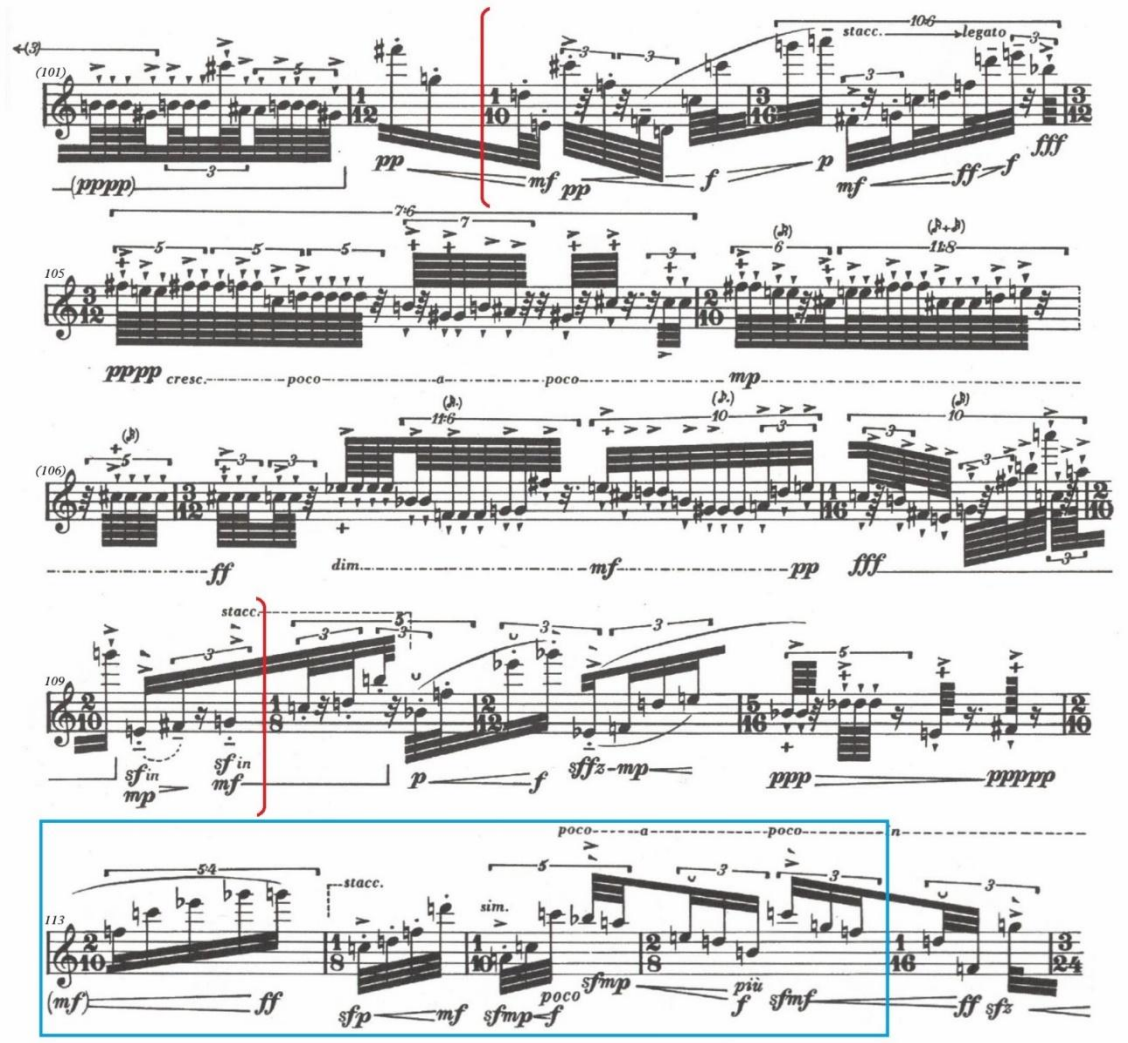
[395] Ferneyhough, *Superscriptio*, 3.

hemidemisemiquaver pulse of the ***3/64*** bar is 0.125𝅘𝅥𝅯. This tracks from the fact that both bars are notationally trisected. Bar 45 is 1.667𝅘𝅥𝅯 in length, whereas bar 46 is 1.6𝅘𝅥𝅯 long. These miniscule differences in similar lengths of adjacent bars hint at the underlying compositional processes Ferneyhough uses to distort and manipulate the structural framework of *Superscriptio*. This could not be achieved without OFTS, because the OFDs result in unconventional bar lengths by way of introducing tuplet pulse/note values.

Alternations and Retrograde

As briefly mentioned with Example 7.17(a), Ferneyhough's use of pre-compositional procedures results in alternating time signature patterns that affect the structure of particular sections. This is often simultaneously coupled with portions of the music being structurally retrograded or involving a palindromic pattern.

Example 7.20: Ferneyhough, *Superscriptio* (bars 101b-117).[396]



[396] Ferneyhough, *Superscriptio*, 4-5.

For instance, consider Example 7.20, which covers almost 17 bars. The red brackets highlight a passage where the denominators are in a mirror image pattern: ***10-16-12-10-12-16-10***, with bar 106 as the point of reflection. The blue box, on the other hand, shows alternating ***10***- and ***8***-denominators with numerators sequenced in a palindrome.

A few bars later, another 17-bar section of the music experiences an extended combined alternation and retrograde pattern with the denominators (see Example 7.21(a)). Table 7.6 further details these time signature patterns.

Example 7.21(a): Ferneyhough, *Superscriptio* (bars 120-136).[397]

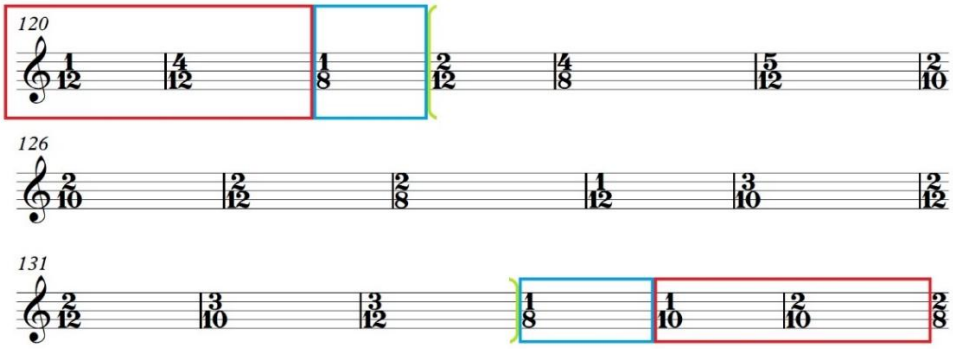


Table 7.6: Breakdown of denominator patterns in Example 7.21(a).

Bars	Numerator	Denominator	Notes (Annotations in Example 7.21(a))	
120	***1***	***12***	Bookending bar-pair with same OFD (first red box)	
121	***4***	***12***		
122	***1***	***8***	Bookending ***1/8*** bar (first blue box)	
123	***2***	***12***		Bars 123-133 (green brackets): Alternating ***12***-denominators
124	***4***	***8***		
125	***5***	***12***		
126	***2***	***10***	Bars 126-130 (second system): Palindrome	
127	***2***	***12***		
128	***2***	***8***		
129	***1***	***12***		
130	***3***	***10***		
131	***2***	***12***		
132	***3***	***10***		
133	***3***	***12***		
134	***1***	***8***	Bookending ***1/8*** bar (second blue box)	
135	***1***	***10***	Bookending bar-pair with same OFD (second red box)	
136	***2***	***10***		

[397] Ferneyhough, *Superscriptio*, 5.

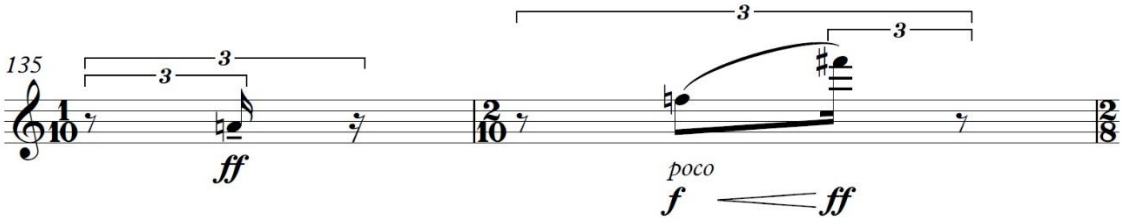
The middle 11 bars (see the green brackets) feature an extensive alternation pattern between ***12***-denominators and other denominators (specifically ***8*** and ***10***). The second system has a palindrome of the denominators: ***10-12-8-12-10***, with the ***2/8*** bar as the reflection point.

Ferneyhough imposes a different pattern onto the numerators of this second system: when added, the ***2***-numerators of bars 126-127 equate to 4, and he uses a different combination in the time signatures of bars 129-130, namely the ***1***- and ***3***-numerators, when the denominators are mirrored. This reorganisation of numerators over a set patterning of denominators is reminiscent of bars 113-116 in Example 7.20.

Ferneyhough bookends this excerpt using a pair of OFTS bars with the same denominator and a ***1/8*** bar (in reverse order for the end of the excerpt, which is yet another mirroring pattern overlaid upon the structure). Bars 129, 131, and 133 are highlighted in Table 7.6 to reveal a small instance of concurrent alternation and patterning. These bars alternate with ***3/10*** bars while simultaneously expressing a gradual ascension of the numerators (***1-2-3***).

The surface rhythms have not been included in Example 7.21(a) so as to not detract or distract from the structural analysis, but Ferneyhough does use a type of mirroring process on the surface of the music in this section. Bars 135-136 at the end of the excerpt contain one such occurrence:

Example 7.21(b): Ferneyhough, *Superscriptio* (bars 135-136).[398]



The processes used in the brief excerpt are made apparent through Ferneyhough's notation: a universal triplet with a nested triplet at the beginning of bar 135 has been mirrored in bar 136 so the nested triplet is at the end of the bar instead. The added complication is that bar 136 is double the length of bar 135, as indicated by the time signatures, so he has reproportioned the universal triplet: instead of a universal

[398] Ibid.

triplet of 5𝅘𝅥𝅯 as seen in bar 135, there is a universal triplet of 5♪ in bar 136. (They are quintuplet rhythms because of the underlying ***10***-denominator of the OFTSs.)

However, the nested triplet fills the same duration of a (universal) ♪ length, hence why the same rhythm of "quaver rest—𝅘𝅥𝅯 note" is reversed under the nested triplet bracket. Within the ***2/10*** bar, there is a reproportioned mirroring of sorts: before the nested triplet, there is a rest then a note; the nested triplet reverses this order so there is a note then a rest. It is a reproportioned palindrome because there is a 3:2 durational relationship between the events under the universal triplet and the events under the nested triplet brackets. Multiple layers of retrograde and mirroring occur in these two short bars, and this is emblematic of the complexity achieved by the compositional processes exploited throughout the piece.

There is a patterning on a larger scale towards the beginning of the 17-bar excerpt, starting at bar 124, where the denominator type cycles between conventional, triplet-, and quintuplet-based (see Example 7.21(c)). The only denominators used here are ***8***, ***12***, and ***10***, but in future examples, conventional, triplet-, and quintuplet-based denominators will include a wider variety of numbers. All these cycles of denominator type are found in 7-bar segments in the latter half of the work.

Example 7.21(c): Ferneyhough, *Superscriptio* (bars 124-130).[399]

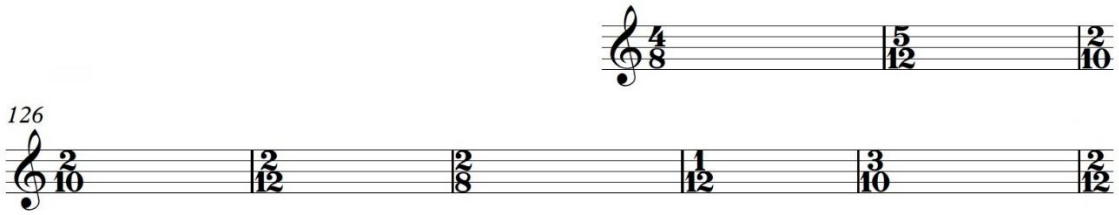


Table 7.7: Breakdown of denominator patterns in Example 7.21(c).

Bars	Conventional Denominator	Triplet Denominator	Quintuplet Denominator
124	***4/8***		
125		***5/12***	
126			***2/10***
127		***2/12***	
128	***2/8***		
129		***1/12***	
130			***3/10***

[399] Ibid.

Patterns of cycling denominator types appear twice more and will be discussed with Examples 7.22 and 7.23(a) (along with their respective Tables 7.8 and 7.9). From bar 150, there are seven bars that start on a different point of the cycle, traversing quintuplet-based, then triplet-based, then conventional denominators:

Example 7.22: Ferneyhough, *Superscriptio* (bars 150-156).[400]

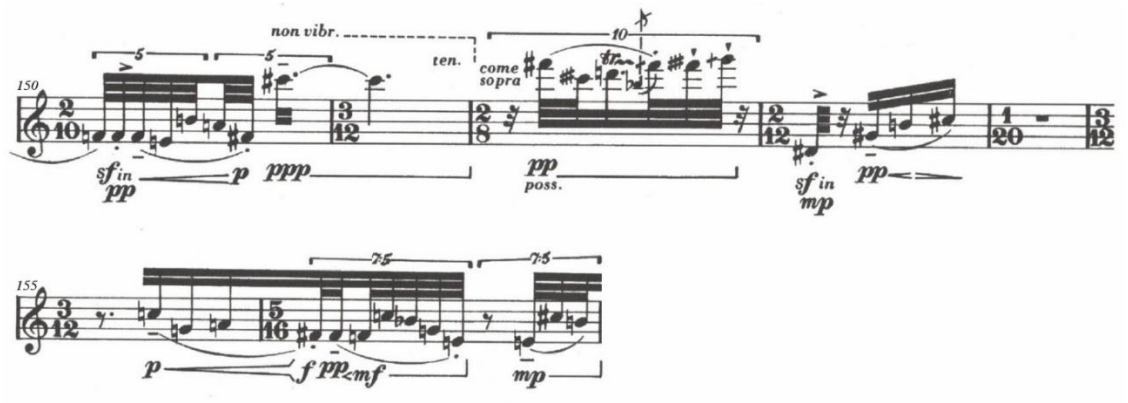


Table 7.8: Breakdown of denominator patterns in Example 7.22.

Bars	Conventional Denominator	Triplet Denominator	Quintuplet Denominator
150			***2/10***
151		***3/12***	
152	***2/8***		
153		***2/12***	
154			***1/20***
155		***3/12***	
156	***5/16***		

As shown in Table 7.8, Ferneyhough has diversified the denominators used to include ***16*** in the conventional denominators and ***20*** in the quintuplet-based denominators. The final 7-bar segment of cycling is found within a broader section that also contains other patterns of alternation and palindromic procedures:

[400] Ferneyhough, *Superscriptio*, 6.

Example 7.23(a): Ferneyhough, *Superscriptio* (bars 181-197).[401]

Table 7.9: Breakdown of denominator patterns in Example 7.23(a).

Bars	Conventional Denominator	Triplet Denominator	Quintuplet Denominator
184	***3/16***		
185		***2/12***	
186			***2/10***
187		***5/12***	
188	***4/8***		
189		***3/12***	
190			***2/10***

To keep Example 7.23(a) uncluttered, the bars discussed in Table 7.9 are not highlighted, but bar numbers have been given for orientation. The red and green brackets in Example 7.23(a) indicate two separate instances of 5-bar segments which experience a palindromic effect in the denominator order. The red bracket contains ***12-16-10-16-12*** denominators. The green bracket contains ***10-12-8-12-10*** denominators.

Note that within the 5-bar segments, the reflection point is the numerically lowest denominator (i.e. for bars 181-185, ***10*** is numerically lower than ***12*** and ***16***; and for bars

[401] Ferneyhough, *Superscriptio*, 7.

186-190, ***8*** is numerically lower than ***10*** and ***12***). Furthermore, the bookending denominator is in between the numerically highest and lowest denominators in each segment to enable a fluctuating pattern of pulse speeds throughout the 5-bar segments, reminiscent of the effect created by the alternation of denominator types. The blue box highlights a brief alternation of ***8***- and ***12***-denominators.

Example 7.23(b): Ferneyhough, *Superscriptio* (bars 181-191).[402]

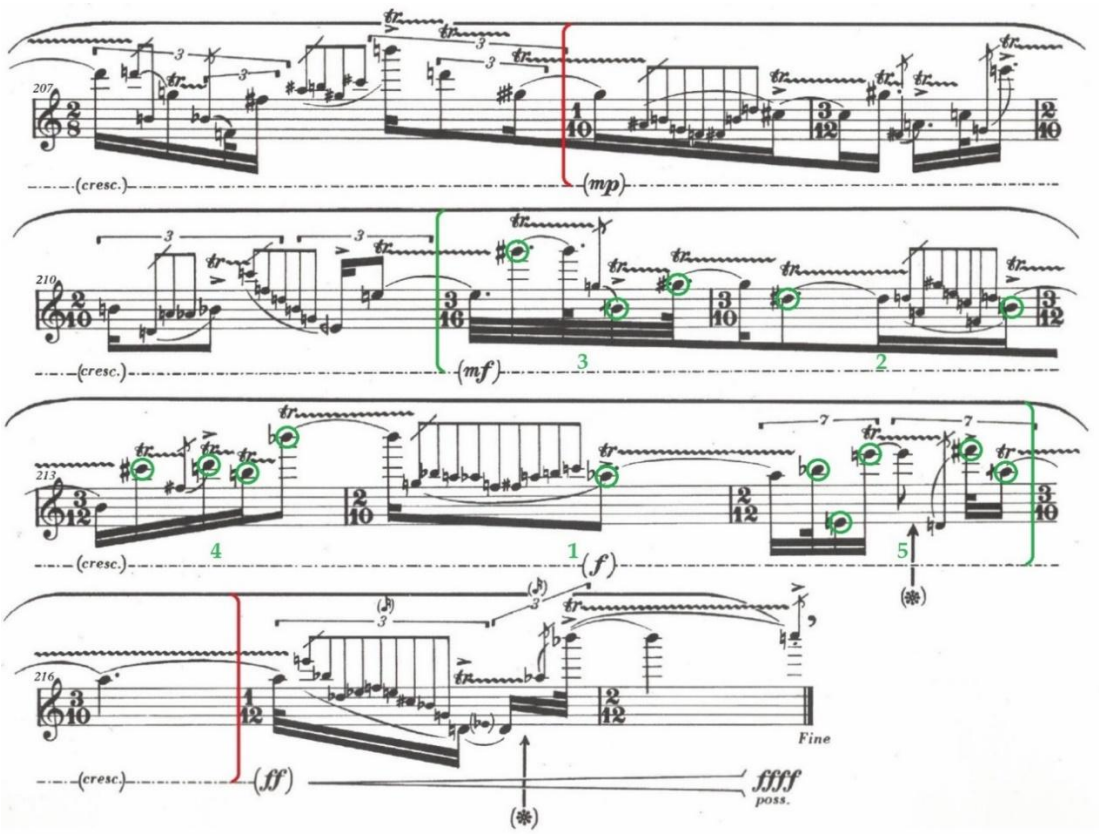
Another alternation is found in bars 185-189 (see the red brackets in Example 7.23(b)). As a result of the alternation of denominator types, these bars also include an alternation of the ***12***-denominator with ***10***- and ***8***-denominators. Concurrent to this process, Ferneyhough has overlaid a gradual truncation of the numerators in a ***5-4-3-2*** pattern in bars 187-190 (see the green circles). This same pattern of alternating denominators while simultaneously ordering the numerators in a specific configuration is seen again a few bars later, at the very end of the piece.

In bars 208-216 (see the red brackets in Example 7.24), all the denominators alternate with ***10***-denominators. The green brackets highlight a portion within the alternating denominator section where the numerators are arranged as ***3-3-3-2-2*** while the surface rhythmic onsets are ordered 3-2-4-1-5 (i.e. a permutation of numbers ranging from 1-5; the onsets do not include grace notes). By the end of the piece, the amount of erasure of surface rhythms is evident in the proliferation of trills, tied notes, and grace

[402] Ibid.

notes, but despite the erasure procedure implemented onto this section of the music, alternation and ordering patterns persist.

Example 7.24: Ferneyhough, *Superscriptio* (bars 207-218).[403]



Truncations and Elongations

Ordering patterns extend to truncations and elongations of both the number of onsets within bars as well as the bar lengths. Unlike Example 7.24, where the number of attacks in each bar is not ordered in an increasing or decreasing fashion, bars 109-116 feature two progressions where the number of attacks per bar gradually increase (see Example 7.25). This is in line with Ferneyhough's technique of de-synchronising absolute bar duration and impulse density.

[403] Ferneyhough, *Superscriptio*, 8.

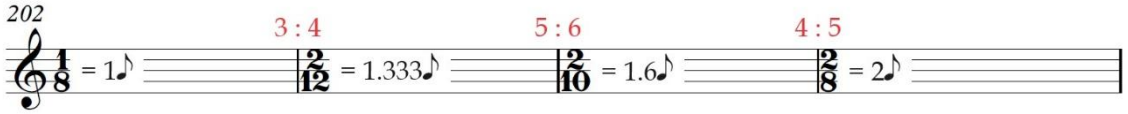
Example 7.25: Ferneyhough, *Superscriptio* (bars 109-117).[404]

There are also brief passages of sequential bar truncation and elongation. The first of note is in bars 139-144 where the bar lengths gradually shorten from ♩♩ to ♪ in duration:

Example 7.26: Ferneyhough, *Superscriptio* (bars 139-144).[405]

Not only is there a gradual truncation of bar lengths here, but there is a sense of deceleration as the difference in bar durations becomes less steep from an arithmetic perspective as the passage progresses (see the annotations within the bars). In a geometric sense, as illustrated in the red text above the staff, there is a gradual flattening out of the proportions from one bar to the next, where the ratios progressively become closer (with the exception of the last bar). Compare this to bars 202-205, where there is an almost equal arithmetic differential as the bars elongate (see Example 7.27). These slight differences in bar durations can only be achieved with OFTSs.

Example 7.27: Ferneyhough, *Superscriptio* (bars 202-205).[406]



[404] Ferneyhough, *Superscriptio*, 4-5.
[405] Ferneyhough, *Superscriptio*, 5-6.
[406] Ferneyhough, *Superscriptio*, 8.

Other Inter-Bar Patterns

The other inter-bar patterns throughout *Superscriptio* are less easily categorised so they will now be discussed in chronological order. The red boxes in Example 7.28 highlight bars of ***10***-denominator time signatures. There are initially three bars, then two, then one, all separated by a triplet-based denominator bar. This decreasing number of bars effectively creates a pattern of truncation. Furthermore, the annotated bars are bookended by bars of ***3/16***, notationally solidifying the fact that this should be taken and viewed as a distinct section of the music.

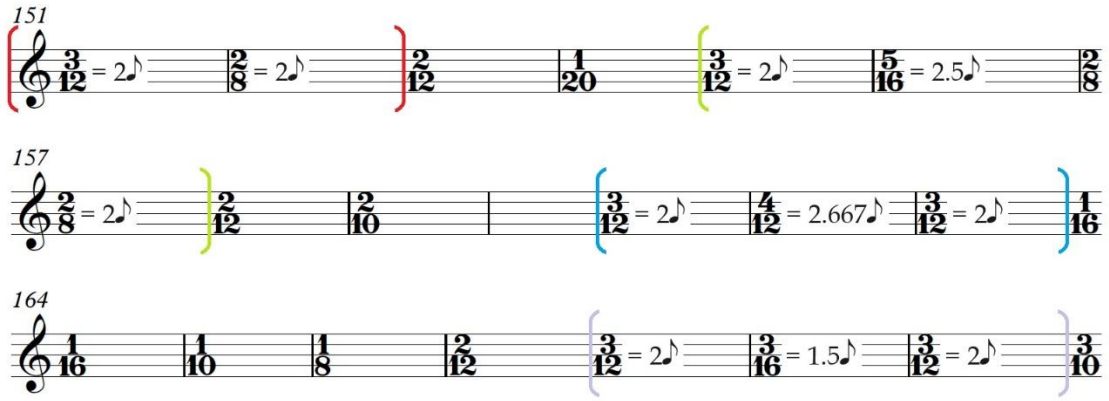
Note that the separating triplet-based denominators of bars 81 and 84 would be the same duration if the numerators were reversed (i.e. if bar 81 had the time signature ***2/24*** and bar 84 had the time signature ***1/12***). As it is, the durational proportion between bars 81 and 84 is 1:4.

Example 7.28: Ferneyhough, *Superscriptio* (bars 76-87a).[407]

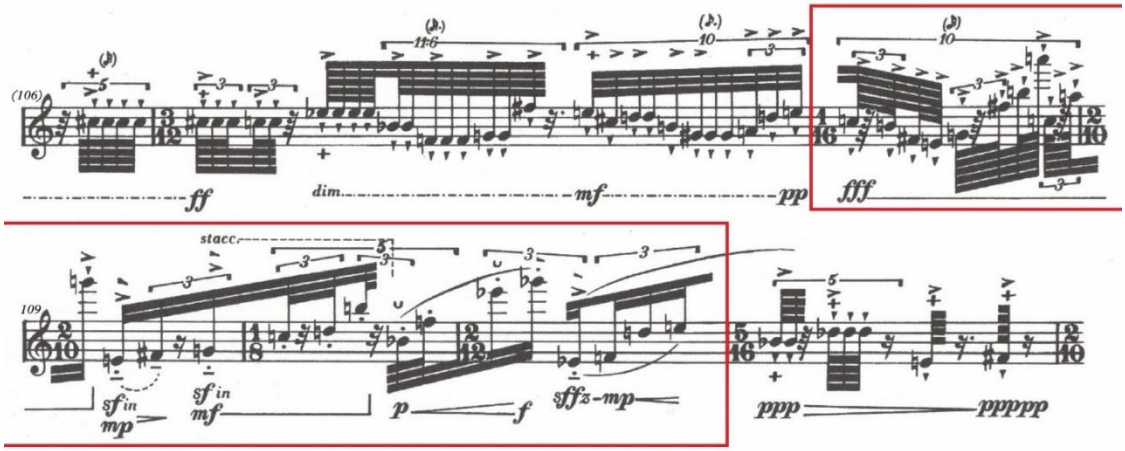
Along a similar vein, Example 7.29 shows that there is a pattern of two, then three, then four unannotated bars, separating each annotated group from one another. There are two bars of 2♪-length bookending each annotated group; note the use of bar equivalence with the ***3/12*** and ***2/8*** time signatures. The bars in the middle of the green, blue, and grey bracketed groups fluctuate in duration.

[407] Ferneyhough, *Superscriptio*, 3.

Example 7.29: Ferneyhough, *Superscriptio* (bars 151-170).[408]



Example 7.30: Ferneyhough, *Superscriptio* (bars 106b-112).[409]



Example 7.30 features alternation of time signature *numerators* instead of denominators, and as such, the pattern presents the four bars as two interlocking pairs. The first pair has ***1***-numerators: ***1/16*** and ***1/8***, a pair of conventional time signatures with bar durations at a 1:2 proportion. The second pair has ***2***-numerators: ***2/10*** and ***2/12***, a pair of OFTSs with bar durations at a 6:5 ratio.

Yet Ferneyhough layers further procedures on top of this. Looking at bars 108-110, he maintains an overarching quintuplet-based rhythm across all three bars, with the universal ***10***-tuplet bracket in bar 108, the ***10***-denominator in bar 109, and the universal quintuplet bracket in bar 110. Examining the number of attacks in bars 109-111, there is a gradual elongation of onsets from four to five to six attacks in each successive bar.

[408] Ferneyhough, *Superscriptio*, 6.
[409] Ferneyhough, *Superscriptio*, 4.

A Synthesis of Techniques

With all these processes in mind, let us now discuss a section of the work that synthesises almost all of them: bars 84-95. This section will be discussed using three separate examples to showcase the complexity and layered intricacy of the pre-compositional procedures Ferneyhough employs.

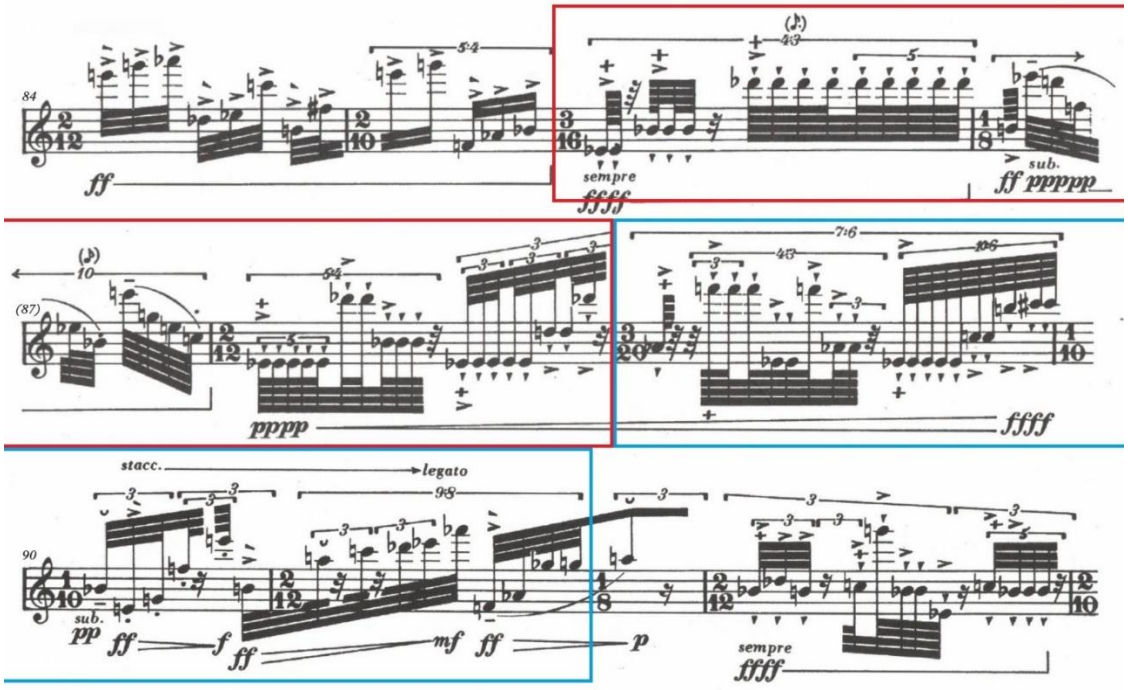
Example 7.31(a): Ferneyhough, *Superscriptio* (bars 84-95).[410]

The red boxes in Example 7.31(a) highlight an exact repetition of the time signatures and their order in bars 84-86 and 93-95. Within these red boxes, the ***2/10*** bars are of similar length to the ***3/16*** bars: ***2/10*** is equivalent to 1.6♪ in duration, compared to ***3/16***, which is 1.5♪ in length. The blue brackets indicate a retrograde effect with the time signatures: where bars 87-88 have ***1/8*** then ***2/12*** time signatures, bars 91-92 mirror this by ordering the time signatures as ***2/12*** then ***1/8***.

[410] Ferneyhough, *Superscriptio*, 3-4.

A final oddity to note is the nested $\overset{3}{\text{𝅘𝅥𝅯}}$ at the beginning of bar 94 (see the green circle). The nested triplet notation would not have any effect on the duration of the note as it is a staccato 𝅘𝅥𝅯 , so the rhythmic notation is likely the result of pre-compositional processes. It may be an indication of some contrapuntal technique occurring where this particular note is a follow-through of the nested triplet figure in bar 90, or the thick beam could simply be a continuation from bar 92.

Example 7.31(b): Ferneyhough, *Superscriptio* (bars 84-93).[411]



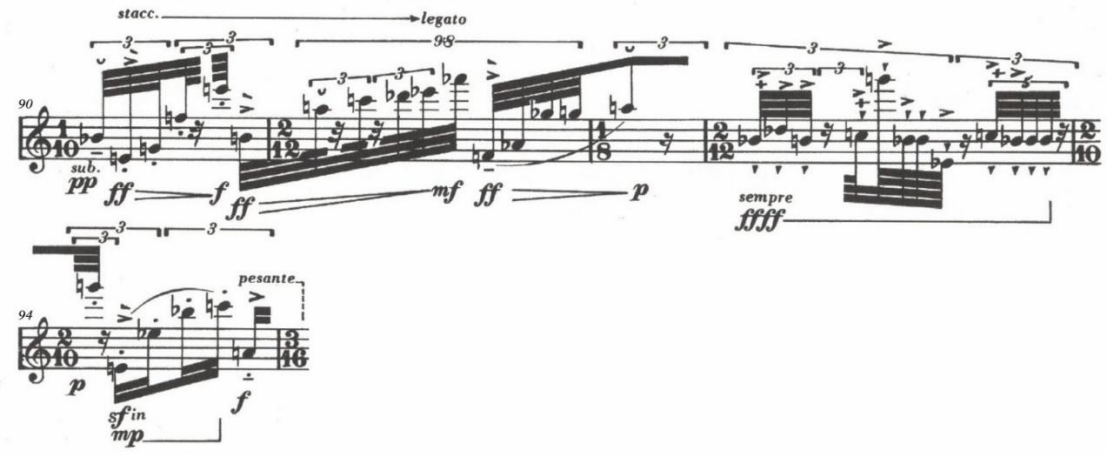
Taking a closer look at the first three systems of the excerpt, as isolated in Example 7.31(b), there is a different pattern seen across bars 86-91, expressed as two groups of three bars. In each group, the *numerators* are organised in a ***3-1-2*** sequence. The first two *denominators* of each group have a 2:1 ratio (i.e. in bars 86-87, the denominators of ***16*** and ***8*** are at a 2:1 proportion; the same is true of the ***20***- and ***10***-denominators in bars 89-90). The final denominator of each 3-bar group is ***12***, effectively making the final time signature of each 3-bar group ***2/12***.

Finally, there is a palindrome of the denominators in bars 90-94, where these are ordered as ***10-12-8-12-10***, the exact same order repeated in bars 126-130 and 186-190 (discussed in Examples 7.21(a) and 7.23(a) respectively). The fact that the exact same 5-bar sequence of denominators appears three times in the work is a result of the cyclic

[411] Ibid.

structure discussed previously with Examples 7.21(c), 7.22, and 7.23(a). It also attests to the fact that Ferneyhough's general use of pre-compositional processes result in various patterns that affect the structure of the work.

Example 7.31(c): Ferneyhough, *Superscriptio* (bars 90-94).[412]



Throughout *Superscriptio*, Ferneyhough exploits OFTSs to draw attention to changes in pulse speed, delineate the structure of the work, and create patterns and relationships throughout multiple layers of the music. He also uses OFTSs to demonstrate the result of the de-synchronisation of absolute bar durations with impulse densities.

Mort Subite epitomises the use of a cyclic/phasing structure to exploit the decoupling of—and explore the proportional relationship between—absolute bar duration and impulse density. Ferneyhough himself singles out *Mort Subite* as the prime example in his extensive discussion of this topic in his essay on "Duration and Rhythm as Compositional Resources".[413] Therefore, to delve deeper into the concepts explored thus far, *Mort Subite* will be examined as the primary case study where this procedure is seen in its simplest and clearest form among Ferneyhough's oeuvre.

[412] Ferneyhough, *Superscriptio*, 4.
[413] Ferneyhough, "Duration and Rhythm," 56.

Chapter 8: *Mort Subite* Case Study

Mort Subite is a two-minute work written by Ferneyhough in 1990 for piccolo, piano, clarinet, and vibraphone with click tracks. The work is structured in a cyclic form, akin to a theme and variation form, and is presented in six distinct, consecutive Phases of equal length: 20 ♪ in duration.[414]

Due to the cyclic nature of *Mort Subite*, Ferneyhough also incorporates phasing procedures in the treatment of some rhythmic elements. As such, whenever "Phase" is used with a capital "P", this refers to one of the sections of the work, and whenever "phase" or "phasing" is used with a lower-case "p", this refers to the procedure of phasing.

The piccolo and piano lines are paired together and notated only in conventional time signatures (***5/8***, ***4/8***, ***3/8***, ***2/8***, ***1/8***), whereas the clarinet and vibraphone, which are also paired together, are notated only in OFTSs (with ***10-*** and ***12-*** denominators). There are too many OFTSs to be practically listed here, but these are displayed in Example 8.1. Although required to play against one another, each pair of instrumentalists is only given their individual click track to listen to as they perform.

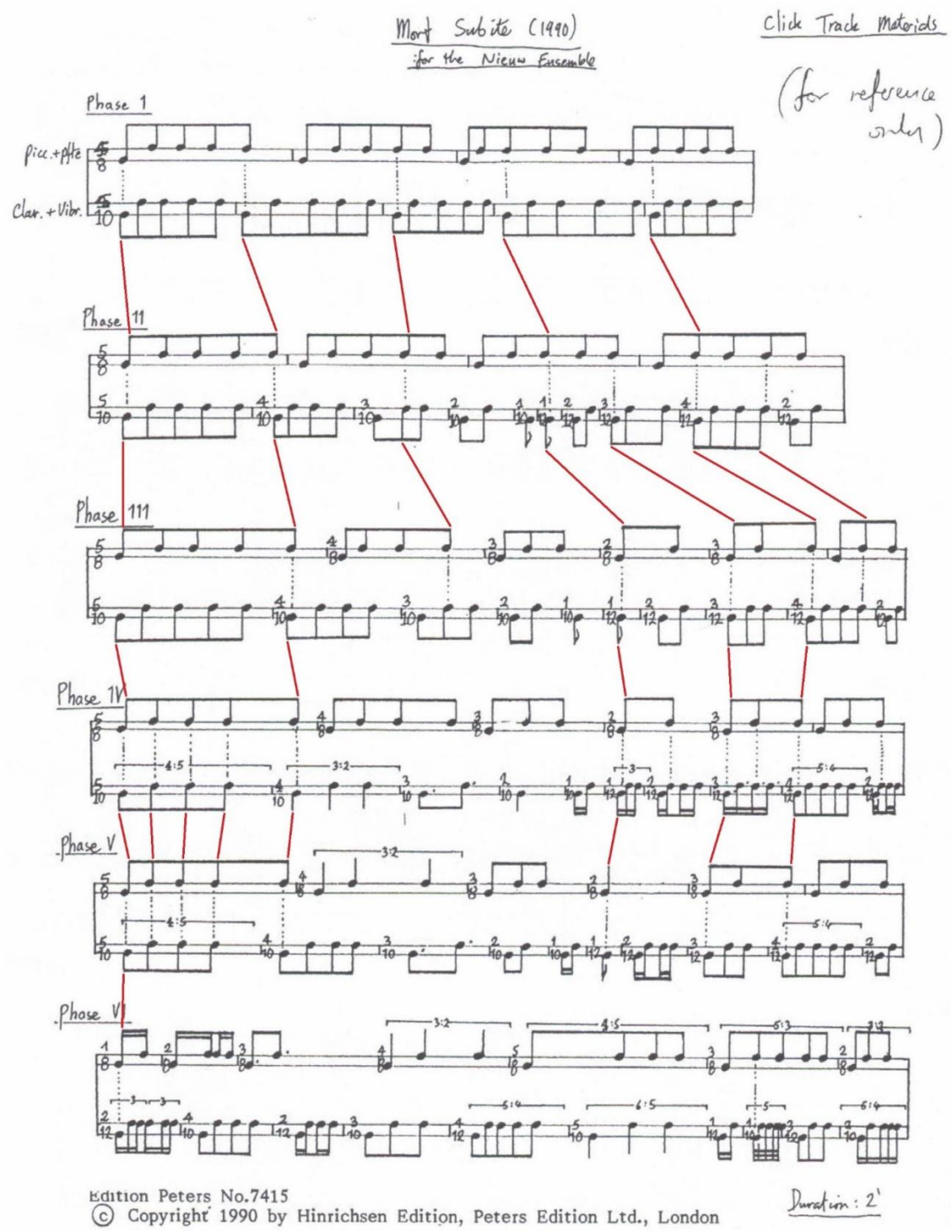
The analytical approach adopted for *Mort Subite* in this chapter is much more detailed than the previous works in this thesis. *Mort Subite* is the shortest work discussed thus far, and the cyclic structure results in relatively gradual changes from Phase to Phase. These factors allow for a more in-depth analysis.

Furthermore, unlike *Superscriptio*, which is a monophonic piece, *Mort Subite* is a chamber work, so many of the proportional temporal relationships exploited are simultaneous as well as consecutive/successive. *Mort Subite* possesses a distinct confluence of factors that make it both short and layered.

In Phases I-III, the click tracks elucidate the underlying metric framework by sounding the notated beats of the given time signatures. In Phases IV-VI, the click tracks expound a different rhythmic framework based on the given time signatures as Ferneyhough imposes certain transformative procedures on the structure of each Phase.

[414] For Ferneyhough's use of cyclic structures, see also Toop, "*Lemma-Icon-Epigram*."

Example 8.1: Ferneyhough, *Mort Subite* (page 5), click track materials.[415]



Regardless of how he divides each bar length using the click track articulations, Ferneyhough always partitions each bar into equal portions. This indicates his pre-compositional preoccupation with structural polyrhythms that can be generated by subdividing the bar lengths into equal parts. However, sometimes these subdivisions are executed in ways that do not necessarily coincide with the notated beats as dictated by the given time signatures.

[415] Ferneyhough, *Mort Subite*, 5.

Conversely, the surface rhythms played by each performer are elaborations of the click track rhythms, and these surface rhythms are far more complex. Sometimes they do not conform or adhere to the click track pulses. The click tracks provide an abstract substrate for rhythms that are more complicated and even at odds with the click tracks at some points.

Example 8.1 is a reference page included in the *Mort Subite* score to aid performers' coordination and practice of the piece. This page details the articulations of the click tracks and how the impulses interact with each other throughout the piece. The red annotations indicate which coordination points are carried forward from one Phase to the next. As this click track reference page is discussed, particularly with regard to Examples 8.1-8.4 and Tables 8.1-8.2, the "top line" refers to the click track heard by the piccolo and piano players, whereas the "bottom line" refers to the click track heard by the clarinet and vibraphone players.

As each Phase progresses with the click tracks, Ferneyhough inserts another layer of complexity by introducing additional musical processes. For the first three Phases, the ratios between the absolute duration of the bar and the impulse density of the click tracks are 1:1. The first Phase is the simplest; it uses a straightforward phasing between ***5/8*** and ***5/10***, with clicks aligning every four pulses (according to the top line) or every five pulses (according to the bottom line). Hence, a 4:5 ratio is explored between the two lines in this first Phase.

Ferneyhough introduces three different layers of complexity in the second Phase. Firstly, the bar lengths in the bottom line transform while the top line remains consistent in ***5/8***. Secondly, the absolute durations of the bars in the bottom line decrease and then increase, progressing from ***5*** to ***1*** and then from ***1*** to ***4***, as per the numerators of the OFTSs. Thirdly, the impulse *values* of the bars in the bottom line also shift from $^{5}\!\!\!

The resulting effect is a surface-level phrase truncation then elongation (according to the decrease and increase of absolute bar durations), and a deeper sense of *accelerando* as the pulse speed becomes faster. Ferneyhough describes this phenomenon as the concept of a 'macro-rhythm' in the second Phase, and he notes that 'we can observe the 'disturbance' effect of a second essentially linear process being superimposed on a primary, even more basic discoordination'.[417]

Following the red annotations in Example 8.1 from the first Phase to the second Phase, further proportions become evident. There are five coordination points in Phase I, yet there are seven coordination points in Phase II. The fourth and fifth coordination points in Phase I are carried through to become the fourth and sixth coordination points in Phase II, thereby explicating the 5:6 ratio between the ***10***- and ***12***-denominator impulses of the first and second Phases respectively.

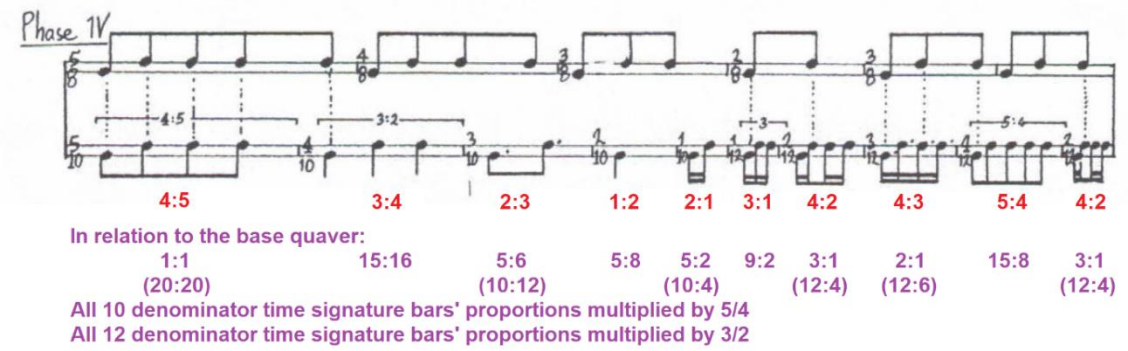
Furthermore, the fourth to seventh coordination points in Phase II feature equal durations, as they form a 3:2 ratio with the straight ♪ pulses of the conventional time signature line. Although these ratios can already be derived from the denominators, they are reinforced here by the pulses being sounded out in the click tracks and the way each Phase progresses through shared coordination points.

The third Phase introduces differing bar durations in the top line, with a similar pattern to that of the bottom line in the second Phase: decreasing then increasing bar lengths *without* the acceleration of impulse values. Thus, all the coordination points from Phase II carry over to Phase III. The bottom line remains unchanged from the second Phase. In fact, the pattern of time signatures in the bottom line remains consistent in Phases II-V 'regardless of the impulse densities imposed'.[418]

However, from the fourth Phase onwards, Ferneyhough starts to decouple the impulse densities from the absolute durations of each bar. The impulse densities in the bottom line follow the same rough pattern of decreasing then increasing (4, 3, 2, 1, 2, 3, 4, 4, 5, 4). The ratios between impulse densities and bar durations are laid out in Example 8.2:

[417] Ibid.
[418] Ferneyhough, "Duration and Rhythm," 58.

Example 8.2: Ferneyhough, *Mort Subite* (page 5), Phase IV.[419]



Ferneyhough makes special mention of the second half of this Phase to highlight an additional musical process he incorporates on top of the decoupling:

> The second half of Phase IV offers several 'encounter points' between the two levels, thus calling forth much rhythmic 'punning', one of the core techniques involved in rendering rhythmic conjunctions – and thus the sensation of time underpinning them – 'tactile'.[420]

This tactility of 'rhythmic conjunctions' (i.e. the dotted lines that indicate the points of coordination between the two pairs of instruments) and the 'sensation of time' hearkens back to Ferneyhough's interest in 'the sense of clock time [being] supported or subverted by the specific tactility of impulse density setting the 'inner clock'[421] of a particular metric space' by drawing attention to this specific 'rhythmic density'.[422] The use of rhythmic 'punning' is utilised to achieve those points of coordination, and this will recur in the discussion surrounding the musical surface of the work.

However, the term "rhythmic punning" can also imply another meaning: if a pun is the use of different words that have separate meanings but sound similar, then a *rhythmic* pun could be two durations that are notated differently but are technically the same length. This definition is not what Ferneyhough originally intended, but this notion is worth considering as it calls to mind the bar length equivalences of *Superscriptio*. Instead of bar length equivalences, *Mort Subite* explores note length equivalences. All these note length equivalences are tabulated in Appendix B which catalogues all the different note/rest durations in this work in descending order and expressed in number of seconds.

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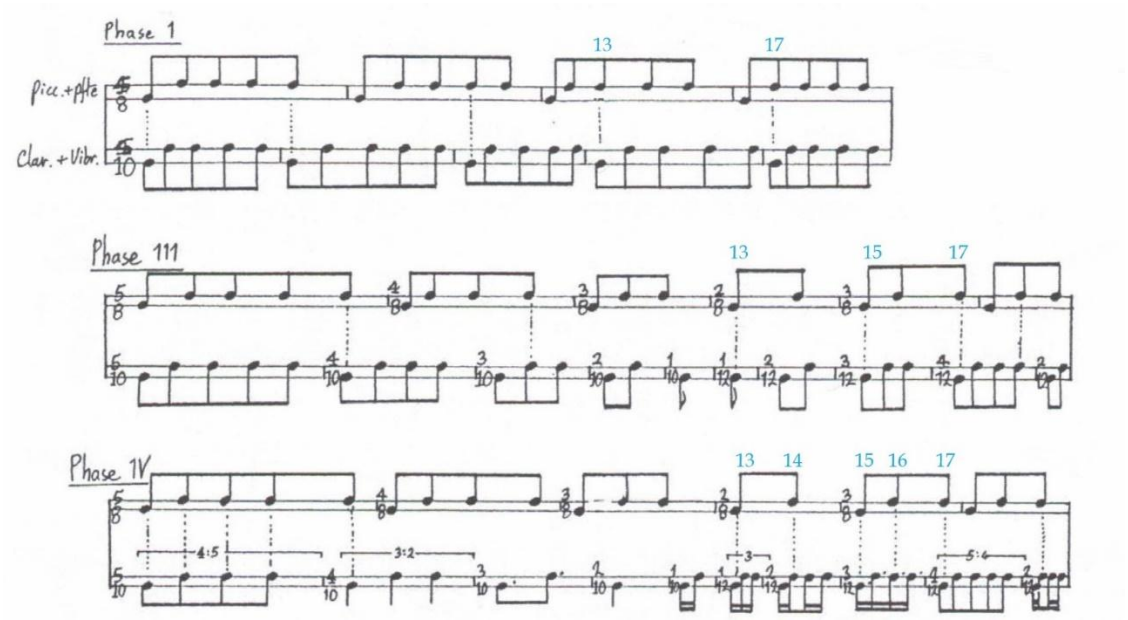
[419] Ferneyhough, *Mort Subite*, 5.
[420] Ferneyhough, "Duration and Rhythm," 58.
[421] Ferneyhough, "Duration and Rhythm," 52.
[422] Ferneyhough, *Superscriptio*, preface.

There is also a pattern of halving elapsed duration between coordination points as they transition from Phase I to Phase IV. In Example 8.3, specific impulses in the top line are numbered (i.e. the "13" and "17" numbers above the first Phase indicate that the associated notes are the 13th and 17th notes of the top line in chronological order). As the piece transitions from Phase I to Phases II and III, there is a halving of duration of when coordination points fall: an additional coordination point is added, which aligns with the 15th note of the top line. Phase II has been represented by Phase III in Example 8.3, as they both share the same coordination lines.

By Phase IV, the duration halves again so that there is a coordination point aligning with every straight ♪ pulse from the 13th to 17th notes in the top line. This could not have been possible without the decoupling of the impulse densities from the absolute bar durations in the bottom line. Phase V has not been included in Example 8.3, as it also shares the same annotated coordination points as Phase III, just like Phase II (i.e. the coordination points fall on the 13th, 15th, and 17th notes of the top line). Therefore, although Phases II and V have both been omitted to streamline the presentation of the example, it should be noted that there is a regression of the procedure after Phase IV where the elapsed duration between coordination points doubles from the fourth to the fifth Phase.

Example 8.3: Halving process implemented on duration elapsed of coordination points in Phases I-IV.



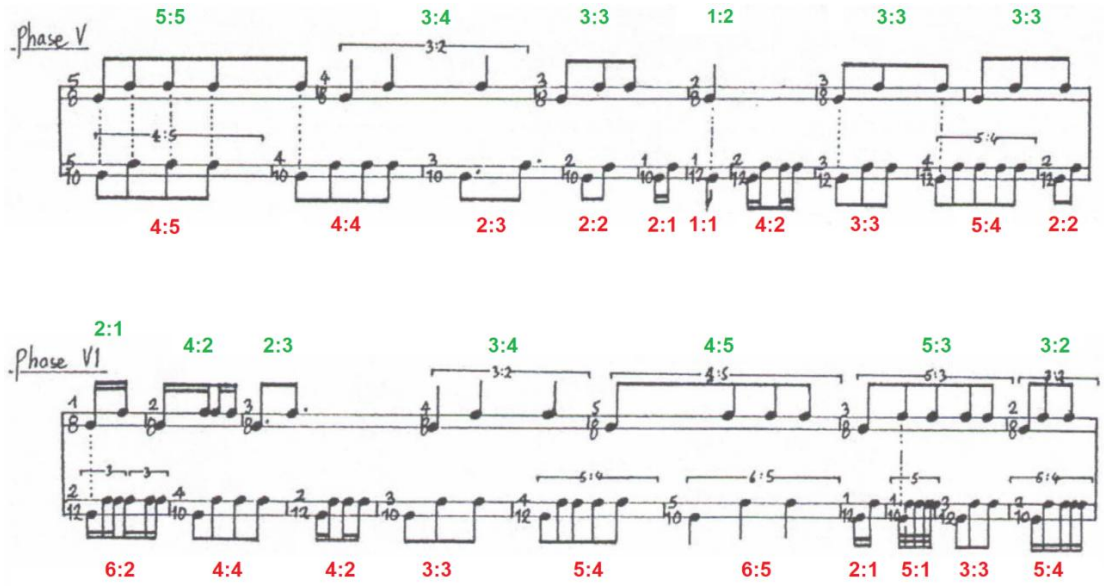
Returning to Example 8.1, the first bars of both Phases IV and V are revealing: the ***4:5*** universal tuplet imposed on the first bar of the clarinet and vibraphone line

ensures that the speed of the impulses match that of the base ♪ (leading to a 1:1 proportion with the top line's pulse speed). Ferneyhough could have effectively written ***4/8*** as the time signature for the first bar of the bottom line (as that would have more clearly indicated the 5:4 ratio of the absolute bar durations between the top and bottom lines). This apparent redundancy reveals the multiple layers of musical processes Ferneyhough is systematically imposing as it demonstrates the process of decoupling impulse densities overlaid atop the initial process of changing absolute bar durations.

There is a sudden shift between Phases V and VI, and this is most clearly seen in Example 8.1: the sole red annotated line between Phases V and VI, which indicates the only coordination point carried over from the fifth to the sixth Phase, is the very first downbeat of both Phases. Everything else has been altered, and there are no other shared coordination points between the final two Phases. This shows that the musical processes employed are no longer linear but are now varied and intricate, as Ferneyhough explains:

> The boundary between Phases V and VI is characterized by massive contrasts in (a) metric structure of both voices and (b) the density of subdivisions (including irrational [i.e. tuplet] values) employed. The disorientation caused by this sudden change of pace is striking; it serves once more to underline the permeability of the membrane separating perceived articulate order from the levelling tendencies of chaos.[423]

Example 8.4: The impulse density to absolute bar duration ratios of Phases V and VI.[424]



[423] Ferneyhough, "Duration and Rhythm," 58.
[424] Ferneyhough, *Mort Subite*, 5.

Table 8.1: Initial proportions of only the bottom line of Phase V transformed into their ultimate proportions in relation to the base quaver.

Phase V										
Initial proportion	4:5	4:4	2:3	2:2	2:1	1:1	4:2	3:3	5:4	2:2
In relation to base quaver	1:1 (20:20)	5:4 (20:16)	5:6 (1:12)	5:4 (10:8)	5:2 (10:4)	3:2	4:1 (12:4)	3:2 (9:6)	15:8	3:2 (6:4)
To get to base quaver	Initial proportions multiplied by 5/4 due to ***10***-denominator					Initial proportions multiplied by 3/2 due to ***12***-denominator				

In the fifth Phase, the impulse densities are paired. In the top line, the impulse densities are 5, 3, 3, 1, 3, 3; there is a level of quantisation imposed onto the decreasing then increasing absolute bar durations as the impulse densities alternate from an odd number to a pair of 3s. However, the pairing in the bottom line is more obvious in the first four bars (i.e. 4, 4, 2, 2). In the top line, the impulse densities are purely odd numbers, while the bottom line here is solely concerned with pairing even numbers.

Alternation in the bottom line also features in the second half of Phase V, as it alternates between unequal and equal impulse density/absolute bar duration proportions: 2:1, 1:1, 4:2, 3:3, 5:4, and 2:2. Focusing only on the impulse densities of the bottom line of Phase V, there also seems to be a preoccupation with different groupings: 4, 4; 2, 2, 2; and 1, 4, 3, 5, 2. The last group of impulse densities continues to show Ferneyhough's focus on ordering and permutation.

Table 8.2: Initial proportions of only the bottom line of Phase VI transformed into their ultimate proportions in relation to the base quaver.

Phase VI										
Initial proportion	6:2	4:4	4:2	3:3	5:4	6:5	2:1	5:1	3:3	5:4
In relation to base quaver	9:2 (18:4)	5:4 (20:16)	3:1 (12:4)	5:4 (15:12)	15:8	3:2 (30:20)	3:1 (6:2)	25:4	3:2 (9:6)	5:4 (25:16)
Denom.	***12***	***10***	***12***	***10***	***12***	***10***	***12***	***10***	***12***	***10***
To get to base quaver: • All ***10***-denominator time signature bars' proportions multiplied by 5/4 • All ***12***-denominator time signature bars' proportions multiplied by 3/2										

In Phase VI, the bar durations and impulse densities in both lines are now entirely decoupled and independent. Although there are still instances of essentially 1:1 proportional relationships, impulse densities are not dictated by the absolute bar lengths. Finding a consistent proportional relationship between the two lines of

instruments is virtually impossible, as they are now clearly moving independently of one another.

The idea of alternation is imposed entirely on the bottom line of this sixth Phase; each bar of the clarinet and vibraphone lines is now alternating between sextuplet and quintuplet pulse speeds due to the alternating ***10***- and ***12***-denominators. To add further complication, the top line has a new process of *increasing then decreasing* absolute bar durations (i.e. ***1***, ***2***, ***3***, ***4***, ***5***, ***3***, ***2***) as dictated by the numerators of the time signatures; this ordering is the opposite of what occurs in previous Phases. Effectively, a significant permutation of bar durations occurs in the top line.

As previously discussed with the first bar of both the fourth and fifth Phases of the bottom line (i.e. the clarinet and vibraphone lines), there is another tuplet counteracting the time signature, featured this time in the fifth bar of the *top* line (i.e. the piccolo and piano lines): a ***4:5*** universal tuplet is imposed on the ***5/8*** bar of Phase VI. As this universal tuplet is counteracting a *conventional* time signature this time, instead of an OFTS like in the fourth and fifth Phases, the time signature cannot be easily renotated to reflect the surface rhythm. However, this does demonstrate the multiple layers of musical process complexity exploited in this Phase.

Thus far, the decoupling of impulse density from absolute bar duration has only been explored through the lens of the base click track materials. However, the multiple layers of musical processes develop in intricacy on the surface of the music as well, and so it would be useful to analyse each Phase in turn.

As each Phase is discussed, excerpts of the original score will be provided; however, the original score bears a few notational errors.[425] Refer to Appendix C for a full indexation of these errors. As excerpts of the original score appear, the corrected note/rest values will be annotated in red above or below the relevant place in the score. The additional transcriptions provided in this chapter already contain the corrected values. Also, for ease of reference to the original score, these transcriptions correspond to the notated pitches in the clarinet line, rather than the sounding pitches.

[425] Key, "Pan-Rational," 265-266.

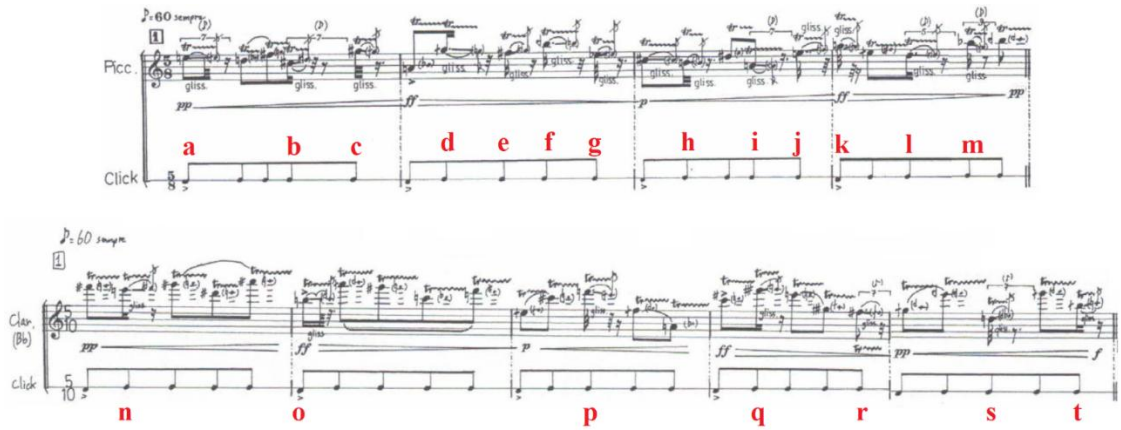
The cyclic metrical framework of *Mort Subite* was determined as part of the pre-compositional process. Although this cyclic element is at its most explicit and least flexible in this work, there are hints towards this conceptualisation in Ferneyhough's other pieces as well. The patterns found in successions of time signatures, elongations and truncations, alternations, and other elements are of the same kind of thinking, reconfigured in a new arrangement with *Mort Subite*.

This piece is, in some ways, the simplest expression of pre-compositional patterning due to the macro structure, but it also creates layers of complexities at the micro level. Therefore, the patterns discussed thus far with Ferneyhough's other works will be found in different forms in *Mort Subite*.

PHASE I

The commentary so far has only related to the proportionality found in the click track reference page. However, when examining the actual notated score, the complexity and depth of the proportionality increase substantially. Compare the piccolo line in the first Phase against that of the clarinet:

Example 8.5.1: Ferneyhough, *Mort Subite* (pages 1 and 3), Phase I.[426]



Mort Subite can be approached as two different pairings of instruments: 1. Piccolo and piano vs clarinet and vibraphone (i.e. the pairs according to the score, their respective click tracks, and time signature restrictions); or 2. Piccolo and clarinet vs piano and vibraphone (i.e. wind instruments vs percussive instruments). The second mode of pairing is reinforced by the texture in Phases I and II, where only the winds are playing.

[426] Ferneyhough, *Mort Subite*, 1 and 3.

The piano and vibraphone are only introduced from Phase III onwards, hence their absence in the above example.

Example 8.5.1 is taken directly from the score, so the bars are not aligned. An aligned version of the first Phase is provided later with my transcription in Example 8.5.2. Every pulse of each click track is sounded with an attack by their respective instruments. However, the relationships between the rests and note durations (which are affected by said rests) in this first Phase highlight Ferneyhough's attention to detail.

The inclusion of these rests is wholly unnecessary from the standpoint of affecting attack timepoints/onsets, but there is much analytical, structural, and procedural significance to be gleaned from these rests and where they are situated in the Phase. Examining the clarinet's part first, Table 8.3 presents the proportions between the written note length and the following rest's duration within the duration of a single click track pulse.

Table 8.3: Proportions of note durations compared with rest durations in Phase I of the clarinet line.

Example 8.5.1 Reference	Bar	Beat	Note Duration	Rest Duration	Proportion
n	1	2	1/20	1/20	1:1
o	2	1	5/80	3/80	5:3
p	3	3	3/80	5/80	3:5
q	4	2	1/20	1/20	1:1
r	4	5	6/70	1/70	6:1
s	5	3	1/70	6/70	1:6
t	5	5	1/20	1/20	1:1

There are seven instances of rests in the clarinet line of the first Phase, and there is a symmetry to the proportions. The 1:1 ratio appears in the first, middle, and last instances. In the second and third instances (i.e. the 5:3 and 3:5 ratios), the proportions are inverted between the note and rest durations because they exchange durations. This is the same for the fifth and sixth instances (i.e. the 6:1 and 1:6 ratios). Ferneyhough purposefully and clearly explores the concept of reciprocity within the proportions of the clarinet line, and he uses a mirror image structure similar to some sections in *Superscriptio* and *Silentium*.

The piccolo's rhythmic values are more varied than those of the clarinet. This may be due to the piccolo being notated entirely in the conventional time signature of

5/8 and therefore having more freedom to explore more complex and varied surface-level rhythms:

Table 8.4: Proportions of note durations compared with rest durations in Phase I of the piccolo line.

Example 8.5.1 Reference	Bar	Beat	Note Duration	Rest Duration	Proportion
a	1	1	5/56	1/28	5:2
b	1	4	1/28	5/56	2:5
c	1	5	1/32	3/32	1:3
d	2	2	3/32	1/32	3:1
e	2	3	1/16	1/16	1:1
f	2	4	3/32	1/32	3:1
g	2	5	1/32	3/32	1:3
h	3	2	1/32	3/32	1:3
i	3	4	1/14	3/56	4:3
j	3	5	7/64	1/64	7:1
k	4	1	3/64	5/64	3:5
l	4	3	3/40	1/20	3:2
m	4	4	1/24	1/12	1:2

The concept of alternation reappears in the piccolo line (which features many alternating and symmetrical proportions, e.g. 5:2 then 2:5), but it is not as consistent as the clarinet's proportions. Furthermore, it seems that these note to rest proportions throughout the whole piece are for the benefit of the reader only; they are unlikely to be perceived through audio cues alone, especially due to the inclusion of indeterminate (i.e. unpredictable and unpulsed) elements such as trills and grace notes, as well as the practical considerations and implications of performative accuracy.

Due to this indeterminacy, surface ornamentations such as the destination notes of trills, grace notes, and *glissandi* have been excluded from the transcriptions to show the proportions more clearly. Surface ornamentations have been omitted so they do not visually distract from any analytical annotations. For this reason, trill symbols are excluded from some examples in this chapter where they would otherwise result in notational clutter.

Example 8.5.2: The coordination of all lines in Phase I.

The black dotted lines in Example 8.5.2 are the coordination lines already isolated in the click track materials.[427] The red coordination lines are not pointed out in the click track materials, but—due to the rhythms Ferneyhough employs—they are further evidence of rhythmic punning (according to Ferneyhough's definition of rhythmic punning as it relates to rhythmic coordination).[428] In other words, the red coordination lines are not a result of the metrical structures but instead of the surface rhythms. This colour-coding for coordination lines repeats in the analysis of all subsequent Phases.

[427] Ferneyhough, *Mort Subite*, 5.

[428] Key uses the term 'metric convergence', and Kyle Gann uses the term 'convergence points': see the discussion around Nancarrow's use of 'temporal dissonance' in Key, "Pan-Rational," 213, 215; see also Drott, "Conlon Nancarrow," 540.

The annotated numbers in blue indicate the absolute duration of each associated note measured in seconds, based on the metronome mark of ♪ = 60BPM. Durations are expressed in decimal form, rounded to three places, to facilitate presentation and comparison in Example 8.5.2.[429] All durations expressed in decimal form are rounded to a maximum of three decimal places throughout the rest of this chapter for consistency. Furthermore, the use of blue annotated numbers is employed in the analysis of all subsequent Phases.

The duration of the notes that start simultaneously at points *e* and *f* in Example 8.5.2 display a pure 5:4 ratio, as they are straight ♪ against ^{5}♪ notes. The straight ♪ is played by the piccolo and is one second in duration each based on the metronome mark. The ^{5}♪ is played by the clarinet and is 0.8 seconds in duration each. The other points of coordination are more interesting. Points *a* and *c* show a much closer note duration between the two parts. At point *a*, the piccolo's tied septuplet rhythm is 0.714 seconds, which is similar to the clarinet's 0.8 seconds. Point *c* is closer still, with the 𝅘𝅥𝅯. equating to 0.75 seconds in duration.

These similar note durations closely approximate one another and, therefore, are comparable; they are reminiscent of the patterns of similar bar durations explored in *Superscriptio*. Therefore, similar note durations and other durational near-misses will continue to be encountered throughout the rest of *Mort Subite*. Ferneyhough not only exploits the natural offset of the phasing effect created by the different time signatures, but he adds complexity by exploring closer durational approximations with the surface rhythms.

Point *b*, the remaining black coordination line in Example 8.5.2, is the first instance of a rhythm notated in a tuplet context, but the actual duration equates to a straight rhythm. The tied clarinet note is equivalent to a straight 𝅘𝅥𝅯 in duration, thus making the piccolo's 𝅘𝅥𝅰 half the clarinet's duration at that point of coordination. This hearkens back to the idea of rhythmic punning as per the second definition: note duration equivalence. The two red coordination lines in Example 8.5.2 show coincidences between a note and a quintuplet semiquaver rest, acting much like a hocket, which provides a neat segue to pseudo-points of coordination as can be seen in the example below.

[429] For the fractional representation of each of these numbers, refer to Appendix B.

Example 8.5.3: All pseudo-points of coordination in Phase I.

Considering both the tuplet rhythms in the piccolo line and the OFTS in the clarinet line, the blue boxes in Example 8.5.3 indicate all the points in the first Phase where notes and rests almost coincide but are very slightly offset. These sorts of occurrences may be viewed as an alternative version of the similar duration phenomenon. At points *a* and *b*, the offset is 0.086 seconds; at point *g*, the offset is 0.067 seconds; at points *c*, *d*, and *f*, the offset is 0.05 seconds; and at point *e*, the offset is 0.029 seconds. As seen by these miniscule durations, it is apparent they act as hockets.

For example, looking at the beginning of the first bar, the black dotted coordination line demonstrates that the piccolo coincides with the clarinet on the first attack. Then there is an alternation between the two instruments where the clarinet plays the sounded D-natural 𝅘𝅥𝅯 (at

point *a*) followed by the piccolo playing the D-natural 𝅘𝅥𝅯, and the rests allow the other instrument to play their note without interruption. This sort of interleaving can be further observed in Example 8.5.4, where the attacks alternate at a consistent duration.

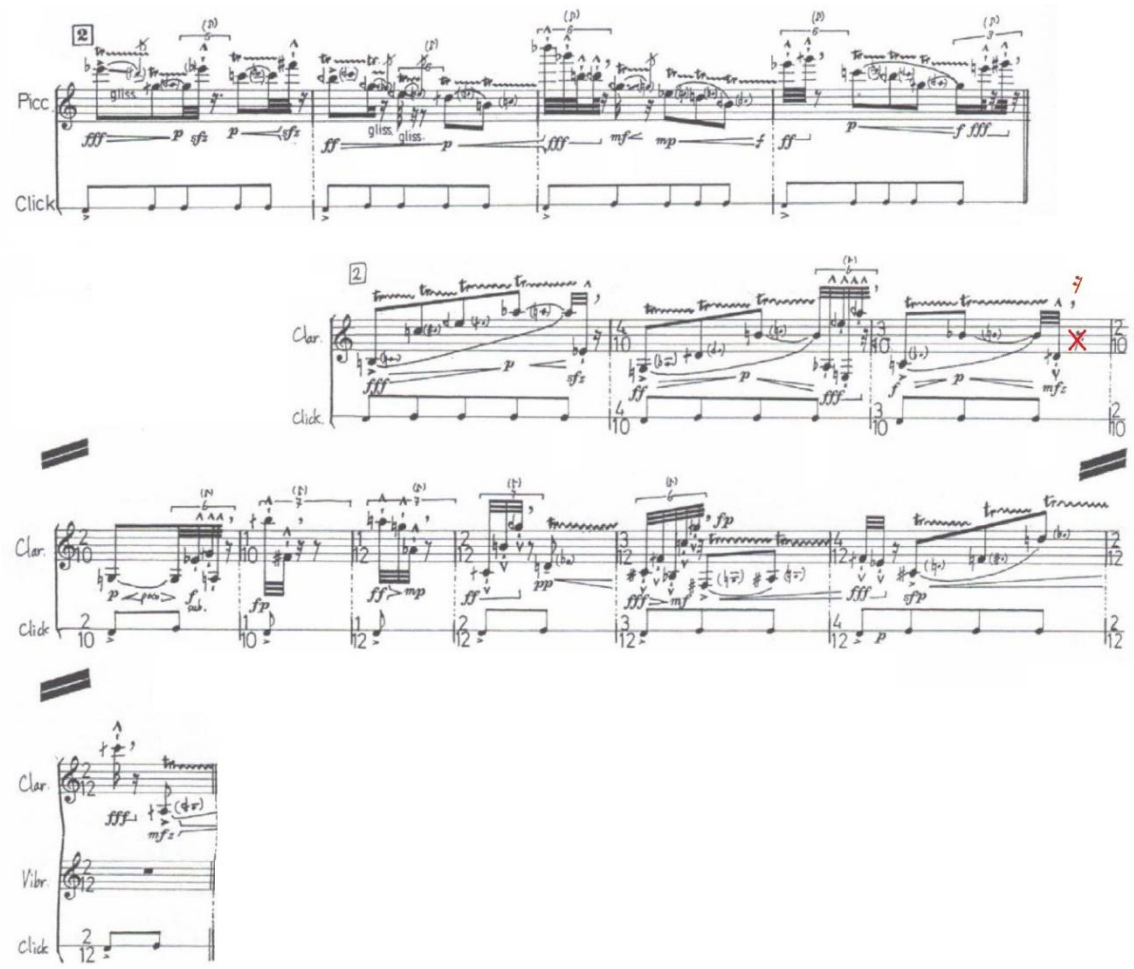
Example 8.5.4: All clear alternations of attacks in Phase I.

At all annotated points other than *d*, a piccolo note plays in between two clarinet notes, and each onset is spaced by 0.4 seconds (which is equivalent to a 𝅘𝅥𝅯). Points *c* and *f* happen to incorporate the red dotted coordination lines. These are all automatic consequences of the pulse spacing in the click tracks. If the pulses in the top line were grouped into groups of four, every third pulse of each group would fall halfway between the third and fourth pulses of each bar in the bottom line. The nature of the simple polyrhythm, as it is initially established, creates an expectation for regularly spaced events at certain points in the pattern. This will occur less as the click track superimpositions become more complex, as is the case in future Phases.

Point *d* is an exceptional annotation; it involves a rest as the final "attack", and there are 0.2 seconds between onsets instead (which is equivalent to a $\overset{5}{\text{♪}}$ in duration). There is one more durational quirk to note in Example 8.5.3. In between the final black and red dotted lines, the clarinet $\overset{5}{\text{♪}}$ (i.e. the second note in the final bar) has a duration of 0.8 seconds. It almost coincides with the piccolo's $\overset{5}{\text{♪}}.$, which happens to be 0.6 seconds in duration. The following piccolo quintuplet semiquaver rest (which falls on the red dotted line) equates to 0.4 seconds. This is another section that utilises a 0.2 differential, and although it is not relating to rhythmic offset, it does show a recurring pattern.

PHASE II

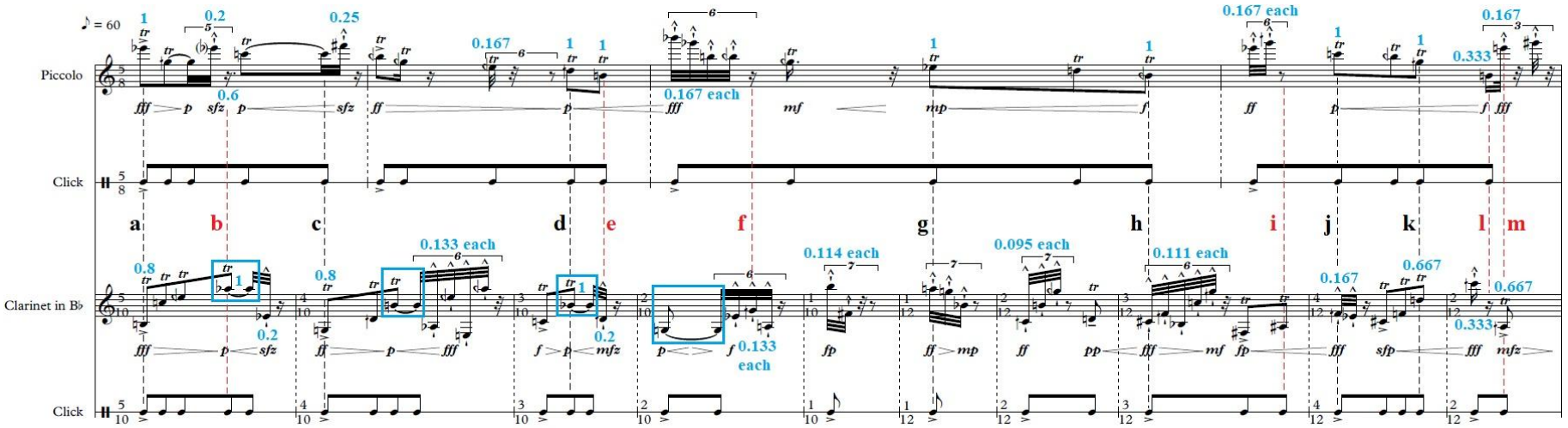
Example 8.6.1: Ferneyhough, *Mort Subite* (pages 1 and 3), Phase II.[430]



[430] Ferneyhough, *Mort Subite*, 1 and 3.

In contrast to the previous Phase, here Ferneyhough incorporates ties into the surface rhythms. As a result, some click track pulses are not sounded by articulated attacks but can still be intuited due to the syncopation created by the tied rhythms. The clarinet line also incorporates different numerators and denominators in the OFTSs, as previously addressed in the preliminary discussion surrounding the click track. At this point, both instruments are still playing sounded attacks that correspond to the click track pulses.

Example 8.6.2: The coordination of all lines in Phase II.



Every black coordination line in Example 8.6.2 involves a straight ♪ played by the piccolo. The only exception is point *c*, which is the first time where the piccolo does not play an attack when the click tracks align. The ♪ 𝅘𝅥𝅯 figure recurs throughout the first part of this second Phase (i.e. when the clarinet's time signatures have ***10***-denominators). Of the four times it is used in the clarinet line (see the blue boxes in Example 8.6.2), the two in bars 1 and 3 are actually equivalent to a straight ♪ in duration due to the ***10***-denominator imposing an implied universal quintuplet on these bars. This is another example of note duration equivalence (the secondary rhythmic punning). The onsets of these two figures in bars 1 and 3 also coincide with coordination lines, whereas the other two in bars 2 and 4 do not. In these even-numbered bars, the quavers are tied to ^{6}𝅘𝅥𝅯 instead, making the duration 0.933 seconds instead of 1 second each.

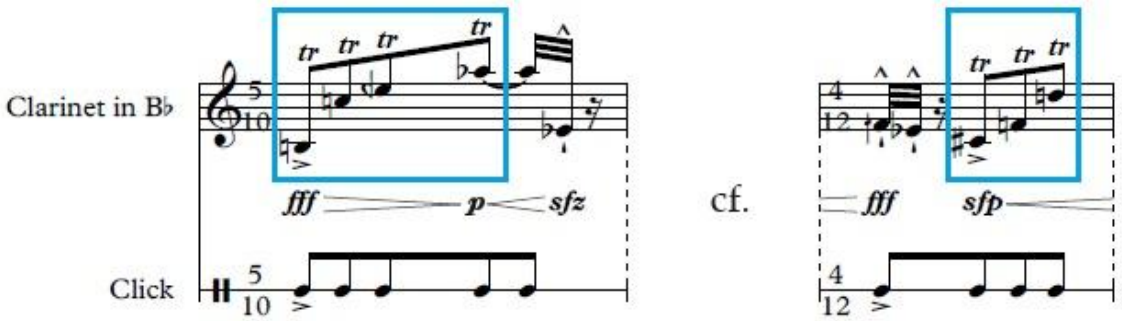
The sextuplet brackets in bars 2 and 4 of the clarinet line are paired with overlapping sextuplets in the piccolo line (specifically found in bars 2 and 3 of the piccolo line). Each of these sextuplet pairs in the first half of the Phase involve or are situated near coordination lines, and all of the sextuplet notes in both the piccolo and clarinet figures are notated with 𝅘𝅥𝅯 notes.

Each piccolo ^{6}𝅘𝅥𝅯 lasts for 0.167 seconds regardless of where the sextuplet is situated in the Phase. The first sextuplet bracket in the piccolo line is especially noteworthy; it includes only one note/sounded attack, so a pulse cannot feasibly be established. Therefore, the sextuplet bracket is purely for the benefit of the performer/reader.

The clarinet sextuplet figures, on the other hand, vary in duration due to the difference in OFTS denominators. For the ^{6}𝅘𝅥𝅯 in ***10***-denominator bars, which have already been addressed in bars 2 and 4 of the clarinet line, each note lasts for 0.133 seconds, as opposed to the duration of 0.111 seconds for each ^{6}𝅘𝅥𝅯 in the ***3/12*** bar towards the end of the Phase.

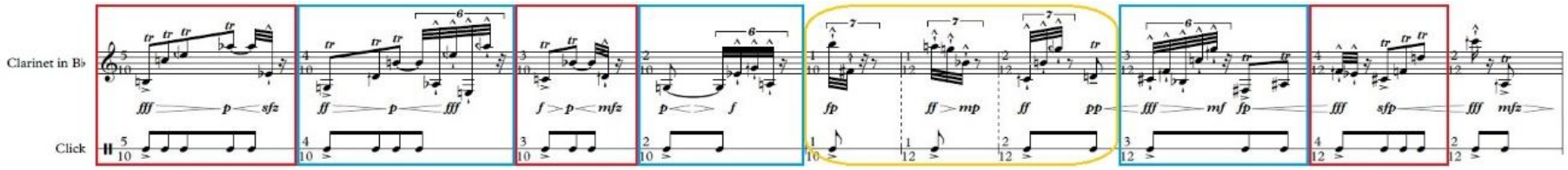
The clarinet line explores a mirroring procedure on the surface of the music. Compare the rhythms in the first bar (***5/10***) with the rhythms in the ninth bar (***4/12***). In the first bar, there are ^{tr}𝅗𝅥 𝅗𝅥 𝅗𝅥 𝅗𝅥 followed by 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 and a semiquaver rest; in the ninth bar, there are 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 and a semiquaver rest followed by ^{tr}𝅗𝅥 𝅗𝅥 𝅗𝅥. The rhythms are loosely retrograded, and this retrograde is superimposed onto a macro phrase truncation (see the blue box annotations):

Example 8.6.3: Macro phrase truncation in Phase II.



The phrase truncation in the clarinet line is due to the aforementioned processes of decreasing then increasing absolute bar durations, (i.e. the numerators decreasing from ***5*** to ***1*** then increasing from ***1*** to ***4***) as well as the pulse speed acceleration (where the denominators change from ***10*** to ***12***). There are retrograde and permutation procedures interleaving throughout this Phase:

Example 8.6.4: Retrograde processes in Phase II.



Observing the red box annotations in Example 8.6.4, the ***10***-denominator bars contain a number of trill tuplet 𝅘𝅥𝅯 notes followed by tuplet 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 figures. The ***4/12*** bar reverses this order with the ^{3}𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 figure preceding the trill ^{3}𝅘𝅥𝅯 notes. However, the number of trill tuplet 𝅘𝅥𝅯 notes in the red boxes are ordered as 5-3-4 notes, not arranged in any *overall* ascending or descending order, which would have otherwise conformed to a specific elongation or truncation process.

Looking at the blue box annotations, the ***10***-denominator bars contain a number of tuplet 𝅘𝅥𝅯 notes followed by nested ^{6}𝅘𝅥𝅰 notes. The ***3/12*** bar reverses this rhythmic order (akin to what the ***4/12*** bar did with the red boxes). The number of tuplet 𝅘𝅥𝅯 notes in the blue boxes are ordered as 3-1-2; again, they are not arranged in any overall ascending or descending order. Also, all the ***10***-denominator bars involve tied rhythms, whereas the ***12***-denominator bars do not (due to the rests separating the 𝅘𝅥𝅰 figures from the trill ^{3}𝅘𝅥𝅯 figures).

The clarinet's fifth, sixth, and seventh bars (***1/10***, ***1/12***, ***2/12***) are established here as the mid-point of the Phase. The mid-point function of these particular bars continues throughout Phases III-V. These bars have a different process imposed on them: arithmetic phrase elongation (see the yellow annotation in Example 8.6.4).

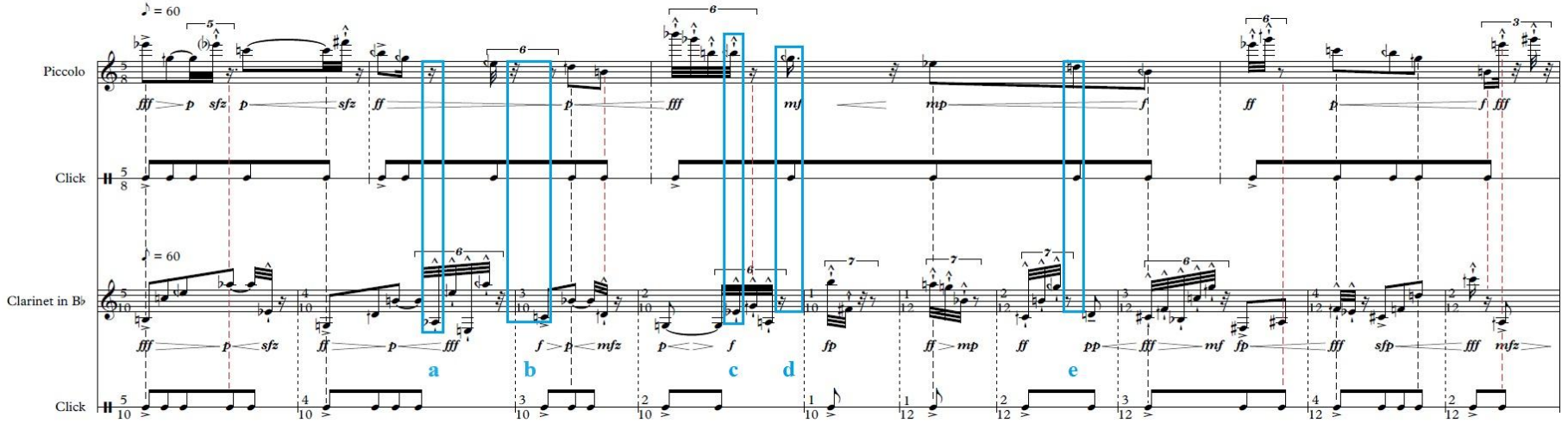
The ***1/12*** bar adds another ^{7}𝅘𝅥𝅯 to the figure previously established in the ***1/10*** bar, and then the ***2/12*** bar adds a ^{tr}𝅘𝅥𝅮 as well. The final ***2/12*** bar confirms its outlier status in that it is the most unusual bar; unlike every other bar, its short rhythm consists of only one 𝅘𝅥𝅯 (and also one trill 𝅘𝅥𝅮). All other bars in Phase II contain at least two notes in their short, non-trill rhythmic figures.

Referring back to Example 8.6.2, the retrograde procedure utilised in the clarinet line is most evident when purely examining the placement of the rests across this Phase. In the first part, where all the time signatures have a ***10***-denominator, the rests land within the *final* pulse of the bar.

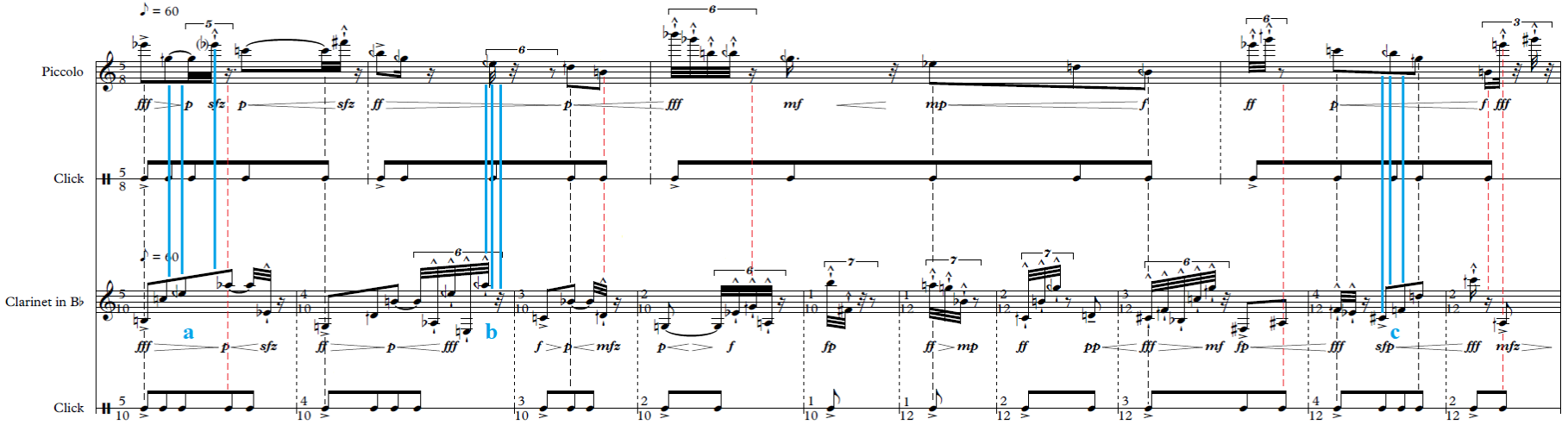
In the second part, where all the denominators are ***12***, the rests land within the *first* pulse of the bar. It is not a pure retrograde (where the rests should fall at the very beginning of the ***12***-denominator bars), most likely because Ferneyhough wants to maintain the articulation of the downbeats of each bar. However, there is a sense of a retrograde procedure executed through the flurries of short rhythmic figures which change their positions in the bar as the Phase progresses.

In Example 8.6.5, due to the proliferation of sextuplet brackets in the first part of the Phase, the recurring offset of 0.033 seconds between the piccolo and clarinet emerges at points *a*, *b*, and *c*. This differential can be understood due to the disparity between the duration of each ^{6}𝅘𝅥𝅯 : the piccolo's ^{6}𝅘𝅥𝅯 notes equate to 0.167 seconds each, whereas the clarinet's ^{6}𝅘𝅥𝅯 notes within the ***10***-denominator bars last for 0.133 seconds each. Similarly, there is an offset of 0.067 seconds at point *d* (which also involves a sextuplet rhythm). At point *e*, there is an offset of 0.048 seconds due to the preceding septuplet rhythms. These offsets in the second Phase are generally shorter than those found in the first Phase.

Example 8.6.5: All pseudo-points of coordination in Phase II.

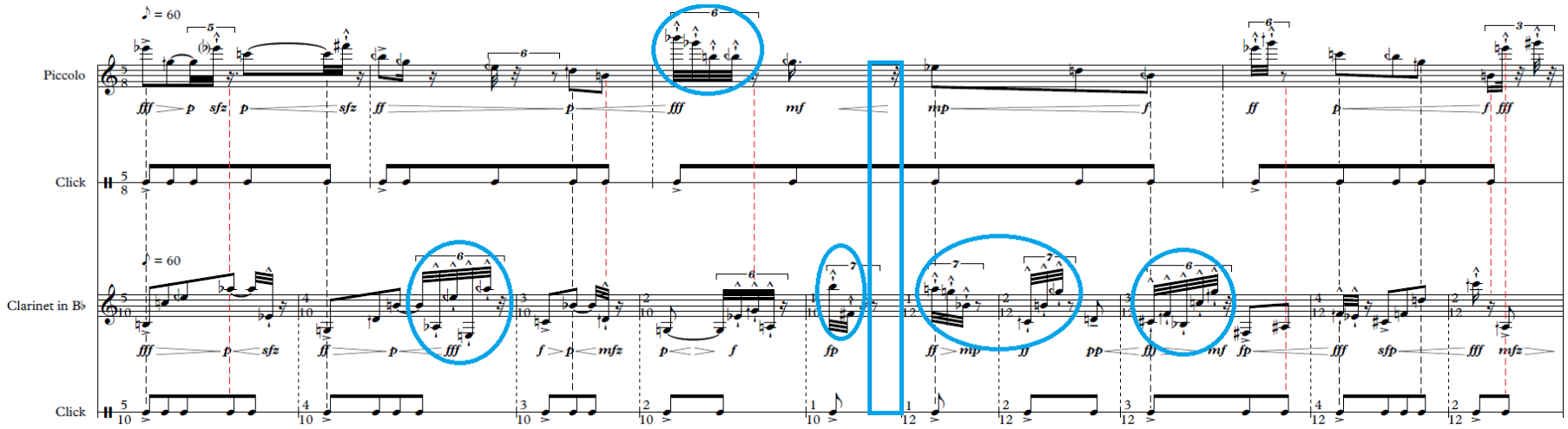


Example 8.6.6(a): All clear alternations of attacks in Phase II.



All the hockets labelled in Example 8.6.6(a) have different durations. With point *a*, due to the quintuplet bracket in the piccolo line, the rhythms align with the clarinet's ***10***-denominator, so the onsets of the piccolo's tied 𝅘𝅥𝅯 notes, the clarinet's third 𝅘𝅥𝅯, and the piccolo's second ^{5}𝅘𝅥𝅯 are all spaced by 0.6 seconds. Although point *b* involves a rest, it is nonetheless interesting to observe an offset of 0.067 seconds between each rhythmic event. At point *c*, the duration between each attack is 0.333 seconds (equivalent to a ^{3}𝅘𝅥𝅯), and this instance of interleaving perfectly highlights the symmetry of the clarinet's 4/12 bar, which is bookended by two coordination lines.

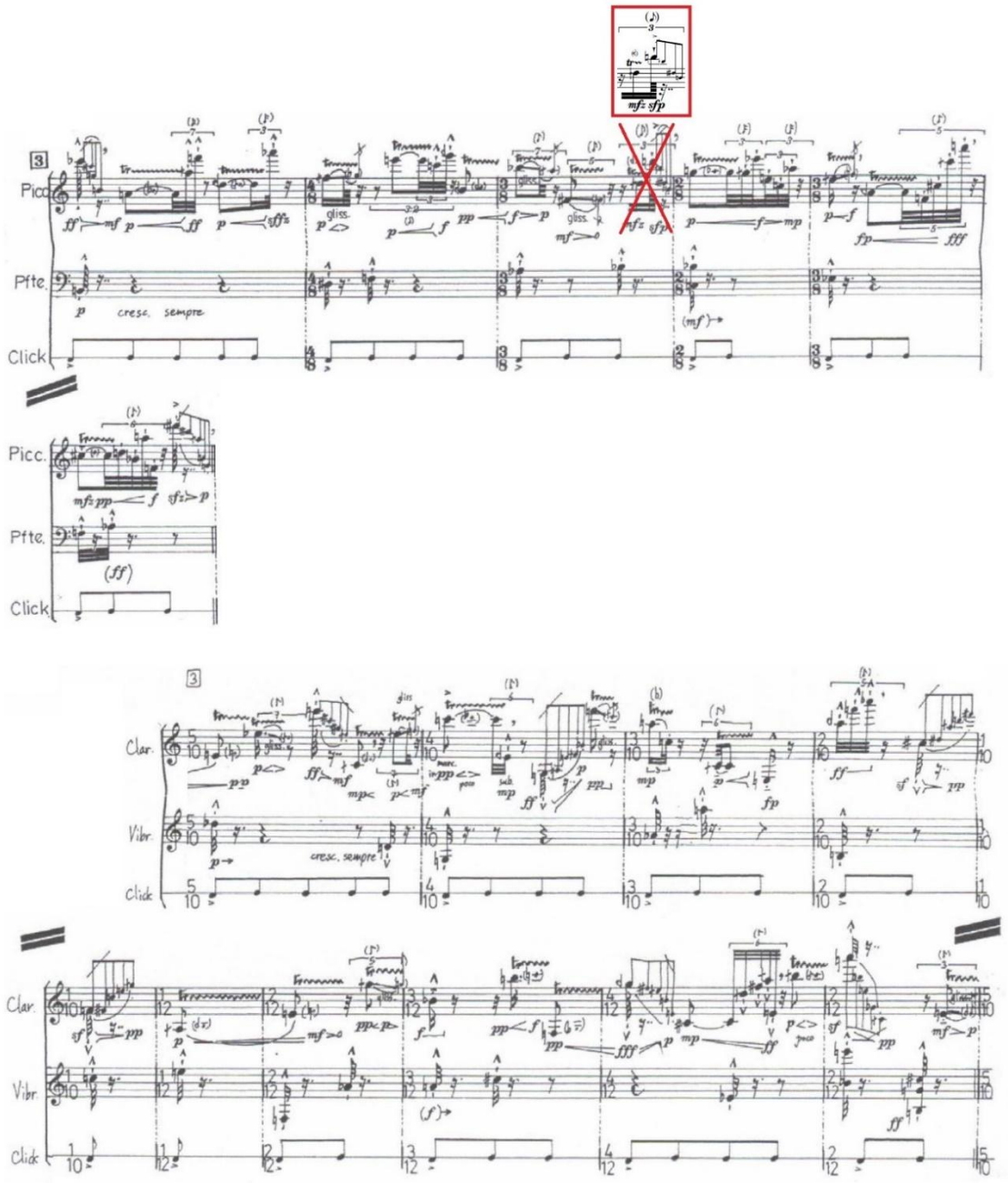
Example 8.6.6(b): All gestural alternations in Phase II.



However, the most important preoccupation with alternation in this second Phase involves rhythmic gestures rather than individual attacks. As seen in Example 8.6.6(b), Ferneyhough introduces flurried tuplet gestures in one instrument with coinciding rests or held notes in the other instrument. There is a pseudo-reset at the rough mid-point of the Phase (as highlighted by the blue rectangle annotation), where both instruments have a rest before the clarinet introduces the ***12***-denominator in the OFTSs for the first time (affirmed by the black coordination line at the beginning of the ***1/12*** bar).

PHASE III

Example 8.7.1: Ferneyhough, *Mort Subite* (pages 1 and 3), Phase III.[431]



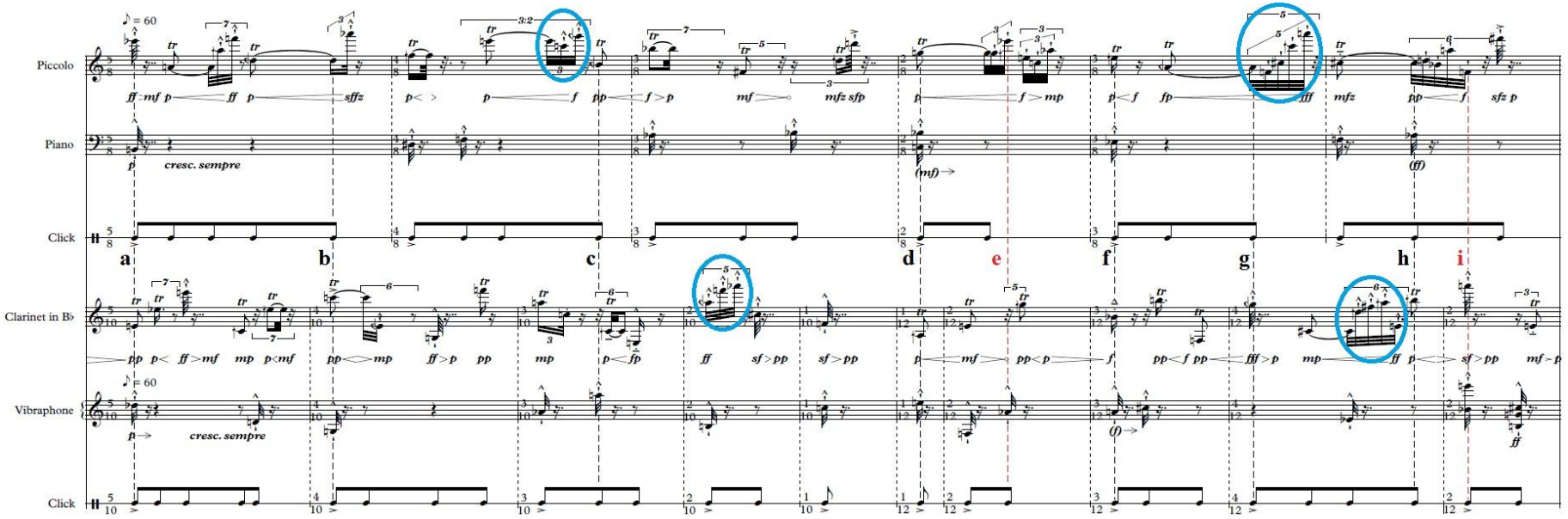
The third Phase presents a few new features. The piano and vibraphone are introduced to pair with the piccolo and clarinet respectively. The piccolo and clarinet lines substitute rests or tied notes on some of the click track pulses, which are counteracted by the piano and vibraphone filling out those rests with single staccatissimo attacks. Also, there are changing time signature numerators—and therefore changing bar durations—in the piccolo and piano lines (as previously discussed).

[431] Ferneyhough, *Mort Subite*, 1 and 3.

There is a vibraphone attack on the first beat of each bar (except for the ninth bar with the ***4/12*** time signature, which has the clarinet landing on the first beat of the bar instead). All vibraphone attacks correspond to a click pulse when the clarinet does not sound due to either a rest or a tie. With both instruments combined, it is conceivable that each pulse of the clarinet and vibraphone's click track is discernible.

The parenthesised "(1)" in Example 8.7.2(a) indicates the absolute duration of the single note, not the full duration of the tied notes. So, at the beginning of the piccolo's bar 4, the "(1)" indicates that only the $^{tr}\!\!\!

Example 8.7.2(b): The coordination of all lines in Phase III.



There is a 2:1 relationship between the note durations at points *d* and *f* in Example 8.7.2(b). The piccolo's 𝅘𝅥𝅯 at point *d* is double the duration of the 𝅘𝅥𝅯 at point *f*, which should be anticipated given normal rhythmic conventions. This is proportionally applied to the clarinet's 𝅘𝅥𝅯 at point *d* (i.e. 0.667 seconds in length), which is double the duration of the 𝅘𝅥𝅯 at point *f* (i.e. 0.333 seconds). The preoccupation with proportional relationships between note and rest durations at coordination lines will recur in later Phases.

Furthermore, there are changing time signatures in the piccolo and piano parts along with nested tuplets in the piccolo line. At this stage, the nested tuplets act as a magnifier; to wit, there are only triplets nested within triplets and quintuplets nested within quintuplets. As a result, they become equivalent rhythmic patterns with the clarinet line, which shares these same nesting tuplet configurations.

The first two blue annotations in Example 8.7.2(b) mark the first significant rhythmic event of the Phase: a nested in the piccolo ***4/8*** bar (with each note lasting 0.111 seconds) followed by the in the clarinet ***2/10*** bar (with each note lasting 0.167 seconds). This is then subtly inverted, as seen with the last two blue annotations, when the piccolo plays a nested in the penultimate ***3/8*** bar (with each note lasting 0.167 seconds) followed by the clarinet's in the ***4/12*** bar (with each note lasting 0.111 seconds). Furthermore, the first piccolo annotation and the last clarinet annotation both involve a tied (though the clarinet's is implied to be a by virtue of the ***12***-denominator).

This pseudo-symmetry is amplified when considering the structure of the Phase as a whole (see Example 8.7.3). Parts A and B are mostly delineated by the difference in denominator in the clarinet and vibraphone parts, though the last ***10***-denominator bar has been included in the B section. It would have made more visual sense for the macro proportions to have determined the demarcation; namely, the phasing proportion in part A should have entirely coincided with the 4:5 ratio (seen with the black dotted lines where straight are played against) compared to the 2:3 ratio in part B (i.e. straight played against). However, the delineation of parts A and B does not quite achieve this, as part B also includes the ***1/10*** bar.

Throughout this third Phase, there is a repeated rhythmic figure: a hemidemisemiquaver, or a 1/64th note, followed by a double dotted semiquaver rest (annotated with red circles in Example 8.7.3). There are only two instances of this figure in the piccolo line, and these serve as bookends for the Phase, thus supporting the notion that the Phase exhibits pseudo-symmetry.

The other instances of the repeated rhythmic figure are played by the clarinet. The red brackets and numbers below the clarinet and vibraphone click track indicate the elapsed number of clicks between each of these clarinet figures. Therefore, the centre point of the Phase is located between the two middle instances of the clarinet rhythmic figures, which straddle the piano's B♭, where only one click has elapsed. Coinciding with the two instances of piccolo annotations are the groups of two elapsed clarinet/vibraphone clicks bookending the Phase, further contributing to the pseudo-symmetry. Apart from these bookending pairs of clicks, there is a procedure of

permutation in that every elapsed duration is different: five and six elapsed clicks in part A, and seven and four clicks in part B.

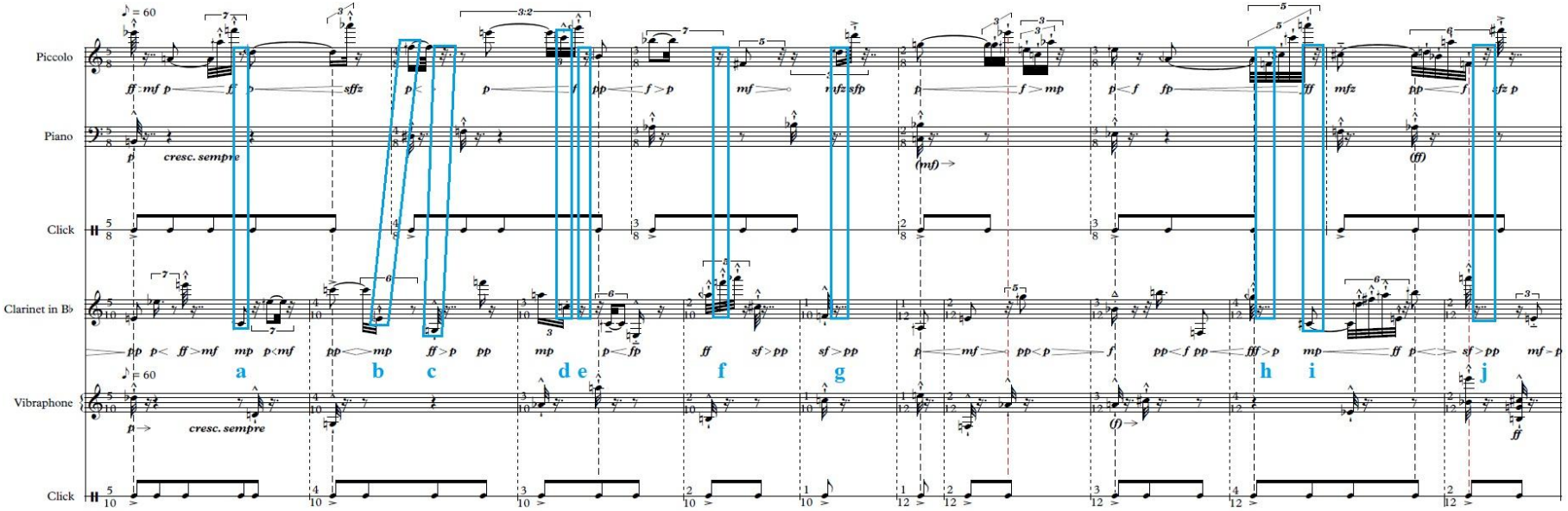
However, this demarcation of parts A and B still does not accurately reflect the actual centre/mid-point of the Phase. As each Phase in *Mort Subite* is 20 straight ♪ in duration, the real mid-point of the Phase is the middle ♪ in the piccolo and piano's first ***3/8*** bar (right after the clarinet's ^{5}𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 figure in the ***2/10*** bar). Ferneyhough uses different notational techniques (through the use of time signatures and rhythmic figures) to draw the reader's eye to speculate on the different proportions and pseudo-symmetries of the Phase, subtly reflecting the reciprocity found in Phase I.

Example 8.7.3: Overall structure of Phase III.

Each of the pseudo-points of coordination in Example 8.7.4 varies in offset duration, which reflects the growing complexity of each Phase. The only pseudo-points of coordination that share the same offset duration are points *b* and *e* which are both offset by 0.067 seconds.

The length of every other point is different. In the table below, point *c* is exactly 0.025 seconds, whereas all other offset durations are rounded to three decimal places.

Example 8.7.4: All pseudo-points of coordination in Phase III.



Point	Offset Duration
a	0.029 seconds
b	0.067 seconds
c	Exactly 0.025 seconds
d	0.022 seconds
e	0.067 seconds
f	0.046 seconds
g	0.033 seconds
h	0.077 seconds
i	0.133 seconds (equivalent to a ^{15}𝅘𝅥𝅯 note)
j	0.083 seconds (equivalent to 1/10th of a ^{6}♪ 𝅘𝅥𝅯 in duration)

Each of the alternations in Example 8.7.5(a) differs in offset duration, further emphasising the growing complexity of the Phases. Although point *c* is entirely comprised of rests (and therefore it may be mathematically coincidental), it is worthwhile to include, as it draws attention to how Ferneyhough utilises specific rhythmic notation throughout the piece.

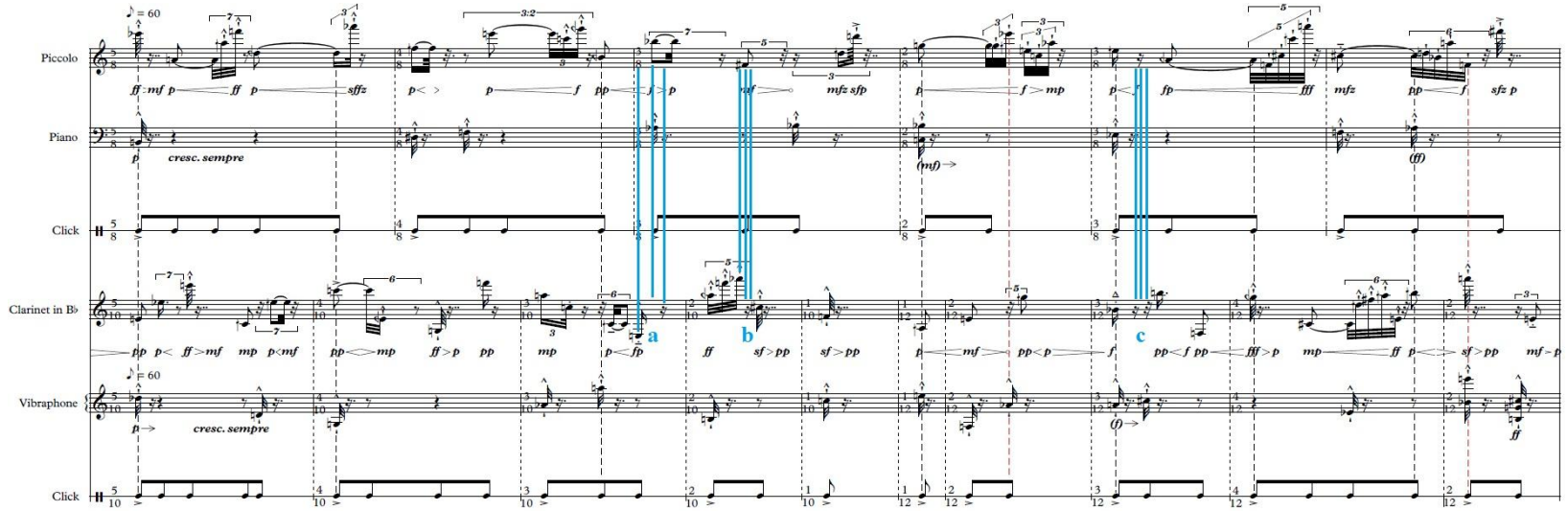
It is curious that at the coordination point at the beginning of the bar, just before point *c*, the piccolo and clarinet both play a 𝅘𝅥𝅯 note while the piano and vibraphone play a 𝅘𝅥𝅯 note. If the piccolo and clarinet also played 𝅘𝅥𝅯 at the coordination point just before point *c*, the following rest would be a dotted semiquaver and there wouldn't be an alternation. This may be coincidental, but it is plausible that Ferneyhough included these particular rhythms as a result of an implemented compositional process.

At point *a* in Example 8.7.5(a), each onset is spaced by 0.2 seconds (equivalent to a $\frac{5}{}$𝅘𝅥𝅯 in duration). At point *b*, each onset is spaced by 0.08-seconds. At point *c*, each onset is spaced by 0.167-seconds.

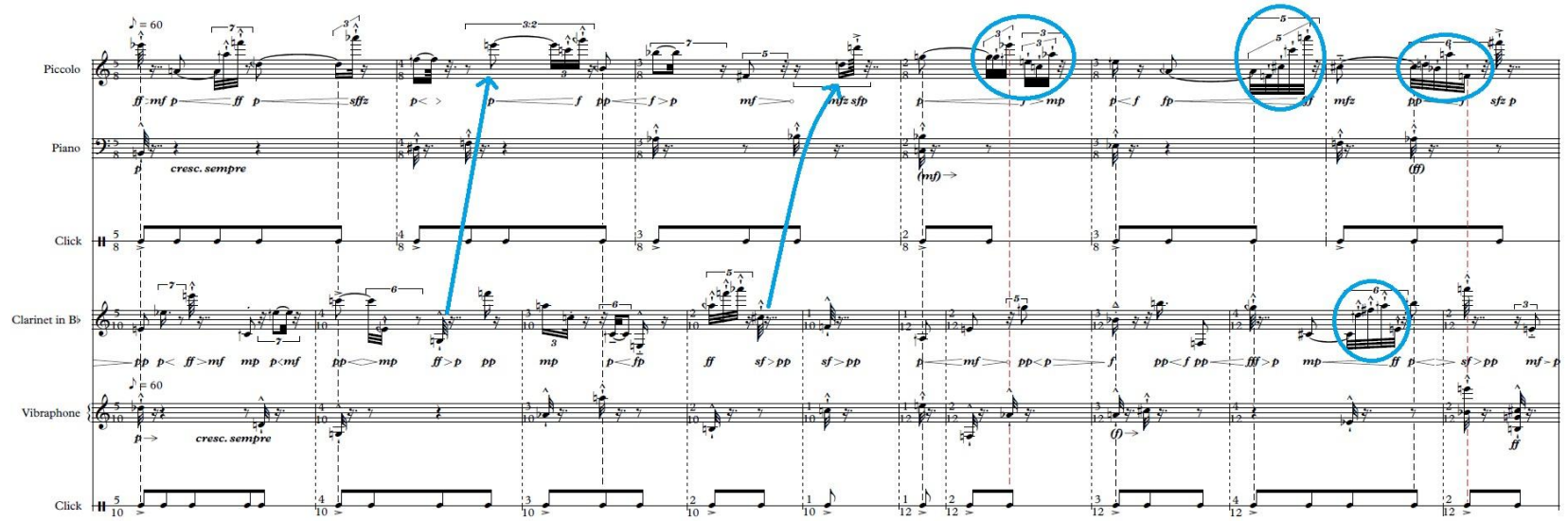
As with the second Phase, this third Phase is also preoccupied with gestural alternations (particularly in part B of the Phase, with the ***12***-denominator bars annotated with blue circles in Example 8.7.5(b)). With these gestural alternations, there continues to be a fixation with triplet rhythms nesting within triplets and quintuplet rhythms nesting within quintuplets. The call-and-response nature of sextuplet figures also returns here in Phase III.

However, other points of interest involve the sequential motion between the clarinet, piano, and piccolo lines (annotated with blue arrows in part A of the Phase). Looking at the first arrow, the duration between the clarinet's sounded F-natural and the piano's F-natural is 0.3 seconds, and the duration between the piano note and the piccolo's E-natural is 0.667 seconds. Compare this to the second arrow: there are 0.6 seconds between the clarinet's sounded B and the piano's B♭, and there are 0.333 seconds between the piano's note and the piccolo's D half-sharp.

Example 8.7.5(a): All clear alternations of attacks in Phase III.

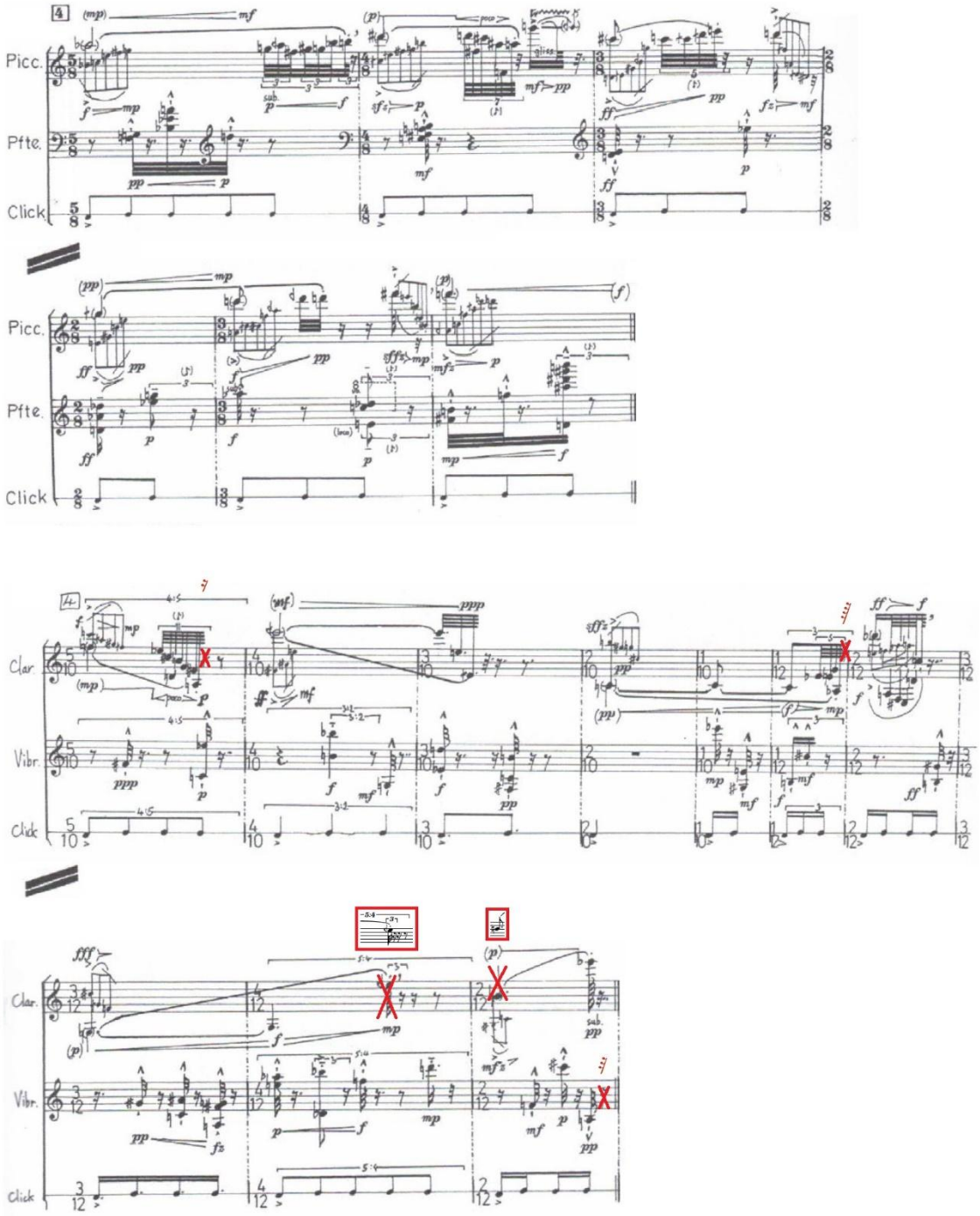


Example 8.7.5(b): All gestural alternations and other points of interest in Phase III.



PHASE IV

Example 8.8.1: Ferneyhough, *Mort Subite* (pages 1, 3-4), Phase IV.[432]



[432] Ferneyhough, *Mort Subite*, 1, 3–4.

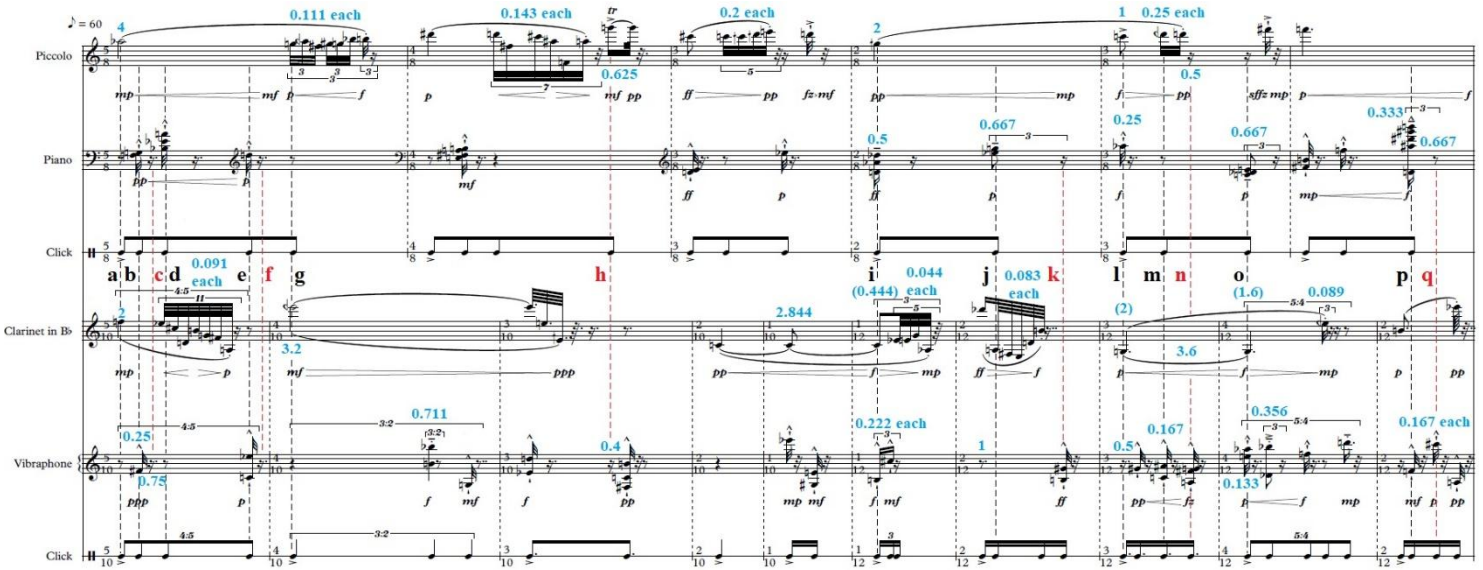
Although all pulses in both click tracks are sounded by attacks across all four instruments, the fourth Phase introduces rhythmic durations that are longer than a 𝅘𝅥𝅮 . Phase IV includes the use of 𝅗𝅥 , ♩ , and tied notes across multiple bars. This is a significant rhythmic departure from previous Phases and therefore necessitates further integration of the two instrumental pairs. The piccolo and clarinet are more reliant on the piano and vibraphone respectively to fill out the pulses as designated by their click tracks, and this is especially true for the clarinet and vibraphone when the impulse density is decoupled from the absolute bar duration.

Similar to the third Phase, there is a preoccupation here with exploring the 2:1 ratio (and other compounded and more complex ratios) at coordination points. At point *a* in Example 8.8.2, the piccolo's 𝅗𝅥 is double the duration of the clarinet's ♩ note. Although the clarinet's ♩ is in a ***5/10*** bar, the ***4:5*** universal tuplet reverts it back to a straight ♩ in duration (another instance of secondary rhythmic punning). At point *i*, the clarinet's 𝅘𝅥𝅮 is double the duration of the vibraphone's ^{3}𝅘𝅥𝅮 note.

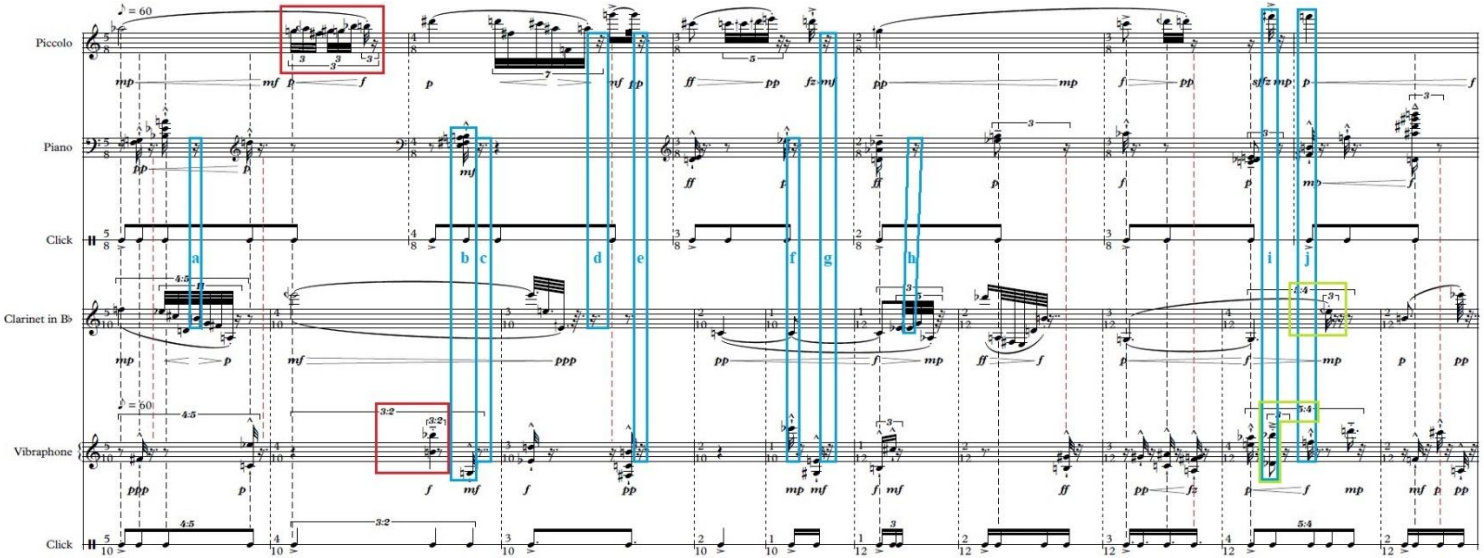
However, upon closer inspection, point *i* begins to superimpose the magnifying/compounding concept onto the durational ratios: the piccolo's ♩ is quadruple the duration of the piano's 𝅘𝅥𝅮 note. The nested quintuplet hemidemisemiquavers in the clarinet ***1/12*** bar (0.044 seconds) are each a tenth of the ^{3}𝅘𝅥𝅮 notes (which are each 0.444 seconds in length).

Finally, at point *l*, all four instruments are involved in this procedure. The clarinet's ^{3}♩. , due to the ***12***-denominator, is 2 seconds in duration, which is double the piccolo's straight 𝅘𝅥𝅮 (i.e. 1 second). The piccolo's 𝅘𝅥𝅮 note is, in turn, double the vibraphone's triplet dotted semiquaver rest (i.e. 0.5 seconds), which is double the piano's straight 𝅘𝅥𝅯 (i.e. 0.25 seconds). While Phase III introduced nested tuplets in the piccolo line, Ferneyhough introduces tuplets in Phase IV that *nullify* the effect of the time signature (as previously alluded to regarding the first bar of the Phase).

Example 8.8.2: The coordination of all lines in Phase IV.



Example 8.8.3: All pseudo-points of coordination in Phase IV.



In other words, Ferneyhough introduces rhythmic figures that are equivalent to straight rhythms in the OFTS bars (as seen with the 𝅘𝅥𝅯. 𝅘𝅥𝅯. 𝅘𝅥𝅯. 𝅘𝅥𝅯. rhythm in the clarinet and vibraphone ***3/12*** bar). This secondary type of rhythmic punning, where certain notated tuplet rhythmic figures present the same note durations as straight rhythms, results in the proliferation of the primary rhythmic punning, as it leads to a considerable increase of coordination points in this Phase compared to the other Phases.

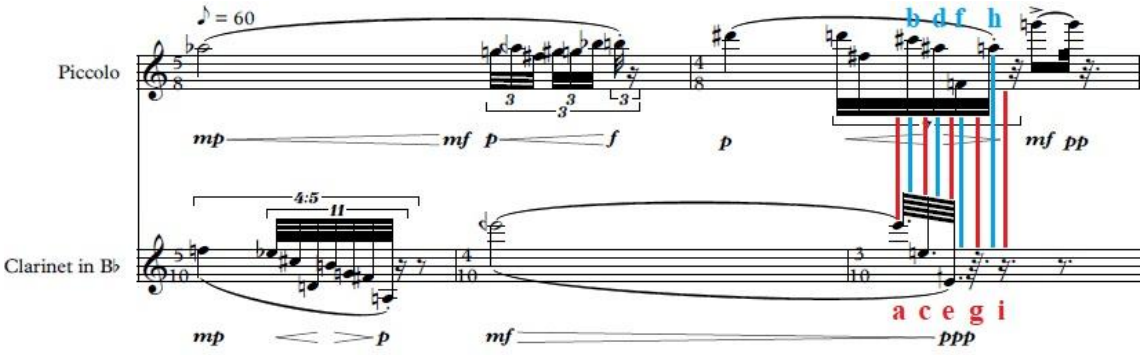
Below are the offset durations for each pseudo-point of coordination seen in Example 8.8.3. Similar to Example 8.7.4 in Phase III, there are only two points that share the same offset duration (*f* and *g*) and they happen to be exactly 0.05 seconds. Point *e* is also an exact duration (0.025 seconds); every other offset duration is rounded to three decimal places.

Point	**Offset Duration**
a	0.022 seconds
b	0.133 seconds
c	0.017 seconds
d	0.057 seconds
e	Exactly 0.025 seconds
f	Exactly 0.05 seconds
g	Exactly 0.05 seconds
h	0.011 seconds
i	0.033 seconds
j	0.067 seconds

Building on the idea of nested tuplets, Ferneyhough pairs nested tuplet figures consecutively in this Phase. The nested triplets within triplets seen in the piccolo ***5/8*** bar are answered by the nested ***3:2***- within ***3:2***-tuplet figure in the vibraphone ***4/10*** bar (see the red boxes in Example 8.8.3). The nested triplet within the ***5:4***-tuplet in the vibraphone ***4/12*** bar is answered by the nested triplet within the ***5:4***-tuplet in the clarinet line (see the green boxes).

As three out of four of these instances are single notes, and also because the attacks in the ***4/12*** bar are staccatissimo notes, it would be virtually impossible to discern the nested tuplet nature of these instances, and this further raises the question of the viability of performative accuracy. It is likely that Ferneyhough included these nested tuplets for the benefit of the performer/reader, to help them discern particular relationships and procedures within this Phase.

Example 8.8.4: Symmetry of alternations in Phase IV.



Pseudo-symmetry was previously explored in the third Phase, but there is an *exacting* symmetry that occurs within a pattern of alternation towards the beginning of Phase IV. The notation—even of the rests—is crucial to the execution of this symmetry found within the sequence of offset durations. The reason this is of particular note is because the other gestural flurries within Phase IV occur where there are rests or held notes; this is the only instance in this Phase where another instrument alternates with the gesture.

Points	Offset Duration
a-b	0.086 seconds
b-c	0.064 seconds
c-d	0.079 seconds
d-e	0.071 seconds
e-f	0.071 seconds
f-g	0.079 seconds
g-h	0.064 seconds
h-i	0.086 seconds

This precise example of symmetry speaks to the continuing evolution and transformation of the underlying procedures Ferneyhough employs as the complexity of each Phase increases.

PHASE V

The integration of the piccolo and piano lines playing as one unit is particularly apparent in Phase V; the densest piccolo activity bookends the Phase, while the piano's attacks are more frequent in the middle when the piccolo features almost two whole bars of rest (see Example 8.9.1). The clarinet and vibraphone, on the other hand, seem to make the click track redundant; most of the latter pulses (as dictated by the click track) in the

majority of the bars are unsounded by the clarinet and vibraphone lines, as can be seen in Example 8.9.2.

Example 8.9.1: Ferneyhough, *Mort Subite* (pages 1-2), Phase V, piccolo, piano, and click lines.[433]

Some of the surface rhythms encountered in the clarinet and vibraphone lines in Example 8.9.2 are played against the click track pulses. In the ***1/12*** bar, the quintuplet bracket is not made obvious with the surface rhythms, as there is only one short attack. In the first ***2/12*** bar, the clarinet's ***5:4***-tuplet rhythm counteracts the pulses in the click track. In the ***3/12*** bar, not only is the duration of the nested attack in the clarinet line obscured due to the staccatissimo articulation, but the universal ***3:2***-tuplet bracket in both the clarinet and vibraphone lines are played against the click track pulses.

[433] Ferneyhough, *Mort Subite*, 1–2.

Example 8.9.2: Ferneyhough, *Mort Subite* (page 4), Phase V, clarinet, vibraphone, and click lines.[434]

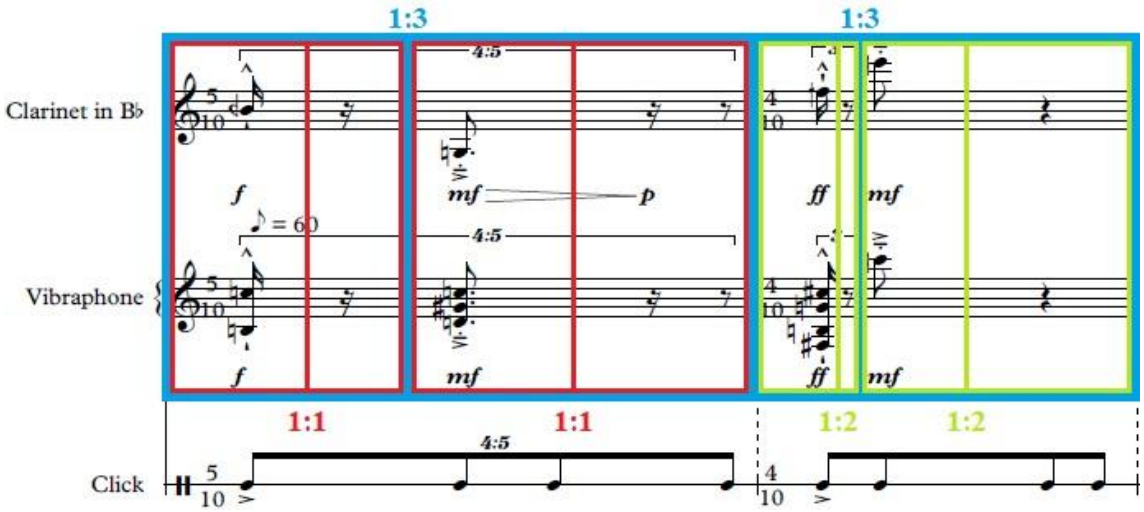
This Phase is the first time the clarinet and vibraphone play in rhythmic unison (i.e. they do not alternate, and the vibraphone does not fulfil the strict function of timekeeper). It seems the first pulse of every bar—and, to a lesser extent, the second pulse as well—is very important in this Phase, as the clarinet and vibraphone play together on those pulses. By doing this, they emphasise the absolute duration of each bar, as each bar's downbeat is articulated. The absolute duration vs impulse density proportion is only really explored on the score and can therefore only be appreciated visually.

[434] Ferneyhough, *Mort Subite*, 4.

Example 8.9.3: The coordination of all lines in Phase V.

Example 8.9.3 shows the coordination between all four instrumental lines. However, Ferneyhough's preoccupation with pseudo-symmetry, mirroring procedures, and reciprocity is brought to the fore when investigating only the clarinet and vibraphone lines. It is clear that their bars in this Phase are paired to draw out comparisons. The ratios of 1:1 in the ***5/10*** bar and 1:2 in the ***4/10*** bar between the note and rest values are repeated (see Example 8.9.4(a)). In the ***5/10*** bar, the 𝅘𝅥𝅯 is in a 1:1 relationship with the following semiquaver rest, then the 𝅘𝅥𝅯. is equal in duration to the combined semiquaver-quaver rests (see the red boxes). In the ***4/10*** bar, the 1:2 relationship is seen between the ^{3}𝅘𝅥𝅯 and triplet quaver rest, and it appears again with the 𝅘𝅥𝅯 and crotchet rest (see the green boxes). Furthermore, the note and rest values are augmented in the repeat (i.e. in the latter parts of both ***5/10*** and ***4/10*** bars). In the ***5/10*** bar, the 𝅘𝅥𝅯 rhythms become 𝅘𝅥𝅯. rhythms (see the red boxes), and in the ***4/10*** bar, the nested triplet rhythms become purely quintuplet rhythms (due to the ***10***-denominator; see the green boxes).

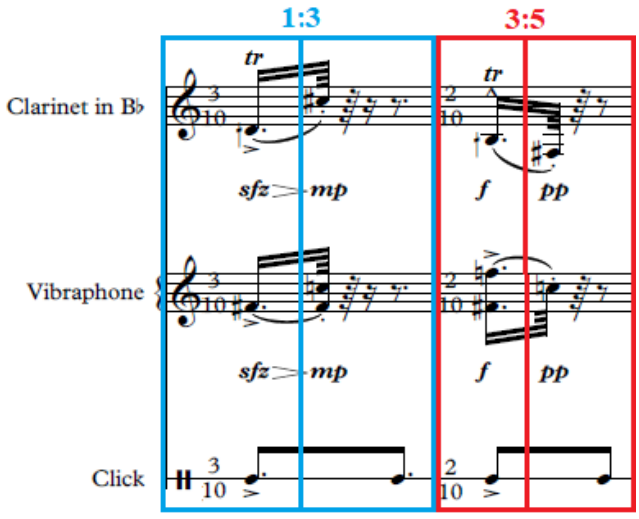
Example 8.9.4(a): The ratios of the first pair of bars of the clarinet and vibraphone lines in Phase V.



There is an overall 1:3 ratio across each of the whole ***5/10*** and ***4/10*** bars (seen the blue boxes): the initial attack on the first pulse vs the augmented repeat on the second to fourth pulses. Due to this overall 1:3 ratio per bar, multiples of three occur in these first two bars. The 𝅘𝅥𝅯 rhythms (with a total of 1 second in overall duration) in the ***5/10*** bar become dotted quavers (with a total of 3 seconds in overall duration).

In the ***4/10*** bar, the nested $\overset{3}{\text{𝅘𝅥𝅯}}$ (1/30 in note value when the denominator is taken into account) transforms into the $\overset{5}{\text{𝅘𝅥𝅯}}$ (1/10 in note value), and the nested triplet quaver rest (1/15 in note value) becomes the quintuplet crotchet rest (1/5 in note value). The 1:1, 1:2, and 1:3 ratios in these first two bars introduce a lopsided reciprocity which is explored for the rest of the Phase.

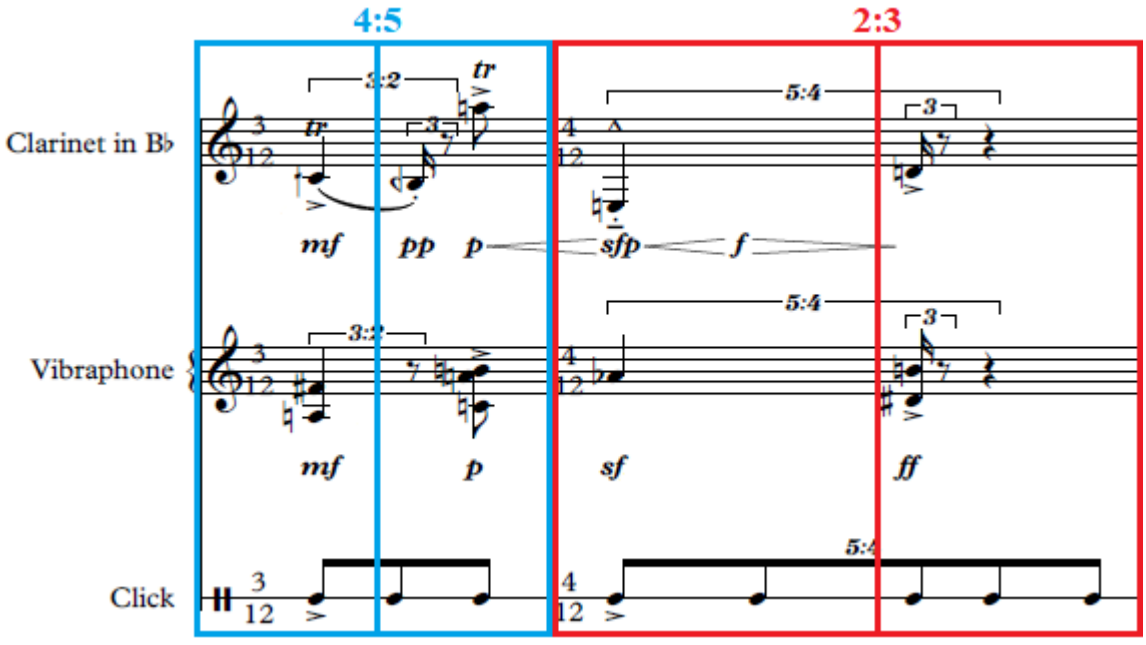
Example 8.9.4(b): The ratios of the second pair of bars of the clarinet and vibraphone lines in Phase V.



In the ***3/10*** and ***2/10*** bars (see Example 8.9.4(b)), the rhythm of the notes is identical. What affects the proportions are the durations of the rests (which are dictated by the time signatures, as they determine the absolute duration of each bar). The attacks continue the lopsided nature of this Phase; however, although the attacks in the ***3/10*** bar continue the 1:3 ratio, the attacks in the ***2/10*** bar divide it into a 3:5 ratio (which is less lopsided, approaching pseudo-symmetry as discussed in previous Phases).

This pseudo-symmetry is further explored in the ***3/12*** and ***4/12*** bars (see Example 8.9.4(c)) as Ferneyhough incorporates a nested triplet in the "middle" of each bar. The nested triplet attack in the ***3/12*** bar splits it into a 4:5 ratio, whereas the nested triplet in the ***4/12*** bar divides the bar into a 2:3 ratio. Unlike the ***3/10*** and ***2/10*** bar pairing, the ***3/12*** and ***4/12*** bars move away from pseudo-symmetry and become more lopsided again. Also, these ratios of 4:5 and 2:3 are inversions of the universal tuplets being employed in both bars (i.e. the 4:5 ratio split of the ***3/12*** bar features a ***3:2*** universal tuplet; the 2:3 ratio split of the ***4/12*** bar features a ***5:4*** universal tuplet).

Example 8.9.4(c): The ratios of the third pair of bars of the clarinet and vibraphone lines in Phase V.



The combination of the ***1/10***, ***1/12***, and ***2/12*** bars continues to act as the "mid-point" for the Phase, and thus a different process is again imposed on these bars. Both the ***1/12*** and ***2/12*** bars impose universal quintuplet brackets on the surface rhythms,

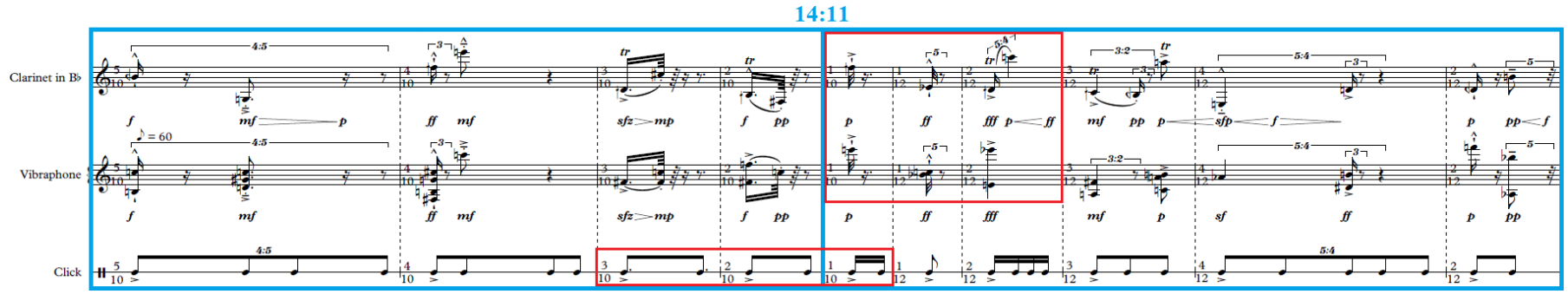
making them somewhat comparable to the ***1/10*** bar (though, of course, the rhythms are ultimately quintuplets nested within triplets due to the ***12***-denominators of these bars).

Ferneyhough seems to designate the ***1/10*** bar as the point of symmetry for this Phase, as the ***1/10*** bar shares similarities with the previous two bars as well as the following two bars (see the red boxes in Example 8.9.4(d)). The bars with ***3/10***, ***2/10***, and ***1/10*** time signatures all have two pulses in the click track; therefore, the rhythms become progressively faster. The notes transition from 𝅘𝅥𝅯. to 𝅘𝅥𝅯 to 𝅘𝅥𝅰 in duration, effectively displaying a 3:2:1 durational proportion, which is imitated in the numerators of the three bars. The ***1/10***, ***1/12***, and ***2/12*** bars all feature only one major/accented attack, generally on the downbeat of each bar. If the ***1/10*** bar is indeed the point of pseudo-symmetry for the entire Phase, it splits the Phase into a 14:11 overall ratio (as indicated by the blue boxes). Parenthetically, the final ***2/12*** bar continues to be an outlier.

With regard to pseudo-points of coordination, there are four notable instances in Example 8.9.5. Although points *b* and *c* entirely involve rests, they notationally indicate where the previous notes' durations supposedly end; though, practically, this is likely not the case, as the clarinet and vibraphone's hemidemisemiquavers just before point *b* have staccato articulation, and their demisemiquavers just before point *c* have staccatissimo articulation.

The difference between the piano's rest "onset" and the clarinet/vibraphone's 𝅘𝅥𝅰 attack at point *a* is 0.022 seconds, creating an almost perfect hocket effect as the clarinet and vibraphone play in between the piano's two bass chords. The differential at point *b* is 0.033 seconds, whereas the differential at point *c* is 0.1 seconds. At point *d*, the difference between onsets is 0.067 seconds, and with the ***fz***/***f***/***ff*** dynamics as well as the accents used, there is an almost *acciaccatura* quality to this rhythmic near miss.

Example 8.9.4(d): The pseudo-symmetry of the clarinet and vibraphone lines in Phase V.

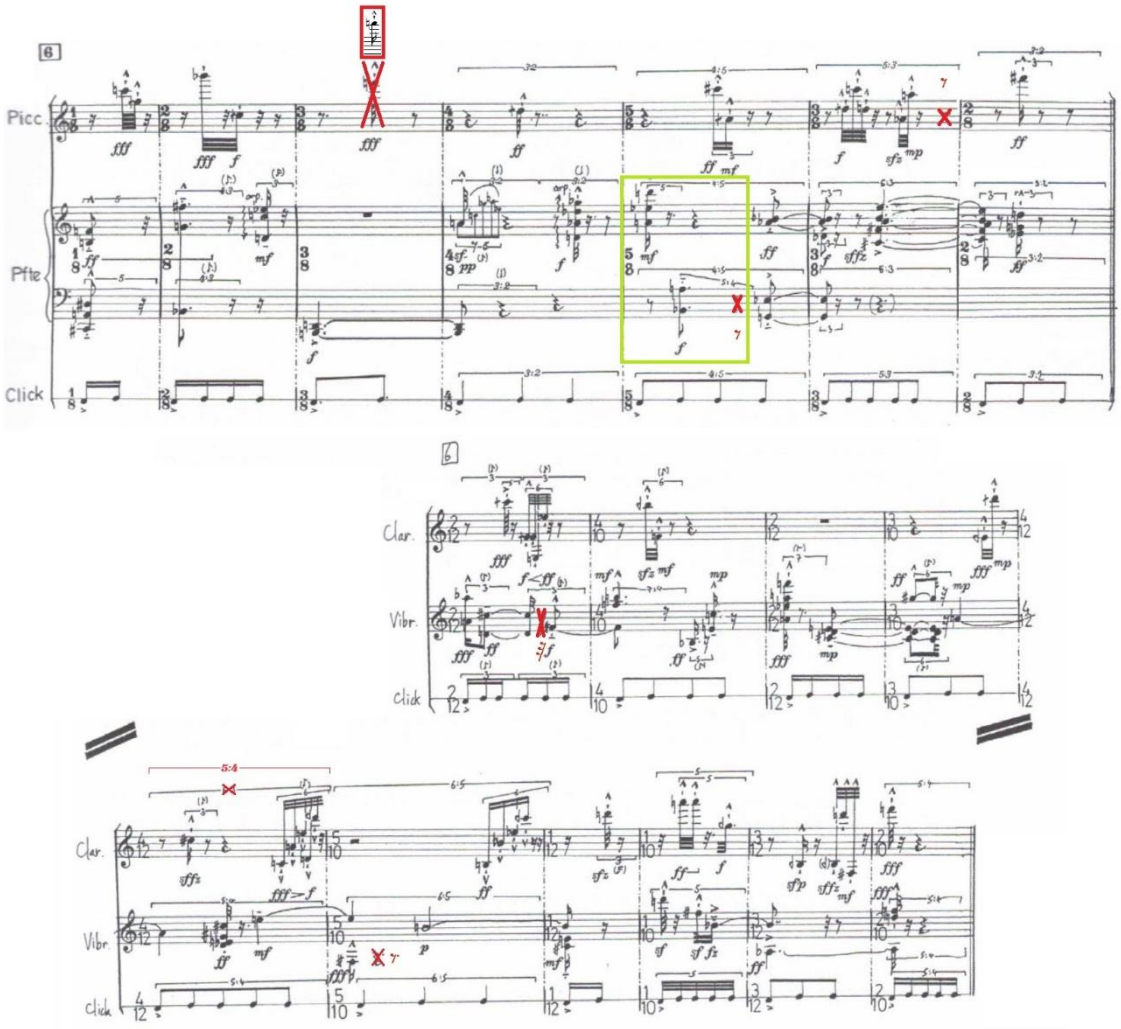


Example 8.9.5: All pseudo-points of coordination in Phase V.

All the pseudo-points of coordination found in Phase V, except for point *c* in Example 8.9.5, could not have been achieved without the de-synchronisation of absolute bar duration and impulse density. Point *a* relies upon a surface subdivision of the second $^{3}\!\!\!

Furthermore, rhythmic reciprocity returns here with the piano's right hand featuring a 2:3 ratio (i.e. nested $\overset{5}{\text{𝅘𝅥𝅯}}$ vs nested quintuplet dotted semiquaver rest) followed by the left hand's 3:2 ratio (found in the nested ***5:4***-tuplet 𝅘𝅥𝅮. vs nested ***5:4***-tuplet quaver rest; see the green box in Example 8.10.1).

Example 8.10.1: Ferneyhough, *Mort Subite* (pages 2 and 4), Phase VI.[436]



Other interesting proportional and notational occurrences appear in the vibraphone line. In the second and third bars, with the time signatures ***4/10*** and ***2/12*** respectively, a septuplet rhythm is used, falling on the first two beats of both bars. The figures mirror one another. In the ***4/10*** bar, the note to rest ratio is 6:1 ($\overset{7}{\text{𝅗𝅥.}}$ against the septuplet semiquaver rest). In the ***2/12*** bar, this ratio is inverted to 1:6 ($\overset{7}{\text{𝅘𝅥𝅯}}$ against the septuplet dotted quaver rest).

[436] Ferneyhough, *Mort Subite*, 2 and 4.

Without taking the denominators of the time signatures into account, there is also a 2:1 ratio between the two bars, as the ***4/10*** click pulses are "quavers" and the ***2/12*** click pulses are "semiquavers" (hence why the septuplet values are notationally halved in the ***2/12*** bar). However, when the denominators *are* taken into account, the overall ratio becomes more complex across the two bars: a 12:5 durational ratio is seen when the $^{5}\!\!\diamond$ pulse of ***4/10*** is compared against the $^{3}\!\!\diamond$ pulse of ***2/12***.

Another noteworthy pair of bars in the vibraphone line is the fourth and fifth bars, which have the respective time signatures of ***3/10*** and ***4/12***. When examining the (universal) tuplets within both bars, a level of symmetry emerges. Due to the ***10***-denominator in the fourth bar, the bar is in an overall 4:5 proportional relationship between the piccolo/piano vs clarinet/vibraphone lines. However, the sextuplet in the vibraphone line imposes a further 2:3 ratio and compounds the vibraphone's rhythms.

Conversely, the ***12***-denominator in the fifth bar specifies an overall 2:3 proportional relationship between the piccolo/piano vs clarinet/vibraphone lines. However, the ***5:4*** universal tuplet imposes a further 4:5 ratio on the bar's rhythms. In the original score, the clarinet has a "***5:3***" universal tuplet bracket, but this is a misprint (see Appendix C).

Although all the aforementioned proportions involve some level of reciprocity and symmetry, there are two fundamental procedures exploited in this final Phase: permutation/reordering, and alternation. With regard to reordering, this is simply demonstrated with the piccolo/piano time signatures where the numerators, rather than being arranged in approximate descending order as seen in Phases III-V, are instead reordered into an ascending-then-descending order: ***1-2-3-4-5-3-2***.

However, the combination of permutation/reordering and alternation procedures is best exemplified in the arrangement of the clarinet/vibraphone time signatures. The time signatures alternate between ***10***- and ***12***-denominators from bar to bar. The previous order established with Phases II-V, where the numerators were arranged in descending order for ***10***-denominator time signatures and then in roughly ascending order for ***12***-denominator time signatures, has also permuted.

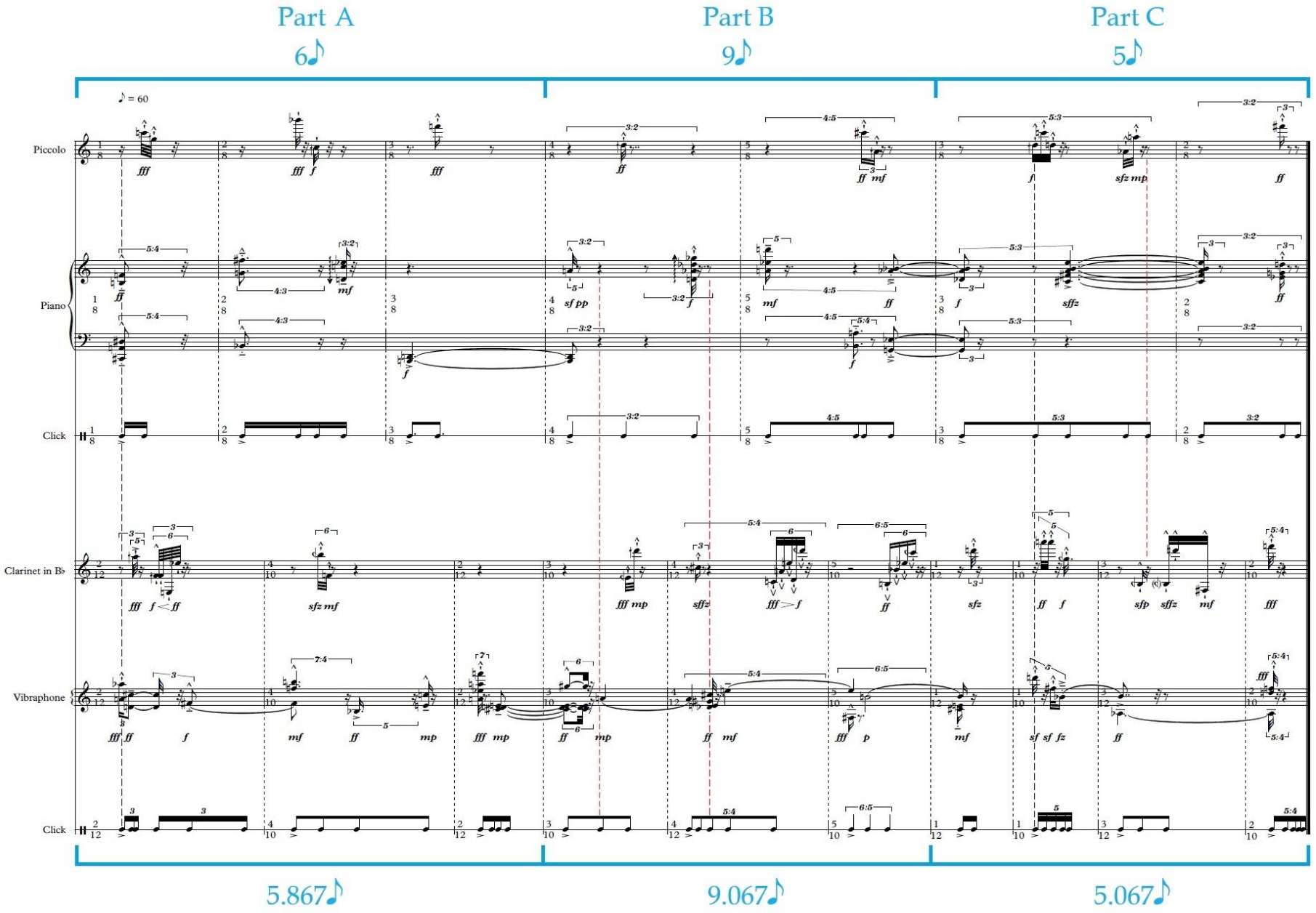
Firstly, Ferneyhough initiates the Phase with a ***12***-denominator bar and ends it with a ***10***-denominator bar, which is the opposite of what was previously established. Furthermore, when isolating the ***12***-denominator bars, instead of the numerators being arranged in roughly ascending order (i.e. ***1-2-3-4-2***), Phase VI features a reordering: ***2-2-4-1-3***. A similar process of permutation is imposed on the ***10***-denominator bars, changing the original descending ***5-4-3-2-1*** order into ***4-3-5-1-2*** in this final Phase.

Up until Phase VI, the rate of change has been gradual, with Ferneyhough slowly implementing a new musical element or development with each new Phase. Phase II introduced changing numerators with the OFTSs. Phase III implemented changing numerators with the conventional time signatures. The OFTS bars in Phase IV featured de-synchronisation between absolute bar duration and impulse density. The de-synchronisation was then also applied to the conventional time signature bars in Phase V. However, the simultaneous combination of both alternation and permutation procedures in Phase VI results in a heightened effect of accelerated transformation, as though Ferneyhough is allowing a glimpse into a Phase that should have been located much later in the development process.

Due to this drastic change in the approach to musical development, it is unsurprising that there are far fewer points of coordination between all four instrumental lines here compared to previous Phases. This effect is similar to what Margaret Thomas describes as the 'progression [of] dissonance': in a canon, when 'the voices approach their maximal distance from the convergence point, their imitative relationship moves into maximal obscurity'.[437] Although this *Mort Subite* is not a canon, the phasing procedure yielded similar effects with regard to 'convergence points', and this final phase is truly at its most metrically dissonant with the least amount of points of coordination.[438]

[437] Key, "Pan-Rational," 215; see also Thomas, "*Temporal Dissonance*," 4.
[438] See also the discussion around Carter's *Anaphora* in Schiff, *The Music of Elliott Carter*, 172; Key, "Pan-Rational," 229.

Example 8.10.2: The coordination of all lines in Phase VI.



Apart from the very first downbeat of the Phase, there is only one other coordination point that has been recorded in the original click track materials (see the dotted black line coinciding with the downbeat of the clarinet/vibraphone's ***1/10*** bar in Example 8.10.2). The other dotted lines (in red) are unofficial points of synchronicity between two or three instruments where elements of the surface rhythms align.

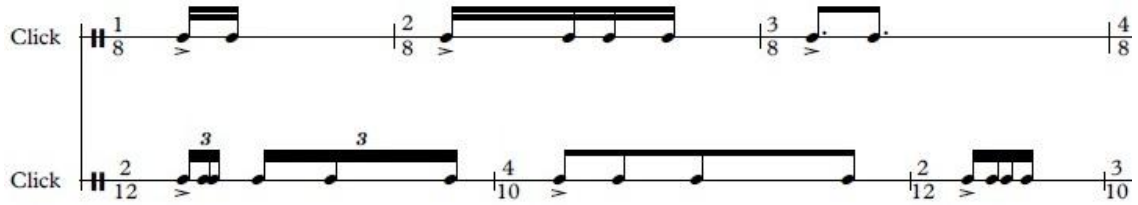
All three dotted red lines show points where a note played by one instrument aligns with a rest in another instrument, but none of these red coordination points show two notes played together. This means that, apart from at the two black coordination lines, the notes played by all instruments never coincide with one another. The only exception is in the final bar, where the piccolo's last note aligns with the piano's last chord and the clarinet's final note aligns with the vibraphone's final chord. In other words, the pairs of instruments align at the very end within each pair, though all four instruments do not.

The way Ferneyhough has arranged the OFTSs has resulted in a warped metric structure with displaced rhythms. To fully understand this warped metric structure, Phase VI may be broken down into three parts (as annotated in Example 8.10.2). These three parts have been delineated according to where the bar lines almost align between the piccolo/piano and the clarinet/vibraphone.

In part A, the piccolo/piano's bars have a total duration of 6 ♪ compared to the clarinet/vibraphone's total of 5.867 ♪; this equates to a 0.133 ♪ difference in length. Parts B and C both feature a 0.067 ♪ differential between the two instrument pairs. There is a sense that the clarinet/vibraphone's sections are slightly warped in duration compared to the piccolo/clarinet's section lengths (or vice versa). The rhythms in this warped metrical structure are inherently displaced by miniscule tuplet durations.

On top of this, there are other inter-instrumental patterns, some of which further support these section delineations of parts A, B, and C in Phase VI. In part A, the number of clicks in each bar of the piccolo/piano's click track are 2-4-2; this correlates to the clarinet/vibraphone's OFTS numerators in part A. There is also a level of symmetry between the two click tracks in part A:

Example 8.10.3: Click tracks in part A of Phase VI.

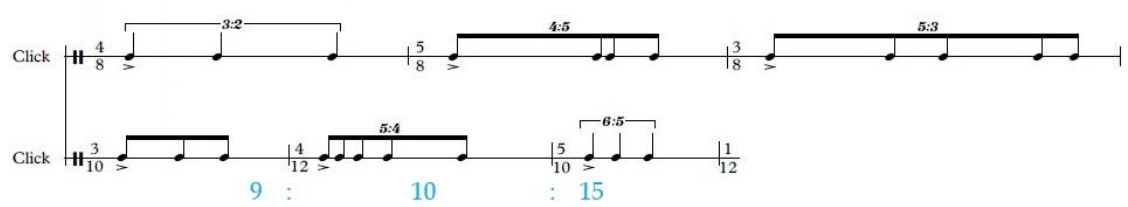


The top click track line of the piccolo/piano contains 𝅘𝅥𝅯𝅘𝅥𝅯 in the first bar, which then doubles in duration to become 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 in the second bar, and in the third bar there is a dotted rhythm of 𝅘𝅥𝅯. 𝅘𝅥𝅯., which implies three equal subdivisions of each dotted note. The bottom click track line of the clarinet/vibraphone contains a pattern of impulses in the reverse order of the piccolo/piano click track. The first bar of the bottom click track explicates the three equal subdivisions of ^{3}𝅘𝅥𝅯 ^{3}𝅘𝅥𝅯, followed by the second bar, which contains 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯, and this rhythm is then halved in duration to become 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 in the third bar. Although not precisely reciprocal in notation, there is a process of symmetry between these two click track lines, at least in part A.

The concept of warping the metrical structure is also seen in part A. It is clear that the bar durations of the piccolo/piano are in a straightforward 1:2:3 ratio. The clarinet/vibraphone bar durations would have been in a simple 1:2:1 proportion based on the time signature numerators if not for the fact that the middle bar has a different denominator, making the middle bar slightly longer and leading to a 5:12:5 durational ratio instead. The OFTSs make this subtle warping of proportionality possible.

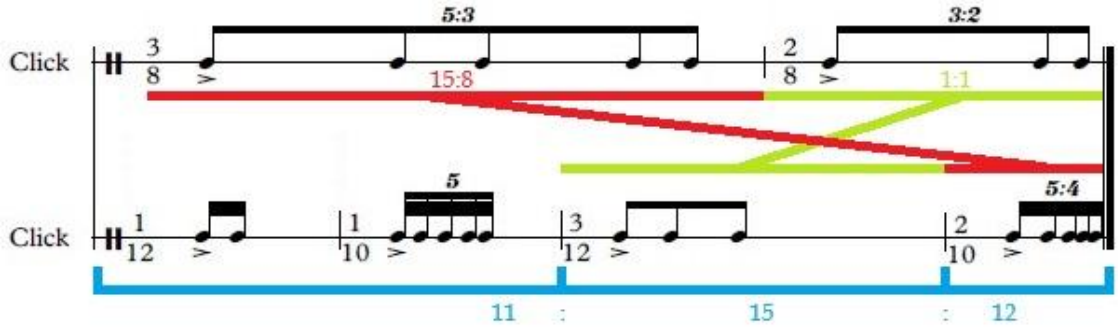
After part A, the number of clicks in the next three bars of the piccolo/piano click track correlate to the clarinet/vibraphone's numerators in part B: they are both ordered 3-4-5. The ***3/8*** bar of the piccolo/piano click track line in Example 8.10.4 does not belong to part B of Phase VI, but the inter-instrumental pattern is present nonetheless. Also, the clarinet/vibraphone bar durations gradually lengthen and so make up a 9:10:15 durational ratio:

Example 8.10.4: Click track middle bars of Phase VI.



Part C of Phase VI is the most interesting section, as it draws attention to bar length equivalence. In fact, it is the same bar length equivalence that was most commonly seen in *Superscriptio*: ***2/8*** vs ***3/12***. Ferneyhough highlights this by featuring three equal impulses in the top ***2/8*** bar, effectively making both bars in the click tracks sound identical, merely offset by a ***2/10*** bar length (see the green annotations in Example 8.10.5). Essentially, it would sound as though the bottom ***3/12*** bar was a call and the top ***2/8*** bar was the response.

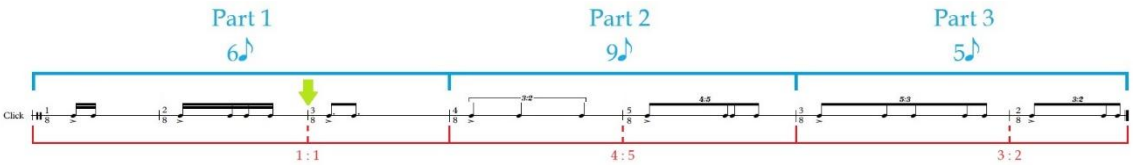
Example 8.10.5: Click tracks in part 3 of Phase VI.



Due to the comparison made between the ***2/8*** and ***3/12*** bars, there is a criss-crossing effect where the ***3/8*** bar is similarly compared with the ***2/10*** bar by virtue of also sharing the same number of impulses. However, instead of featuring a bar length equivalence, the ***3/8*** bar is almost twice the duration of the ***2/10*** bar, making up a 15:8 durational ratio (see the red annotations).

The numerators of the bottom clarinet/vibraphone click line could be grouped as [***2***]-***3***-***2*** if the consecutive ***1***-numerators are combined into "[***2***]". This interpretation could act as a potential reference to part A (where the numerators were ***2***-***4***-***2***). If this were the case, the bar durations would make an 11:15:12 ratio, which is less steep compared to the 5:12:5 ratio in part A. The smoothing out of proportions in the clarinet/vibraphone bar durations is presented in contrast to the gradually steepening ratios of the piccolo/piano bars:

Example 8.10.6: Piccolo/piano bar duration ratios of Phase VI.



If each part in Phase VI of the piccolo/piano lines was divided in two, they would reveal a 1:1 ratio for part A, a 4:5 ratio for part B, and a 3:2 ratio for part C, as can be seen in Example 8.10.6. Each ratio becomes steeper as the Phase progresses. Also, from the green arrow annotation onwards, the impulse density of each bar is correlated to the numerator of the previous bar.

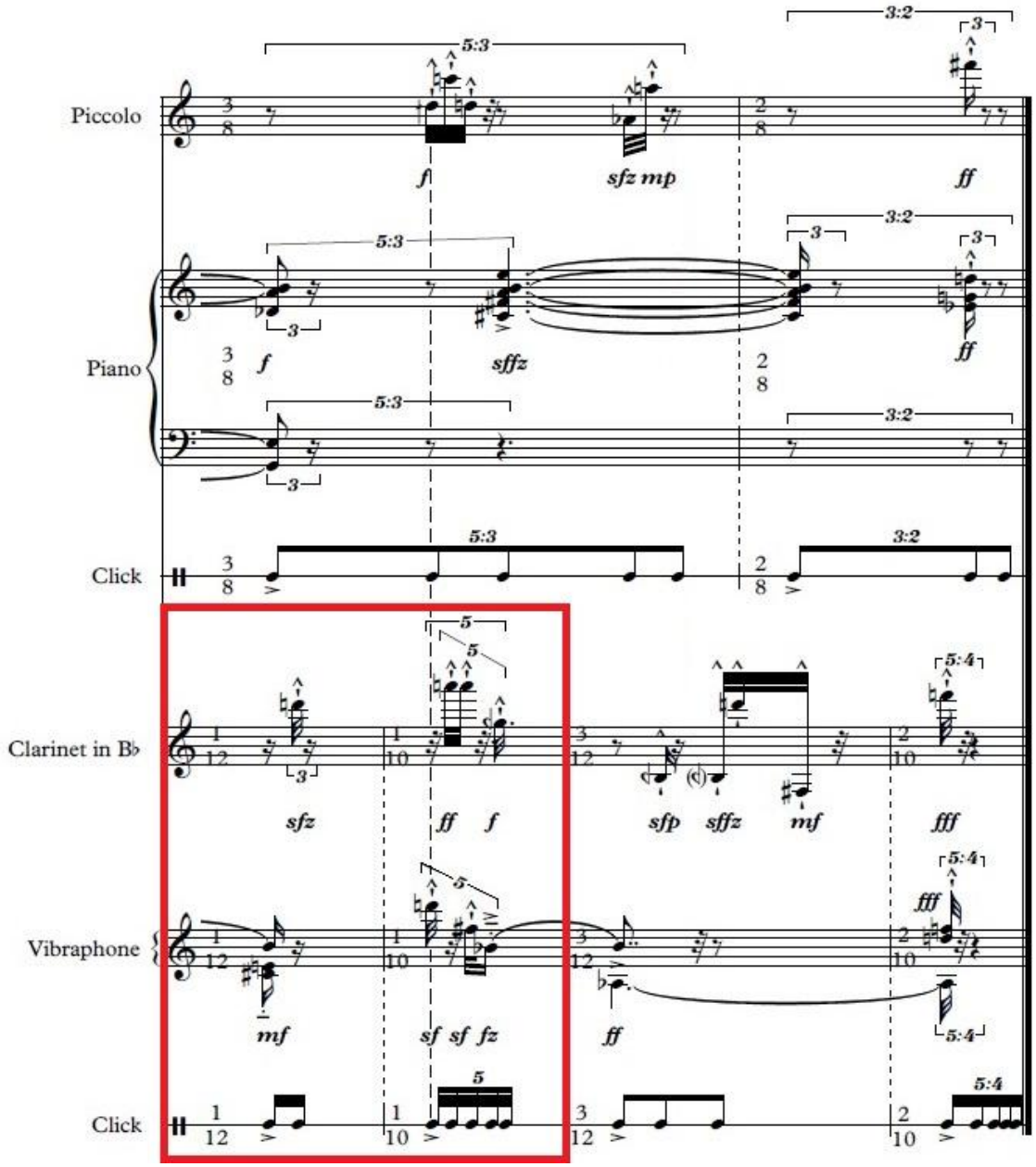
So, the ***3/8*** bar contains two impulses because the previous bar has a ***2***-numerator; the ***4/8*** bar contains three impulses because the previous bar has a ***3***-numerator; and so on until the end of the Phase. This is reminiscent of the pattern at the beginning of *Superscriptio*, where Ferneyhough complicates the de-synchronisation of impulse density and absolute bar duration by correlating the impulse density of one bar to the absolute bar duration of the following adjacent bar.

The two adjacent OFTSs with ***1***-numerators at the beginning of Example 8.10.5 hearken back to previous Phases, and they do indeed bear a resemblance to the technique used in *Superscriptio*, where the numerator is kept consistent to focus on the change of pulse speed. This emphasis of the pulse speed is heightened by the nested tuplets used on the surface of the music. Ferneyhough includes a nested triplet bracket in the clarinet's ***1/12*** bar (thereby enacting a triplet nested in a triplet) and multiple nested quintuplets in the clarinet and vibraphone's ***1/10*** bar (thereby nesting quintuplets within a quintuplet; see the red box in Example 8.10.7).

What makes *Mort Subite* so distinctive amongst Ferneyhough's repertoire is the fact that it is structured to be a didactic work, laying bare each stage of the process, until the final Phase where the confluence of multiple procedures results in a dramatic climax of accelerated structural and musical development. The use of OFTSs is integral to the piece as Ferneyhough layers and compounds levels of proportions.

This is best exemplified in the sections of reciprocal and symmetrical bars, and by the two different types of rhythmic punning found in several structural points of coordination and surface rhythmic equivalent durations (on the note and bar level). By notating a pair of instruments entirely in OFTSs, Ferneyhough invites and challenges all the performers to grapple with the layers of proportional relationships explored throughout the work.

Example 8.10.7: Part C of Phase VI.



Conclusion

Now that OFTSs have been analysed in the context of each composer separately, we should consider how OFTS use has larger-scale implications in each composer's conception of musical time and the perception of musical form. Given that most of this thesis has focused on each composer and their works, one might expect a comparison of compositional styles in these concluding remarks, contrasting Ferneyhough's "top-down" approach of generative process-driven compositional methodology with Adès' more "bottom-up" approach.[439]

Without composer interviews or access to compositional sketches, these compositional approaches have been largely inferred. Nevertheless, this concluding chapter will compare the two major case study works *Piano Quintet* and *Mort Subite*, as *Piano Quintet* is one of Adès' most structurally complex works, and *Mort Subite* is one of Ferneyhough's most diachronic works (or, at least, it contains a high level of musical continuity and succession/progression).

If ever there were similar uses of OFTSs and approaches to organising musical time between the two composers, they would likely be found in these two case study pieces. However, it must be stressed that neither composer has published an etude on OFTSs. Instead, OFTSs are one of the techniques at their disposal, and their uses will always be mixed with other compositional techniques.

As OFTSs have been found in different types of works, from solo pieces such as *Superscriptio* to orchestral compositions such as *Totentanz*, there will also be a discussion surrounding the variety of uses in each context, followed by broad observations about the composers. Specific answers will then be given for the research questions of this project. This final chapter will then conclude with remarks about the limitations of the project and potential avenues for future research.

Comparison of Case Studies

Throughout this thesis, the uses of OFTSs have been framed as a means of communicating the organisation of time experienced in music, and so it may now be

[439] Toop, "*Lemma-Icon-Epigram*," 56.

appropriate to reference some of the concepts posed by Kramer in *The Time of Music*. Certain notions Kramer addressed appear particularly relevant to both Adès and Ferneyhough, as they seem in line with both composers' fundamental views on how OFTSs expose particular relationships within the music and its performance.

Kramer asserts that time is both 'a *relationship* between people and the events they perceive' and 'an ordering principle of experience'. He goes on to say that '[i]f time exists not as an objective reality but as an interaction between listener and composition, then time can indeed be interrupted or even reordered'.[440]

The ideas of time being interrupted and reordered are certainly seen throughout Adès and Ferneyhough's uses of OFTSs. For example, in *Piano Quintet*, OFTS bars are used as rhythmic interjections; and in *Mort Subite*, Phase VI features a complete reordering of time signatures.[441] However, these conceptualisations extend to a larger scale, and Kramer specifies that:

> …musical time is both linear *and* nonlinear… Opposing characterizations are not mutually exclusive when we are studying time. Music can be, for example, linear on a deep structural level yet nonlinear on the surface.[442]

This is why different types of musical time are experienced across various layers of both compositions. Furthermore, how OFTSs interact with each type of musical time will, to some extent, determine the efficacy of their use in each context.[443]

Kramer's use of 'linear' and 'nonlinear' can be problematic, as 'linear' may narrowly imply concepts related to lines, and 'nonlinear' is too broad in its application. However, there are several related categories that are appropriate to describe the various elements of experiential time in the music of *Piano Quintet* and *Mort Subite*: 1. Continuity vs non-continuity; 2. Direction vs non-direction; 3. Projection vs non-projection; and 4. Diachronicity vs non-diachronicity. With all four categories, the former of each pair represent some level of trajectory, succession, and progressive chronology in the music; the latter of each pair represent the relevant antithetical sentiments.

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[440] Kramer, *The Time of Music*, 5, and 6.
[441] See chapter 5, subsection 2a(i), for discussion around the corollary effect of rhythmic interjection in *Piano Quintet*. See also chapter 8, subsection "PHASE VI" for discussion around the reordering of time signatures in Phase VI of *Mort Subite*.
[442] Kramer, *The Time of Music*, 2.
[443] Ibid.

Ultimately, the subjective experience of time in music encompasses elements such as 'motion, continuity, progression, pacing, proportion, duration, and tempo'; as Thomas Clifton describes it, 'the time which a piece *presents* or *evokes*'.[444] Compare this to absolute time, which is 'the time a piece *takes*'.[445]

This distinction is important, because the subjectivity of experiential musical time and the "objectivity" of absolute time must be felt simultaneously for proportionality to be experienced, and proportionality is fundamental to the uses of OFTSs.[446] Furthermore, addressing the four categories of experiential musical time, it is crucial to understand that both *Piano Quintet* and *Mort Subite* will express these conceptualisations at different levels of the music.

Piano Quintet

On a structural level, both pieces are processive and progressive, but in different ways.[447] *Piano Quintet* conforms to a type of sonata form and so, by virtue of developing the various melodic themes, there is a 'temporal continuum created by a succession [of] events'.[448] Moreover, although it is a post-tonal piece, there is a certain quality of tonal motion with regard to Adès' treatment of the time experienced in the music.[449]

As Kramer describes it, '[t]he temporal form of a tonal piece typically consists of a move towards a point of greatest tension that is usually remote from the tonic, followed by a drive back towards the tonic'.[450] *Piano Quintet* moves towards the tonic key of C major, and its point of greatest tension—rehearsal mark 16—is fraught with harmonic instability. There is a sense of an arc in how Adès organises the experiential time of the piece.

In some sections of the work, there is a strong sense of metric stability produced by the consistent, recurring periodicities, and these are contrasted against sections of metric instability with an abundance of OFTSs or a general breakdown of metrical coherence. Table C.1 details the broad metric and rhythmic progression of *Piano Quintet*.

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[444] Kramer, *The Time of Music*, 2, and 7; Clifton, *Music as Heard*, 81.
[445] Clifton, *Music as Heard*, 81; Kramer, *The Time of Music*, 7.
[446] Kramer, *The Time of Music*, 7.
[447] Kramer refers to the notion of process in music as 'linearity': Kramer, *The Time of Music*, 20.
[448] Kramer, *The Time of Music*, 20.
[449] Service, "Piano Quintet."
[450] Kramer, *The Time of Music*, 25.

Table C.1: Broad metric and rhythmic progression of *Piano Quintet*.

Reh. Mark	OFDs	OFTS %	Notes	Scale
Intro	6	26.667% (4/15)	Only one OFD	2
1	5	27.273% (6/22)	Only one OFD Accompaniment: straight rhythms	4
2	5, 10 6, 12 7, *(14)*	36.207% (21/58)	Multiple OFDs Consecutive proportions/flux between bars Accompaniment: straight rhythms	6
3	**5**, 10 6, 12	56.25% (18/32)	Nested tuplets within OFTSs OFDs in simple proportions No straight rhythms	7
4	5 6 7	67.568% (25/37)	Complex consecutive proportions High level of flux between bars	8
5	5 **6**	41.176% (7/17)	OFDs in simple proportions	5
6	**5** **6** 7	34.483% (10/29)	Moderate level of flux between strings' bars Accompaniment: straight and tuplet rhythms	8
7	**5** **6** 7	34.483% (10/29)	Moderate level of flux between strings' bars Accompaniment: straight and tuplet rhythms	8
8	6 7	11.429% (4/35)	OFDs in simple proportions OFTSs progressively peter out Accompaniment: tuplet rhythms	5
9	6	0.877% (1/114)	Breakdown of metrical coherence Only one OFTS	10
10	10 12	72.727% (8/11)	OFDs in simple proportions	5
11	10	53.125% (17/32)	Only one OFD Accompaniment: tuplet rhythms	7
12a	—	0%	No OFTSs, no straight rhythms	1
Repeat				
12b	5 6	27.273% (6/22)	OFDs in simple proportions	5
13	6, 12	29.412% (5/17)	Composite time signatures of both conventional and OFTSs	6
14	6, 12	62.857% (22/35)	OFDs in simple proportions Accompaniment: grouped OFTSs (tuplet rhythms)	5
15	6 **7** **9**	60% (27/45)	Complex simultaneous and consecutive proportions High level of flux across instrumental parts and between bars Progressive breakdown of metrical coherence	9
16	5 6 7	50.265% (95/189)	Breakdown of metrical coherence	10
17	5 6 7	65.934% (60/91)	Composite time signatures High level of flux between bars	8
18	5	32.468% (25/77)	One composite time signature containing OFD Accompaniment: straight and tuplet rhythms	6

Reh. Mark	OFDs	OFTS %	Notes	Scale
19	–	0%	No OFTS, no straight rhythms	1
20	**5** 6	22.222% (6/27)	Nested tuplets within OFTS OFDs in simple proportions Progresses to no OFTS, no straight rhythms, coordinated *accel*.	7 1
21	–	0%	No OFTSs, no straight rhythms	1
22	5 6	21.053% (4/19)	Initially no OFTSs, no straight rhythms Progresses to OFDs in simple proportions at end	1 5
23	5 6 7	48.485% (16/33)	Complex simultaneous and consecutive proportions High level of flux across instrumental parts and between bars	9
24a	5 6 7	38.095% (16/42)	Complex simultaneous and consecutive proportions High level of flux across instrumental parts and between bars	9
24b	10 *(24)* 7	42.105% (8/19)	Complex composite time signatures and tuplets Progresses to coordination with straight rhythms in final two bars	6 0

The "OFDs" column lists the specific OFDs used in each section. Any OFD bolded and underlined is predominantly used in that section. Any OFD parenthesised and italicised indicates an OFD used solely for the purpose of specifying particular durations of rests or long held notes to realign the metre mathematically; they are not experienced as pulses in their own right. For example, the ***14***-denominator in rehearsal mark 2 is only used as a bar of rest—it does not contain three 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 pulses—and it is used so that the piano's ***2/4*** bar comes back into alignment with the strings after the ***2/6*** bar:

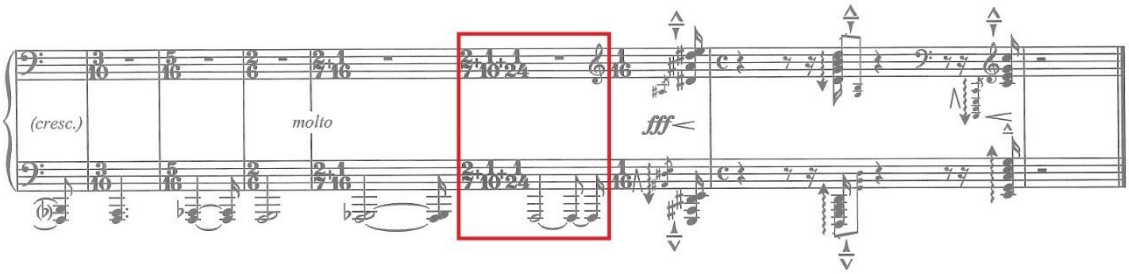
Example C.1: Adès, *Piano Quintet* (page 3), selected parts.[451]

[451] Adès, *Piano Quintet*, 3.

There are three unique OFDs in *Piano Quintet*, and they appear in only one section each. Two of them are parenthesised and italicised in Table C.1: the ***14***-denominator (found towards the beginning of the piece; see Example C.1) and the ***24***-denominator (found at the end of the piece; see Example C.2). The other unique OFD is the ***9***-denominator, the only OFD in the work with two odd factors, and it is predominantly used in rehearsal mark 15, in the Development of the sonata form, just before the climax of rehearsal mark 16 (see the discussion around Examples 5.22 and 5.38-5.42(b) in chapter 5). Rehearsal marks 15 and 16 are addressed later when the 'point of greatest tension' is discussed.

Looking at the "OFDs" column, the variety of OFDs seems mainly concentrated on ♩-based pulse durations, with ***5***-, ***6***-, and ***7***-denominators occurring most frequently. Use of OFDs based on ♪ pulse durations (seen in ***10***- and ***12***-denominators) are generally reserved for the middle of the piece (towards the end of the Exposition and in the Development); the notable exceptions are the ones encountered in rehearsal marks 2 and 3 which are almost exclusively used to delineate bars of rest. Rehearsal mark 2 is peculiar, as it has the most variety of OFDs compared to any other section, and yet that variety is generally not used for signifying pulse durations but bar durations instead. The only OFD based on a 𝅘𝅥𝅯 pulse is found at the end of the piece with the ***24***-denominator, but since it is a tied note, the ^{3}𝅘𝅥𝅯 pulse duration cannot be distinctly felt:

Example C.2: Adès, *Piano Quintet* (page 39), piano line.[452]



The "OFTS %" column in Table C.1 specifies the proportion of OFTS bars in that section, and the numbers in parentheses show how many OFTS bars are found within the total number of bars. To calculate the total number of bars per section, a few rules have been applied. All composite or multiplied time signatures are counted separately (e.g. rehearsal mark 13 has a composite time signature of ***5/12+7/8+1/12*** which is counted as three separate bars; rehearsal mark 14 has a multiplied time signature of

[452] Adès, *Piano Quintet*, 39.

3×5/12, which is also counted as three separate bars). Furthermore, any time the bar lines do not coincide, they are counted as separate bars; this is especially relevant in sections such as rehearsal mark 16, where all the instrumental parts have different bar lines.

The "Scale" column refers to the following scale, which measures the level of metric and rhythmic complexity:

0. No OFTSs
1. No OFTSs and does not contain any straight rhythms (i.e. rhythms are entirely tuplet rhythms)
2. Only one OFD
3. Only one OFD but incorporated into composite time signatures
4. Only one OFD played against accompaniment in straight rhythms
5. OFDs in simple proportions
6. Multiple OFDs in more complex proportions and/or OFDs incorporated into composite time signatures
7. Only one OFD/OFDs in simple proportions but there are nested tuplets in OFTS bars and/or played against accompaniment in tuplet rhythms
8. Moderate-high level of flux between bars: characterised by complex consecutive proportions caused by OFTSs
9. High level of flux across instrumental parts and between bars: characterised by complex simultaneous and consecutive proportions caused by OFTSs
10. Breakdown of metrical coherence

With rehearsal marks 20, 22, and 24b, the metric and rhythmic characteristics progress throughout each section, so a second scale number is given to represent the change. Rehearsal mark 12 is split into 12a and 12b due to the Exposition repeat. Rehearsal mark 24 is split into 24a and 24b according to the double bar lines towards the beginning of page 39 in the score.

There is a change of rhythmic character and treatment of OFTSs in rehearsal mark 24b as the piece rushes to its conclusion: apart from the ***3/7*** bar, none of the OFTSs indicate any tuplet pulses or rhythms. Rather, they are used to delineate particular held note durations in the piano which accompany the straight rhythms in the strings. All the tuplet rhythms are found in conventional time signature bars instead. It is as though

Adès is unravelling the "tupletness" of the piece so that it culminates in two final bars of common time, one articulated, and one not.

Example C.3: Adès, *Piano Quintet* (page 39).[453]

There are two sections that feature the breakdown of metrical coherence (i.e. they rank "10" on the scale in Table C.1): rehearsal marks 9 and 16. Looking at Table C.1, there seems to be a general correlation between the proportion of OFTSs and the complexity of a section: the higher the percentage of OFTSs, the more metrically and rhythmically complex it becomes. However, rehearsal mark 9 is the exception to this, acting as the climax of the Exposition. The breakdown of metrical coherence is ultimately bound up in the ability or inability to project the metre, one of the four categories of experiential

[453] Ibid.

time in music. In rehearsal mark 9, Adès uses conventional methods of cues, metric modulation, and free *accelerando* to achieve incoordination and metric non-projection.

The breakdown of metrical coherence in rehearsal mark 16 (the rhythmic and metric climax of the Development and ultimately the whole piece) is accomplished with the use of OFTSs instead. In the lead up to the 'point of greatest tension', Adès establishes a sense of escalation with the elongating bar lengths in rehearsal mark 14, which build to the momentum generated by the phasing in rehearsal mark 15, before the explosion of complete instrumental rhythmic independence in rehearsal mark 16.

After this point, inter-instrumental coordination returns in rehearsal mark 17 and gradually reverts to the metrical consistency of ***4/4*** from rehearsal mark 19 until almost the very end of the piece. There is a slight sense of a denouement from rehearsal mark 17 until rehearsal mark 20, where a gradual deceleration is featured, resolving of the tensions in musical time explored in rehearsal mark 16, which seems reminiscent of tonal motion and speaks to the overall developmental arc of time in the work.

In this regard, there is arguably a sense of goal-oriented trajectory in *Piano Quintet* where 'the arrival of goals is usually supported by rhythmic and textural means', and thus the music is enabled to feel and act in a diachronic manner.[454] It is noteworthy that rehearsal mark 16 exhibits a range of OFTSs in the string lines, with the denominators fluctuating between ***4***, ***5***, ***6***, and ***7***, to showcase the intricate proportional relationships between the note durations and pulse speeds. The conventional time signature of ***4/4*** is then used to ensure and symbolise temporal stability from rehearsal mark 19 onwards. The goal-oriented trajectory of *Piano Quintet* affects how OFTSs are used to build temporal tension on a large scale.

Mort Subite

Mort Subite is structured in progressive Phases, almost akin to a theme and variation form. Again, by its very nature, each successive Phase builds upon the previous one (i.e. they build upon 'earlier events of the piece') at least in a structural/formal sense with the use of the time signature progressions.[455] Therefore, like *Piano Quintet*, this piece also exhibits a sense of trajectory on a structural level. However, although there is

[454] Kramer uses the term 'goal-directed linearity' instead of 'goal-oriented trajectory': Kramer, *The Time of Music*, 39.
[455] Kramer, *The Time of Music*, 20.

continuity, there is not a strong sense of a particular direction, as 'the goals of this motion are not unequivocal' and 'we do not really know where we are going in each phrase or section until we get there'.[456]

As *Mort Subite* is non-tonal, it runs into a similar problem as *Piano Quintet* where the goals of the piece's trajectory cannot be expressed solely in a pitch or tonal context. However, as *Mort Subite* unfolds, there is also a sense of uncertainty as to its direction; the only element that seems assured is the total length of each Phase remaining the same (akin to a strict theme and variation form).

Everything else pertaining to the continuum of the work's formal structure is called into question, especially with OFTSs being isolated to the clarinet and vibraphone parts. There is a sense that at any moment, Ferneyhough could introduce complexities to the treatment of the rhythms in a given Phase by flipping which instruments are written with OFTSs, or incorporating/alternating OFTSs with conventional time signatures within the same instrumental layer. The developmental jump from Phase V to Phase VI exemplifies this uncertainty and "non-direction".

Furthermore, in the "middleground" (to co-opt the Schenkerian term), another form of continuity is explored: one that is expressed with the potential to branch off into multiple directions, where 'the sense of goal-direction is acute, even if more than one goal is implied and/or more than one route to the goal(s) is suggested'.[457] With each new Phase, Ferneyhough adds another layer of complexity by developing the order of the time signatures. However, there is no one singular way in which Phases I and II should permutate to show that development.

For example, there is a jump in development from Phase I to Phase II in the clarinet line: a new OFD is added, but a truncation–then–elongation pattern is also established with varying numerators. The combination of both changes introduces different bar lengths in the process, and this could imply various transformations. It could result in the same process being imposed on the numerators of the piccolo/piano line, as seen in Phase III where the bar lengths change based on differing time signatures.

[456] Kramer uses the term 'nondirected linearity' to describe this phenomenon: Kramer, *The Time of Music*, 40.
[457] Kramer uses the term 'multiply-directed linearity' to describe this phenomenon: Kramer, *The Time of Music*, 46.

It could also give rise to a reordering of bar durations, as seen in Phase VI where the time signatures have been rearranged. Thirdly, it could transform by imposing the process of differing bar lengths onto differing pulse durations/impulse densities instead, or even using specific tuplets to subvert the OFTSs, as seen in Phases IV and V where tuplets are used in contravention of the metre the OFTSs imply. The fact that there is a trajectory of permutation and an ongoing increase in complexity speaks to the continuity of the musical time in the middleground, but the numerous different avenues of musical development attest to this continuity being 'multiply-directed'.[458]

Mort Subite also displays layers that are non-diachronic on the musical surface. The use of "non-diachronic" can include—but is not limited to—a synchronic notion (i.e. consideration of a piece or passage of music in its entirety and not in succession).[459] For example, consider the act of listening to music compared to reading music. Although audible music can only be experienced through time (and therefore diachronically), '[t]he musical score … does not unfold in time'; thus, the first phrase of a piece can be analysed simultaneously with the last phrase.[460]

This is one of the most significant differences between analysing Adès' music and Ferneyhough's oeuvre. Although, of course, any musical score can be viewed as a whole and analysed that way, the musical continuity of Adès' works encourages an aural realisation of his music in order to be fully appreciated. On the other hand, the layered and intricate construction of Ferneyhough's works invites a visual analysis of the score, because some components of the composition can only be appreciated visually (such as the 4:5 tuplets that counteract the ***5/10*** time signature in the beginning of Phases IV and V).[461]

Non-diachronic ways of representing music allow for elements of time-planning to be observed and understood before they are experienced diachronically. Ferneyhough generally incorporates this as part of his pre-compositional approach. He sets an overall timespan which represents the total duration of a piece or a section, and then implements processes to divide up that timespan.

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[458] Kramer, *The Time of Music*, 46.
[459] Kramer uses the term 'nonlinearity' instead of 'non-diachronic': Kramer, *The Time of Music*, 20.
[460] Kramer, *The Time of Music*, 2; Philip Bohlman, "Musicology as a Political Act," *The Journal of Musicology* 11, no. 4 (1993): 424; Schuiling, "Notation Cultures," 429.
[461] See the discussion around Examples 8.8.2 and 8.9.1 in chapter 8.

The surface-level gestural phrases in *Mort Subite* seem to be self-contained and lack a sense of external trajectory. Without the context of the overall structure of the six Phases, the surface gestural phrases 'are heard more for themselves than for their participation in the progression of the music' upon first hearing.[462] It is only with the benefit of hindsight, through the cumulative listening of the whole work and an analysis of the musical score, that the background continuity of the piece is exposed.[463] As such, the surface layer of the work may be viewed as adhering to a version of moment time (as Kramer defines it: a shallower concept than that of the structural 'moment form' as first espoused by Karlheinz Stockhausen).[464]

Moment time is characterised by extreme non-continuity, when the goals of the music 'cannot be unequivocally implied in an atonal idiom'.[465] On the surface of *Mort Subite*, this seems to be the way the music is experienced. As Kramer describes it, 'even music purely in moment time does have discernible form and… the form comes from the proportions and/or consistencies of the moments'.[466] Although *Mort Subite* isn't in moment *form* (i.e. in a structural sense), this general idea of form—or at least surface-level patterns—arising from proportions is inherent to the use of OFTSs throughout the piece.

With all these layers of experiential musical time at varying degrees of continuity, direction, and diachronicity (or lack thereof), the OFTSs take on multiple roles in *Mort Subite*. They hint at a multitude of ways in which the music can transform and develop, particularly when Ferneyhough starts to decouple the OFTS absolute bar durations from the nested tuplet impulse densities (as seen in Phase IV onwards).

They also enable particular gestural durations in the rhythmic surface of the clarinet/vibraphone line, which then interact in tandem with the piccolo/piano line to create even more complex gestures as the rhythms complement each other (e.g. as seen in all the hocket patterns throughout the work).[467] With each layer of music, OFTSs create various inter-related implications, which are imposed on the organisation and communication of musical time.

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[462] Kramer, *The Time of Music*, 50.
[463] Kramer, *The Time of Music*, 52.
[464] Kramer, *The Time of Music*, 201; Karlheinz Stockhausen, "Momentform," in *Texte zur elektronischen und instrumentalen Musik*, vol. 1 (Cologne: DuMont, 1963), 189-210.
[465] Kramer, *The Time of Music*, 51.
[466] Kramer, *The Time of Music*, 52.
[467] See the discussion around Examples 8.5.3, 8.6.6(a), and 8.9.5 in chapter 8.

Reflecting on both the case study chapters 5 and 8, it is apparent that each composer's approach to using OFTSs is so different that the analytical method required for each composer needed to be tailored accordingly. Ferneyhough's uses of OFTSs must be traced chronologically through *Mort Subite* as they are borne out of pre-compositional processes developed over the course of the work. Conversely, Adès' uses can be categorised and do not require chronologising, as they are more context-driven than dictated by particular pre-compositional processes; therefore, one can observe similar effects play out throughout a work (or several works) in isolated incidents.

Comparison of Instrumentation

This project, alongside my previous honours dissertation, has uncovered five different types of works containing OFTSs:

1. Monophonic solo pieces such as *Superscriptio* in chapter 7;
2. Polyphonic solo pieces such as *Traced Overhead* in chapter 4;
3. Non-conducted chamber works such as *Piano Quintet* in chapter 5;
4. Chamber works with an external timekeeper such as *Mort Subite* in chapter 8; and
5. Conducted orchestral works such as *Totentanz* in chapter 3 of my honours dissertation.[468]

Although *Totentanz* was not particularly addressed in this thesis, the relevant components will be briefly examined here for the sake of completeness. The following observations are generalised and drawn heavily from the aforementioned example pieces.

In monophonic solo pieces such as *Superscriptio*, OFTSs are used to exploit rhythmic proportions within bars (i.e. intra-bar ratios), and tempo and bar durational proportions between bars (i.e. inter-bar ratios). These are seen in successive proportional relationships, such as bar length equivalences and similar bar lengths, and patterns of consecutive truncations and elongations.

Polyphonic solo pieces such as *Traced Overhead* (or any other work which allows for polyphony) introduce the additional consideration of the vertical element. Therefore, OFTSs are also used to exploit proportions that are simultaneous as well as successive,

[468] Wheatley, "Irrational Time Signatures," 51-91.

such as the vertical ratios of Example 4.11 in chapter 4, which dictate particular note groupings and durations.

In non-conducted chamber works that utilise OFTSs, such as *Piano Quintet*, performers are required to contend with the proportionalities not only within their own instrumental line (i.e. intra-instrumental proportionality) but also between all the instrumental parts (i.e. inter-instrumental proportionality, as demonstrated in Example 5.9 of chapter 5). This affects how players coordinate and interact with one another to ultimately contribute to a larger-scale proportionality.

In chamber works that include an external timekeeper, such as the click track in *Mort Subite*, the experiential time of the music is forced to interact with a form of absolute time. OFTSs do not only interact with the subjective and relative experiences of tempo, rhythmic gestures, and bar durations, but they also draw attention to the proportional relationships between what the performer feels in the music and what the performer "knows" from the clock.

Finally, with conducted orchestral works such as *Totentanz*, OFTSs may be used to aid with large-scale instrumental coordination and orchestral unity. As *Totentanz* is the only such work analysed thus far in my research, the scope of observation is somewhat limited. However, Example C.4 demonstrates that Adès uses specific OFTSs such as ***6/6*** to allow the conductor to beat the articulated tuplet rhythms so that the orchestra can maintain unison through particularly difficult changes in tempo (such as the *ritenuto* in the example above).

Changes to instrumentation affect the possibilities of OFTSs to express proportionalities. Each type of instrumentation presents certain challenges and limitations to the efficacy of OFTS use. However, it is apparent that at the heart of all these uses of OFTSs is the ability to express temporal proportional relationships between rhythms, tempi, metre, and instrumentalists.

Example C.4: Adès, *Totentanz* (bars 164-167), selected parts.[469]

Comparison of Composers

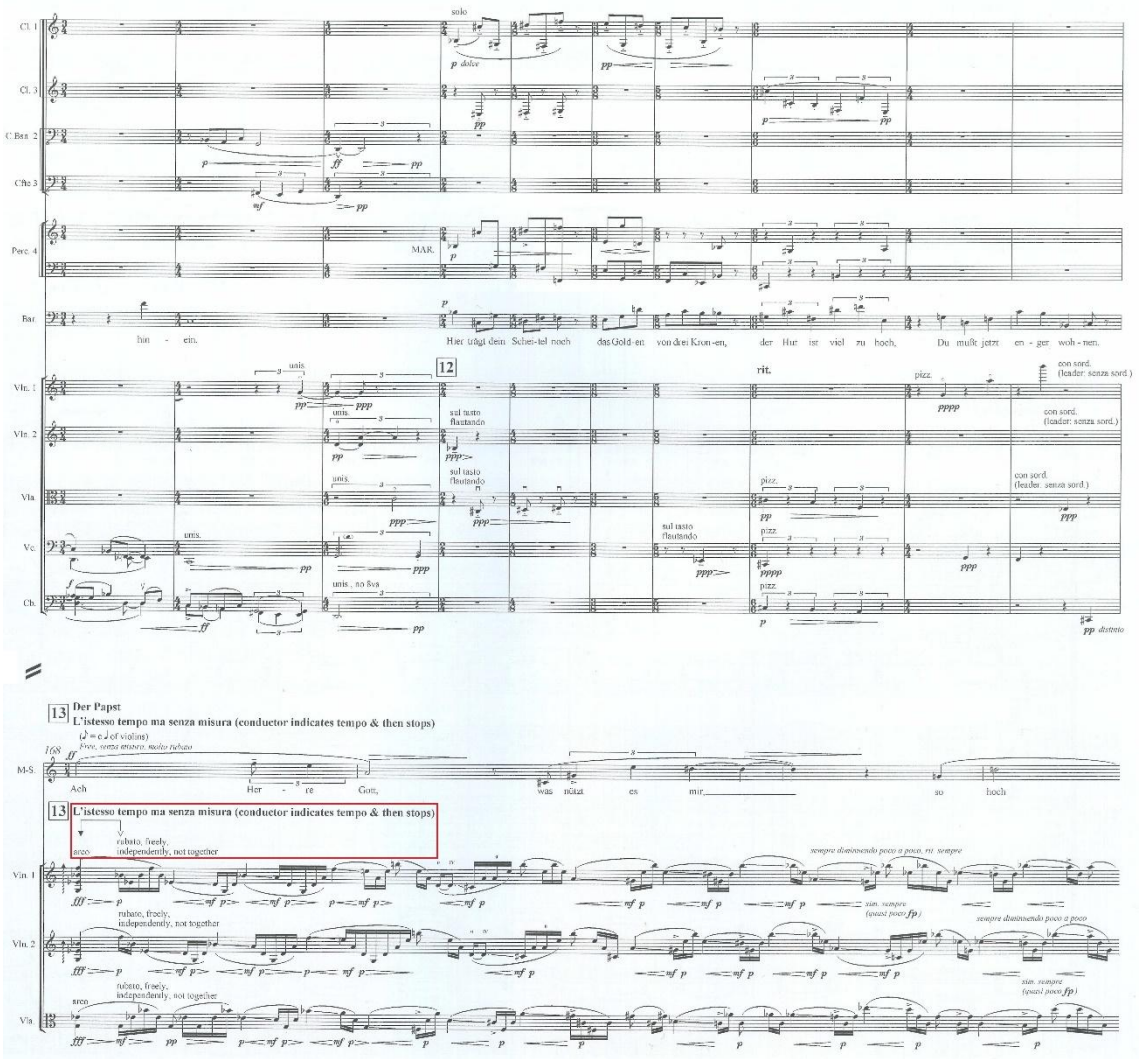
Looking at Adès' and Ferneyhough's treatments of OFTSs overall, several observations may be derived. The sensation of metre in Adès' works is far more apparent than in the majority of Ferneyhough's works. Metre is able to be projected in Adès' works, at least within sections of the music (if not throughout the majority of a piece).

There is trajectory, continuity, and periodicity in his works which result in Adès using OFTSs to alter the regular metric grid by means of rhythmic interjections, truncations and elongations, and precise distortions of pulse speed (through *accelerandi*, *ritardandi*, and rubato).[470] For these sorts of time-related distortions to exist and be felt, metric sensation—or at least metric projection—must be present on some level.

[469] Adès, *Totentanz*, 13.
[470] Roeder, "Co-operating Continuities," 134.

Another example of this from Adès can be seen in *Totentanz*. A strong sensation of metre must first be established before the music metrically devolves in rehearsal mark 13.[471] Despite the changing notated time signatures (see Example C.5), rehearsal mark 12 actually consists of five ***4/4*** bar durations: ***2/4*** + ***4/8***, ***3/8*** + ***5/8***, ***6/6***, and then two bars of ***4/4***. It is likely that the bars in rehearsal mark 12 are notated with these particular time signatures to aid with conducting and orchestral coordination, particularly the ***6/6*** bar.[472]

Example C.5: Adès, *Totentanz* (bars 158-168), selected parts.[473]



This section of *Totentanz* also highlights how Adès accommodates elements of indeterminacy in his treatment of OFTSs, since metre and rhythm are flexible in performance practice (see the red box with the directions 'rubato, freely, independently,

[471] For a more detailed discussion surrounding tumultuous passages in *Totentanz*, see Wheatley, "Irrational Time Signatures," 77-81.
[472] For a more detailed discussion surrounding OFTSs used to aid conducting in *Totentanz*, see Wheatley, "Irrational Time Signatures," 81-85.
[473] Adès, *Totentanz*, 11.

not together'). Musicians learn and understand a hemiola as a 3:2 ratio, but in actual practice, performers may not precisely execute the proportion down to microtiming precision. Even the beats of regular metres are performed with very slightly different durations in performance microtiming—very few performers truly play each duration as strictly as notated.

The same is true for understanding and projecting metre even though the actual microtimings fluctuate with natural rubato, and unmeasured *accelerando* and *ritardando*. The articulated beats and pulses are still part of the periodicity as dictated by the metre and/or time signature even though the intervals between attacks are not precisely, accurately uniform. Therefore, incorporating these indeterminate tempo considerations with the use of OFTSs adds another layer to the complexity of their utilisation in the context of metrical sensation.

Rhythmic interjections and tempo distortions are, by nature, irregularities in the established periodicities. Therefore, Adès goes to great lengths to gradually introduce and contextualise OFTSs in *Piano Quintet* so performers may become familiar with the technique in a measured and didactic manner.[474] Ultimately, Adès seems to use OFTSs as a means to an end: to communicate his time-related ideas as clearly, succinctly, and effectively as possible to the performer.[475] Indeed, his uses of OFTSs generally centre around the performer: how the notation enables the performer to interact with the intended rhythms, 'volatility of tempo', and transitional nature of his music.[476]

Ferneyhough, on the other hand, does not factor metre into his pieces in the relatively conventional way Adès does. His works tend to focus more on bar-length gestural shaping (i.e. using gestures as musical phrases). Generally, there is not really a possibility of long- or even medium-term metrical entrainment, as he obscures almost every timepoint that would allow entrainment to or projection of the metre implied by the notated time signature. This is even more so the case for metrical projection. His music seems to be mostly concerned with a dialogue of phrases and structural patterns as the result of pre-compositional processes.

Due to Ferneyhough's propensity for formalisation and notational maximalism, OFTSs do not seem to be treated as especially unusual. Rather, they are one of many

[474] See the discussion around Example 5.2 in chapter 5.
[475] Adès and Service, *Full of Noises*, 67, 107.
[476] Adès and Service, *Full of Noises*, 75, 107.

tools at his disposal to achieve different bar lengths, periodicities, tempi, and gestural phrases. They add another layer of tupleting and are used to show large-scale proportionalities. In other words, OFTSs are one of the devices of temporal irregularities Ferneyhough uses to distort complex patterns created by mobile juxtapositions of bars on the middleground and even broad structural levels.[477]

Ferneyhough often specifies that the tempi in his works with OFTSs must be strictly adhered to, as the measured proportional changes of speed and duration have been accounted for by the use of OFTSs:

> While the overall tempo of the work may to some extent be regarded as a matter of choice, relationships between the tempi within [bars] must be strictly observed, and metre changes interpreted precisely. Metronome markings always apply to normal quaver values.[478]

Even in some of his pieces that do not contain OFTSs, such as *Transit* (in which he explicitly precluded expressive rubato) or *Time and Motion Study I*, he still requires precision with the performance of his notated rhythms:[479]

> "Tempo primo" is not intended to be interpreted as an invariable quantity: the exact relationships obtaining from section to section where this indication is operative should be regarded as functions of the texture types encountered in context. Within such a section, however, the temptation to deviate from the preselected norm in the name of "expressivity" should be avoided. Particularly in the matter of rests (of whatever length) this rule is meant to be observed rigorously.[480]

Regardless, Ferneyhough's notational maximalism frequently leads to the inclusion of indeterminate elements. This is because the complexity of the score is often so dense that a performer cannot actualise it with perfect accuracy.[481] Even so, Ferneyhough intends the proportionate lengths of the bars to be as precise as possible,

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[477] Ferneyhough, *Superscriptio*, preface.
[478] Brian Ferneyhough, String Quartet No. 3 (London: Edition Peters, 1987), performance notes.
[479] Brian Ferneyhough, *Transit* (London: Edition Peters, 1977), performance notes.
[480] Brian Ferneyhough, *Time and Motion Study I* (London: Edition Peters, 1971-1977), performance notes.
[481] Roger Marsh, "Heroic Motives. Roger Marsh Considers the Relation between Sign and Sound in 'Complex' Music," *The Musical Times* 135, no. 1812 (1994): 84; as cited in Duncan, "The Concept of New Complexity," 32. See also Strizich, "'Double Concerto'," 62; Key, "Pan-Rational," 230-231.

even if the events within those bars are so rhythmically complex that perfect performance accuracy is unachievable.

Even in his most didactic and diachronic works, including those with OFTSs, Ferneyhough still casts the performer and reader into the notational deep end. The complexity of his approach to musical notation may be quite overwhelming on first viewing/hearing, but it is from this complexity that he also invites the reader, analyst, and performer into the music. If Adès' use of notation is a means to an end, Ferneyhough's use centres around the means itself. The complexity seems to compel the invested reader to look deeper, to excite a desire to engage with the score on an analytical level, and to wrestle with the visual intricacies.

In some ways, Ferneyhough notates his music as though the relationship he wants to explore is visual, between an author and a reader; it hearkens back to the notion of synchronic time and taking the score in its entirety, outside the confines of diachronic experience. (This is unlike the aural chain of communication from composer to listener, as with Adès' approach, which requires experiencing the music through time.)[482] Ferneyhough uses OFTSs as another means of complexity to draw conceptual connections and show structural depth, relationships, and patterns resulting from the imposition of pre-compositional limitations and processes.

Adès and Ferneyhough position themselves differently with reference to the timescale. With much of Adès' oeuvre, the music unfolds diachronically and durations are projected ahead. Those projected durations may end up being longer or shorter than expected, and thus there is a sense of a curvature of time being created. Using the metaphor of a "curvature of space", the surface of Adès' music has gravitational impact where the music itself is generating and unfolding the space. Furthermore, all the notational detail Adès includes in his score may potentially be audibly perceptible, as he sets up the relationships in such a way that they could conceivably be heard.[483]

Conversely, Ferneyhough views the total timespan of the work and uses different techniques and mechanisms to divide the timespan, so the music is experienced through

[482] See Cox, "Notes Toward a Performance Practice," 71-74; Smalley, "Some Aspects of the Changing Relationship," 73-75; as cited in Duncan, "The Concept of New Complexity," 21-25. Compare to Redgate, "On Music," 99-100; Ferneyhough, *Collected Writings*, 3; as cited in Duncan, "The Concept of New Complexity," 26-27.
[483] Compare this to Ferneyhough's rhythmic proportions which are typically 'not simple arithmetical ratios': see Toop, "*Lemma-Icon-Epigram*," 81.

multiple simultaneous "filter rates". There is little sense of projected durations. With the overall high density and diversity of forms of accentuation, the boundaries or pulse timepoints of the notated bars (or their durations) are obscured, even though they are the predetermined structural components that are filled with (highly diversified) content.

Again, using the metaphor of a "curvature of space", it is as though Ferneyhough has "pre-curved" the space (i.e. timespan) with his pre-compositional techniques so that the surface of the music is subject to the gravitational fields he has set up in advance. I am grateful to my supervisors Richard Kurth and Elliott Gyger for their contributions to these ideas as discussed in our supervisory meetings.

Also, in relation to Ferneyhough's notational practice, even supposing a perfectly accurate performance of his works is possible, most notational details would not be communicable. For example, the process of erasure towards the end of *Superscriptio* results in the inclusion of more and more grace note gestures, which impede upon the duration of tuplet notes.

Even if the performer perfectly plays the last two pages of the score, they would not be able to actually realise the majority of main tuplet note durations.[484] Furthermore, including procedures such as erasure would not only introduce additional complications in the analysis of Ferneyhough's works, but it would also strengthen the assertion that pieces which include such procedures contain a weak to non-existent conception of metre.[485]

From these differences, it is evident that there will be some effects and uses of OFTSs that are specific to each composer's specific approaches. For example, the seeming notational contradictions and redundancies of Ferneyhough could not result from a stance where the intent is to communicate rhythmic ideas as simply and succinctly as possible the way Adès does; nor could Adès' notational ease of reading result from Ferneyhough's desire for layers of notational complexity.

However, there are two uses of OFTSs both composers share: 1. Using OFTSs as a means of achieving a wide array of bar durations; and 2. Using OFTSs to display

[484] See the discussion around Examples 7.23(b) and 7.24 in chapter 7.
[485] Mirka, *Metric Manipulations*, 93.

proportional relationships, regardless of the musical layer. These shared uses are best addressed by answering our original research questions.

Answering the Research Questions

1. What are the advantages of using OFTSs?

OFTSs can indicate multiple time-related musical parameters simultaneously. However, they do not have a different use in the sense that they are not different from other time signatures in the way they can be deployed. All time signatures indicate absolute bar durations, as the numerator acts as a multiplier of the duration denoted by the denominator. All time signatures may imply metre and periodicity, particularly when the articulation of downbeats and pulses occur with sufficient clarity and regularity; for OFTSs, this is illustrated in rehearsal marks 5, 10, and 15 of *Piano Quintet*.

The key differences of OFTSs are seen in the possibilities they open and the way they are all related to proportionality. They show the possible tuplet rhythms signified by the denominator; therefore, they also make tuplet durations—including incomplete tuplets—easier to comprehend and execute, as seen in the opening of *Piano Quintet*. They also implicitly (and sometimes explicitly) indicate tempo shifts relative to surrounding time signatures, similar to the effect of a metric modulation.

However, OFTSs are also able to subvert or contravene metre, rhythm, tempo, and other time-related parameters as a means of exploring structural complexities and large-scale patterns. Examples of these subversions or contraventions include equivalent bar durations using different time signatures as in *Superscriptio*; tuplet notations that make the time signature redundant as in *Mort Subite*; nested tuplets and constantly changing time signatures that make metrical entrainment and projection extremely difficult if not virtually impossible as seen in the majority of Ferneyhough's works; and OFTSs used to interrupt and distort the regular metric grid as seen in the majority of Adès' works.[486] All these techniques have been employed to indicate inter-bar and large-scale patterns in the music—yet another way to express musical development.

OFTSs also make it possible to communicate proportional relationships (particularly those that are not easily rationalisable) in a succinct, efficient, and effective

[486] Roeder, "Co-operating Continuities," 134.

way. By doing so, they reduce the notational clutter of the score. This proportionality also speaks to a more fundamental preoccupation with relationships both within the music itself as well as within the performance of the music (i.e. the relationships between players, and more specifically the relationship between the composer and performer/reader).

2. What circumstances determine the effectiveness of OFTSs?

With seemingly more straightforward uses of OFTSs such as Adès', effective contexts include instances where there is a direct correlation between the tuplet rhythms/beats of the bar/pulse stream and the OFD. The efficacy of the notation is found in the clear communication of tuplet note durations, such as in Examples 5.1 and 5.3 in chapter 5.

Example C.6: Thomas Adès, *Asyla* (bars 59-66), selected parts.[487]

Furthermore, if the piece has a clear sense of metre—at least in the short- to medium-term, within a section or over several phrases—then OFTSs would be able to

[487] Thomas Adès, *Asyla* (London: Faber Music, 1997), 50.

act as an interruption or distortion of the regular metric grid, as seen in Example C.6, where the regular ***4/4*** metre is interrupted by the ***5/8*** and ***2/6*** bars, which equate to a total duration of ***23/24*** (i.e. a $^{3}\!\!\!\diagup$ short of a normal ***4/4*** bar).[488] Otherwise, they could produce a measured rubato, *accelerando*, or *ritardando*, as seen in Example 5.28 in chapter 5.

If the piece features polymetres and polyrhythms where two or more instruments are playing differing metres, OFTSs are able to produce bar length equivalences and help with inter-instrumental coordination. Along the same vein, OFTSs may also assist with large ensemble contexts; a conductor may be able to clearly communicate points of coordination with intersecting tuplet rhythms.

On the other hand, with pieces featuring seemingly redundant or obscure uses of OFTSs, such as Ferneyhough's, effective contexts may require simultaneous communication of relationships between equivalent or similar bar durations and other inter-bar patterns. For example, in Phases IV and V of *Mort Subite*, the ***5/10*** time signature is required because it is the equivalent bar length of ***4/8*** *and* it is also necessary for the inter-bar truncation pattern transitioning from ***5/10*** to ***4/10***, ***3/10***, ***2/10***, and ***1/10***.

Also, when nested tuplets are required, OFTSs declutter the notation as they account for one layer in the tupleting. This is particularly effective in Adès' pieces, as nested tuplets are rarer in his oeuvre and he generally uses them in a gradually layering effect. Furthermore, OFTSs provide further insight into nested tuplet relationships, as adjacent OFDs may indicate base proportional relationships between the tuplet rhythms. An example that demonstrates both the gradual layering effect and the base proportional relationships between tuplet rhythms is seen in rehearsal mark 3 of *Piano Quintet* where the nested $^{7}\!\!\!\diagup$ notes of the piano are used to show an added layer on top of the universal $^{5}\!\!\!\diagup$ pulses of the strings.

However, the most frequently recurring circumstances that determine effective OFTS use in an enigmatic/obscure sense are those that hint at deep structural implications of pre-compositional limitations and procedures. These contexts contain inter-bar patterns, which require OFTSs to produce unusual or uncommon bar lengths

[488] Roeder, "Co-operating Continuities," 144.

and pulse streams to further develop the musical structure as the piece progresses, as seen throughout *Superscriptio*.

All in all, OFTSs are useful in contexts where different time-related musical parameters are juxtaposed, where the different notations are not easily commensurable within a regular metrical framework.[489] OFTSs lose their notational efficacy in a purely regular metrical context as there are more straightforward traditional ways to notate metric, rhythmic, and tempo relationships in a regular metrical context. As such, OFTSs are not as common in tonal works, though of course, this does not preclude the use of OFTSs in tonal works.[490]

3. In the music that employs OFTSs, how does the metrical notation reflect other aspects of the musical discourse (particularly time-related musical parameters)?

With regard to rhythm, OFTSs indicate the tuplet rhythms expected within the given bar. For example, ***4/12*** implies four $^{3}\!\!\!

downbeat will fall; OFTSs would displace the next bar's accent in relation to the previously established periodicity.

4. Why are OFTSs important in understanding the relationships between time-related musical parameters in a musically innovative context?

As OFTSs simultaneously impact all the aforementioned time-related musical parameters, they broaden the possibilities and potential of how these parameters interrelate with one another. Moreover, they also broaden the conceptualisation of all these parameters. No longer is metre bound to the rigid definition of two or more hierarchically nested pulse streams. With OFTSs, metre has a more fluid conception incorporating elements of rhythm and tempo since regularity and predictability are not as mandatory—nor as commonly found—in non-tonal music compared to tonal music.

Much non-tonal music calls into question the fixed delineations of tonality in the realms of pitch and harmony. It stands to reason that this tendency to challenge—if not to outright dissolve or reject—traditionally held conceptualisations of musical parameters would also extend to time-related parameters and constructs as well. The interconnectivity of relationships explored with the uses of OFTSs presents a microcosm of the shifting treatment of musical elements in a musically innovative context (compared to common-practice tonal music).

5. How do OFTSs help composers and performers grapple with and understand musical time?

OFTSs enable composers to explore and interact with all the different properties of musical time across a comprehensive spectrum of elements. For example, they allow composers to view musical time from multiple perspectives: as defined as duration compared to speed; in the contexts of continuity, direction, projection, diachronicity, and their opposite counterparts; and in pieces with hierarchical formulations of metre compared to pieces that are structurally ametrical.

From all these conceptual dualities and continuums, OFTSs can then facilitate the succinct and clear communication of aspects of time across multiple parameters all at once. Furthermore, this allows composers to choose to position the performer to experience musical time diachronically, discontinuously, or anywhere in between.

For the composer, there is also another way OFTSs help them to grapple with musical time: in the construction of musical time within the structure of a piece. The uses of OFTSs that seem to negate their obvious effects speak to deeper, underlying structural patterns in play. This further challenges the composer to contemplate their pre-compositional approach and compositional methods when incorporating OFTSs into the structure of their music.

With regard to performers, OFTSs enable easier comprehension of the interconnectivity of duration and speed in musical time, and how these relate on the surface, middleground, and structural levels. They can also illuminate the composer's intent. For example, if the surface rhythms align with what is naturally implied by the OFTS, like four triplet quavers being notated in a ***4/12*** bar, then the performer can focus on how the OFTS bar draws out proportional relationships on the foreground or middleground and highlight those relationships in performance. However, if there are seemingly unusual or inexplicable elements on the surface, such as the hanging nested in bar 94 of *Superscriptio*, they may be hinting at deeper structural connections and patterns.[491]

Through this multilayering, OFTSs aid with the execution of these relationships, particularly when other performers are involved. In a chamber ensemble context, the OFTSs can help with inter-instrumental coordination by illuminating equivalent durations, as with the phase durations in *Mort Subite*, or by emphasising shared pulse speeds, as in rehearsal mark 3 of *Piano Quintet*. In a conducted context, OFTSs enable the conductor to coordinate difficult passages and maintain ensemble unity, as seen with *Totentanz*.[492]

Although this was not included in the research question and therefore not studied in detail, we should also briefly address how OFTSs can potentially impact the listener. After reflecting on this in a supervisory meeting as well as after my completion seminar, I have come to realise from my own engagement with the works including OFTSs that I personally cannot aurally discern when OFTSs are used, at least not without the score. This is because I only hear rhythms and note durations that are faster and slower, longer and shorter; I experience an overall feeling of a push and pull in the

[491] See the discussion around Example 7.31(a) in chapter 7.
[492] Wheatley, "Irrational Time Signatures," 81-85.

musical time. I sense the geometry and flexing of the pulse and/or pulse speed, but this could be achieved notationally in a variety of ways.

Ultimately, the effects of OFTSs on the listener will always be filtered through how composers communicate their particular notions and perceptions of musical time to performers through the score, and how the performer digests and comprehends the score will then affect how they prepare for their performance to achieve the sound and realise it. This will then dictate how the listener receives the music, so it seems the effects of OFTSs on the listener are indirect at best.[493]

Limitations of the Study and Avenues of Future Research

When this doctoral project began in 2020, there was an intention to travel overseas to interview both Adès and Ferneyhough, as well as a few performers, theorists, and analysts. Unfortunately, the restrictions imposed during the COVID-19 pandemic interfered with these plans. Avenues of future research would likely benefit from such interviews. As this project was approached from a theoretical and analytical perspective, it would be insightful to compare the analysis with the composers' original intentions as ascertained through interviews and compositional sketches.

The pandemic also greatly restricted access to many scores, particularly the most recent works of both composers. This made it impossible to conduct research on works such as *Concerto for Piano and Orchestra* by Adès, which seems like a spiritual successor to *Piano Quintet* with regard to his treatment of OFTSs.

As this project focused solely on two composers, there is potential for future study to incorporate the works of others. It is likely that there are other uses of OFTSs not employed by either Adès or Ferneyhough, which have therefore not been covered in this thesis. Furthermore, other genres of music, particularly world music not belonging to contemporary/new Western Art music, should be studied with this lens. As suggested by Dylan van der Schyff in my completion seminar, aspects of Flamenco or Konnakol South Indian musics share similar elements with OFTSs.[494]

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[493] See Cox, "Notes Toward a Performance Practice," 71-74; Smalley, "Some Aspects of the Changing Relationship," 73-75; as cited in Duncan, "The Concept of New Complexity," 21-25. Compare to Redgate, "On Music," 99-100; Ferneyhough, *Collected Writings*, 3; as cited in Duncan, "The Concept of New Complexity," 26-27.

[494] Justeen Wheatley, "Justeen Wheatley PhD Completion Seminar: The Uses of Odd-Factored Time Signatures," filmed at The University of Melbourne, YouTube, June 6, 2024, video, 1:34:43, https://youtu.be/b_UykYAwxSo?si=CU4lmvl6XnpN9ma6.

It is also worth exploring how performers perceive and interact with OFTSs on a practical level in informed practice and how this perception impacts their execution of this notational device. Does an "accurate" understanding of the layers of proportionality affect how they perform the notational device, which in turn may affect how the audience receives the music? Can the notational device only be fully appreciated on a visual level? If so, further research and advancements in computer notation software should be pursued, as many of the current systems have very limited capacity in accommodating OFTSs and other rhythmic complexities.

This project generally did not address the perception of OFTSs from the perspective of the listener; therefore, further research is required in this area. Are the layers of proportionality consciously perceived by listeners, or do OFTSs have subconscious, ephemeral effects on the audience? (An example of an ephemeral effect would be OFTSs used as rhythmic interjections: these interjections provide a disjointed feeling, which in turn may unsettle or disturb the listener.) Furthermore, are there any differences between how lay audiences vs musically educated listeners interact with the performance of this notational device?

Potentially one of the most thought-provoking questions for future research would be whether OFTSs are effective in tonal works that adhere to more conventional conceptualisations of metre. I believe this to be one of the most interesting questions to ask because, throughout this project, OFTSs have challenged my own understanding of metre to include far deeper relationships with rhythm, tempo, bar duration, and periodicity than I had previously assumed. If OFTSs broaden the definitions and dilute the delineations between time-related musical parameters in non-tonal music, will they also achieve the same effect in tonal music?

Ultimately, musical time in post-metrical works is conceived and perceived through the interaction of multiple musical parameters, and this is best exemplified through the uses of OFTSs.

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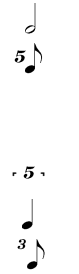
Appendices

Appendix A: Note values of each duration as implied by time signature denominators up to *x/64*.[495]

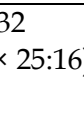
Time Sig.	Denominator Factorisation	Direct Note Value	Ratio	Notation	Indirect Note Value	Ratio	Notation
x/1	1	Semibreve					
x/2	2	Minim					
x/3	3	Triplet minim	3:2				
x/4	2 × 2	Crotchet					
x/5	5	Quintuplet crotchet	5:4				
x/6	2 × 3	Triplet crotchet	6:4 (2 × 3:2)				
x/7	7	Septuplet crotchet	7:4				
x/8	2 × 2 × 2	Quaver					
x/9	3 × 3	Nonuplet quaver	9:8		Triplet minim with nested triplet crotchet	9:4 (3:2 × 3:2)	
x/10	2 × 5	Quintuplet quaver	10:8 (2 × 5:4)				
x/11	11	***11***-tuplet quaver	11:8				
x/12	2 × 2 × 3	Triplet quaver	12:8 (4 × 3:2)				
x/13	13	***13***-tuplet quaver	13:8				
x/14	2 × 7	Septuplet quaver	14:8 (2 × 7:4)				

[495] Prime-numbered tuplets beyond 19-tuplet are not included. Multiples of prime-numbered tuplets beyond 13-tuplet are not included.

Time Sig.	Denominator Factorisation	Direct Note Value	Ratio	Notation	Indirect Note Value	Ratio	Notation
***x*/15**	3 × 5	***15***-tuplet quaver	15:8		Interpretation 1: Triplet minim with nested quintuplet quaver Or Interpretation 2: Quintuplet crotchet with nested triplet quaver	15:8 (3:2 × 5:4) 15:8 (5:4 × 3:2)	
***x*/16**	2 × 2 × 2 × 2	Semiquaver					
***x*/17**	17	***17***-tuplet semiquaver	17:16				
***x*/18**	2 × 3 × 3	Nonuplet semiquaver	18:16 (2 × 9:8)		Triplet crotchet with nested triplet quaver	18:8 (2 × 9:4)	
***x*/19**	19	***19***-tuplet semiquaver	19:16				
***x*/20**	2 × 2 × 5	Quintuplet semiquaver	20:16 (4 × 5:4)				
***x*/21**	3 × 7	***21***-tuplet semiquaver	21:16		Interpretation 1: Triplet minim with nested septuplet quaver Or Interpretation 2: Septuplet crotchet with nested triplet quaver	21:8 (3:2 × 7:4) 21:8 (7:4 × 3:2)	
***x*/22**	2 × 11	***11***-tuplet semiquaver	22:16 (2 × 11:8)				
***x*/24**	2 × 2 × 2 × 3	Triplet semiquaver	24:16 (8 × 3:2)				

Time Sig.	Denominator Factorisation	Direct Note Value	Ratio	Notation	Indirect Note Value	Ratio	Notation
***x*/25**	5 × 5	Quintuplet crotchet with nested quintuplet semiquaver	25:16 (5:4 × 5:4)				
***x*/26**	2 × 13	***13***-tuplet semiquaver	26:16 (2 × 13:8)				
***x*/27**	3 × 3 × 3	***27***-tuplet semiquaver	27:16		Triplet minim with nested triplet crotchet with nested triplet quaver	27:8 (3:2 × 3:2 × 3:2)	
***x*/28**	2 × 2 × 7	Septuplet semiquaver	28:16 (4 × 7:4)				
***x*/30**	2 × 3 × 5	***30***-tuplet semiquaver	30:16		Interpretation 1: Triplet crotchet with nested quintuplet semiquaver Or Interpretation 2: Quintuplet quaver with nested triplet semiquaver	30:16 (2 × 3:2 × 5:4) 30:16 (2 × 5:4 × 3:2)	
***x*/32**	2 × 2 × 2 × 2 × 2	Demisemiquaver					
***x*/33**	3 × 11	***33***-tuplet demisemiquaver	33:32		Interpretation 1: Triplet minim with nested ***11***-tuplet semiquaver Or Interpretation 2: ***11***-tuplet quaver with nested triplet semiquaver	33:16 (3:2 × 11:8) 33:16 (11:8 × 3:2)	

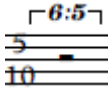
Time Sig.	Denominator Factorisation	Direct Note Value	Ratio	Notation	Indirect Note Value	Ratio	Notation
***x*/36**	2 × 2 × 3 × 3	Nonuplet demisemiquaver	36:32 (4 × 9:8)		Triplet quaver with nested triplet semiquaver	36:16 (4 × 9:4)	
***x*/39**	3 × 13	***39*-tuplet demisemiquaver**	39:32		Interpretation 1: Triplet minim with nested ***13*-tuplet semiquaver** Or Interpretation 2: ***13*-tuplet quaver with nested triplet semiquaver**	39:16 (3:2 × 13:8) 39:16 (13:8 × 3:2)	
***x*/40**	2 × 2 × 2 × 5	Quintuplet demisemiquaver	40:32 (8 × 5:4)				
***x*/42**	2 × 3 × 7	***42*-tuplet demisemiquaver**	42:32 (2 × 21:16)		Interpretation 1: Triplet crotchet with nested septuplet semiquaver Or Interpretation 2: Septuplet quaver with nested triplet semiquaver	42:16 (2 × 3:2 × 7:4) 21:16 (2 × 7:4 × 3:2)	
***x*/44**	2 × 2 × 11	***11*-tuplet demisemiquaver**	44:32 (4 × 11:8)				

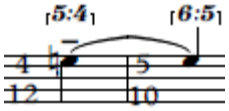
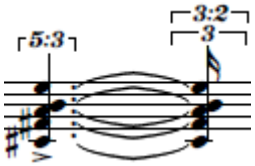
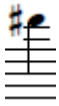
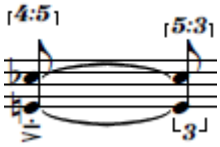
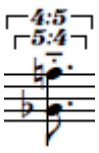
Time Sig.	Denominator Factorisation	Direct Note Value	Ratio	Notation	Indirect Note Value	Ratio	Notation
***x*/45**	3 × 3 × 5	***45***-tuplet demisemiquaver	45:32		Interpretation 1: Triplet minim with nested triplet crotchet with nested quintuplet semiquaver Or Interpretation 2: Triplet minim with nested quintuplet quaver with nested triplet semiquaver Or Interpretation 3: Quintuplet crotchet with nested triplet quaver with nested triplet semiquaver	45:16 (3:2 × 3:2 × 5:4) 45:16 (3:2 × 5:4 × 3:2) 45:16 (5:4 × 3:2 × 3:2)	
***x*/48**	2 × 2 × 2 × 2 × 3	Triplet demisemiquaver	48:32 (16 × 3:2)				
***x*/49**	7 × 7	***49***-tuplet demisemiquaver	49:32		Septuplet crotchet with nested septuplet semiquaver	49:16 (7:4 × 7:4)	
***x*/50**	2 × 5 × 5	Quintuplet quaver with nested quintuplet demisemiquaver	50:32 (2 × 25:16)				
***x*/52**	2 × 2 × 13	***13***-tuplet demisemiquaver	52:32 (4 × 13:8)				

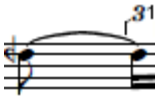
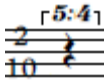
Time Sig.	Denominator Factorisation	Direct Note Value	Ratio	Notation	Indirect Note Value	Ratio	Notation
***x*/54**	2 × 3 × 3 × 3	***54*-tuplet demisemiquaver	54:32 (2 × 27:16)		Triplet crotchet with nested triplet quaver with nested triplet semiquaver	54:16 (2 × 3:2 × 3:2 × 3:2)	
***x*/55**	5 × 11	***55*-tuplet demisemiquaver	55:32		Interpretation 1: Quintuplet crotchet with nested ***11*-tuplet demisemiquaver Or Interpretation 2: ***11*-tuplet quaver with nested quintuplet demisemiquaver	55:32 (5:4 × 11:8) 55:32 (11:8 × 5:4)	
***x*/56**	2 × 2 × 2 × 7	Septuplet demisemiquaver	56:32 (8 × 7:4)				
***x*/60**	2 × 2 × 3 × 5	***60*-tuplet demisemiquaver	60:32		Interpretation 1: Triplet quaver with nested quintuplet demisemiquaver Or Interpretation 2: Quintuplet semiquaver with nested triplet demisemiquaver	60:32 (4 × 3:2 × 5:4) 60:32 (4 × 5:4 × 3:2)	

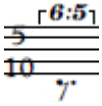
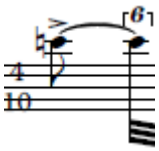
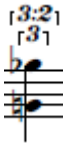
Time Sig.	Denominator Factorisation	Direct Note Value	Ratio	Notation	Indirect Note Value	Ratio	Notation
x/63	3 × 3 × 7	***63***-tuplet demisemiquaver	63:32		Interpretation 1: Triplet minim with nested triplet crotchet with nested septuplet semiquaver Or Interpretation 2: Triplet minim with nested septuplet quaver with nested triplet semiquaver Or Interpretation 3: Septuplet crotchet with nested triplet quaver with nested triplet semiquaver	63:16 (3:2 × 3:2 × 7:4) 63:16 (3:2 × 7:4 × 3:2) 63:16 (7:4 × 3:2 × 3:2)	
x/64	2 × 2 × 2 × 2 × 2 × 2	Hemidemisemiquaver					

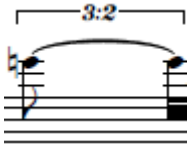
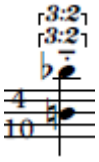
Appendix B: Catalogue of all durational values in descending order, expressed as seconds in fractions and decimal points (♪ = 60).

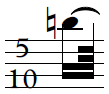
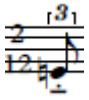
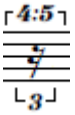
Note	Image	Fractional Duration in Seconds	Decimal Duration in Seconds (rounded to three decimal places)
Minim		4/1	4
Triplet dotted crotchet tied to quintuplet nested in triplet dotted crotchet		18/5	3.6
Quintuplet minim tied to quintuplet dotted hemidemisemiquaver		67/20	3.35
6:5 tuplet nested in quintuplet minim tied to triplet semiquaver		3/1	3
Quintuplet crotchet tied to quintuplet quaver tied to triplet nested in triplet quaver		128/45	$2.8\overline{4}$ (2.844)
Triplet minim		8/3	$2.\overline{6}$ (2.667)
Triplet crotchet tied to quaver tied to triplet semiquaver			
6:5 tuplet nested in quintuplet minim			
Quintuplet crotchet tied to quintuplet nested in triplet crotchet			

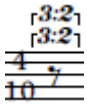
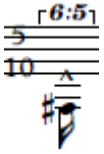
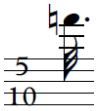
4:5 tuplet crotchet		5/2	2.5
Quintuplet nested in triplet crotchet tied to 6:5 tuplet nested in quintuplet crotchet		12/5	2.4
Triplet dotted crotchet tied to quintuplet nested in quintuplet demisemiquaver		54/25	2.16
5:3 tuplet dotted crotchet tied to triplet nested in triplet semiquaver		91/45	$2.0\overline{2}$ (2.022)
Crotchet		2/1	2
4:5 tuplet nested in quintuplet crotchet			
5:3 tuplet dotted crotchet		9/5	1.8
4:5 quaver tied to triplet nested in 5:3 tuplet quaver		33/20	1.65
Quintuplet crotchet		8/5	1.6
Triplet crotchet tied to triplet demisemiquaver		3/2	1.5
Quaver tied to semiquaver			
Quintuplet nested in 4:5 tuplet dotted quaver			

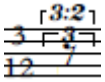
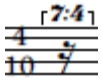
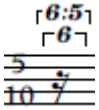
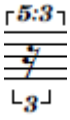
Quintuplet nested in quintuplet semiquaver tied to triplet double dotted quaver		223/150	$1.48\overline{6}$ (1.487)
7:4 tuplet nested in quintuplet dotted crotchet		48/35	$1.\overline{3714285}$ (1.371)
Quaver tied to triplet semiquaver		4/3	$1.\overline{3}$ (1.333)
Triplet crotchet			
Triplet quaver tied to sextuplet nested in quintuplet quaver tied to sextuplet nested in quintuplet demisemiquaver			
Quintuplet nested in quintuplet crotchet		32/25	1.28
4:5 tuplet quaver		5/4	1.25
Quintuplet dotted quaver		6/5	1.2
Quaver tied to triplet demisemiquaver		7/6	$1.1\overline{6}$ (1.167)
Quaver tied to sextuplet demisemiquaver			
Triplet dotted semiquaver and quaver			
Quaver tied to quintuplet nested in quintuplet demisemiquaver		29/25	1.16

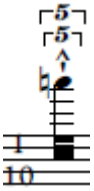
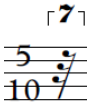
Quaver tied to septuplet demisemiquaver		8/7	$1.\overline{142857}$ (1.143)
4:3 dotted quaver		9/8	1.125
Triplet nested in quintuplet crotchet		16/15	$1.0\overline{6}$ (1.067)
Quaver		1/1	1
4:5 tuplet nested in quintuplet quaver			
Triplet dotted quaver			
6:5 tuplet nested in quintuplet dotted quaver			
Quintuplet quaver tied to sextuplet nested in quintuplet demisemiquaver		14/15	$0.9\overline{3}$ (0.933)
Triplet nested in quintuplet double dotted quaver			
Triplet nested in triplet quaver tied to 7:4 tuplet nested in quintuplet quaver		284/315	$0.\overline{9015873}$ (0.902)
Triplet nested in triplet crotchet		8/9	$0.\overline{8}$ (0.889)
Double dotted semiquaver		7/8	0.875
Sextuplet quaver tied to sextuplet demisemiquaver		5/6	$0.8\overline{3}$ (0.833)
Quintuplet quaver		4/5	0.8

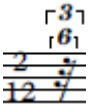
Triplet quaver tied to triplet nested in triplet demisemiquaver		7/9	$0.\overline{7}$ (0.778)
Triplet quaver tied to sextuplet nested in triplet demisemiquaver			
Dotted semiquaver		3/4	0.75
4:5 tuplet nested in quintuplet dotted semiquaver			
Septuplet quaver tied to septuplet demisemiquaver		5/7	$0.\overline{714285}$ (0.714)
Triplet nested in triplet nested in quintuplet crotchet		32/45	$0.7\overline{1}$ (0.711)
Septuplet nested in quintuplet dotted quaver		24/35	$0.\overline{6857142}$ (0.686)
Triplet quaver		2/3	$0.\overline{6}$ (0.667)
Sextuplet quaver			
Sextuplet nested in quintuplet demisemiquaver tied to sextuplet nested in quintuplet quaver			
Semiquaver tied to hemidemisemiquaver		5/8	0.625
Quintuplet dotted semiquaver		3/5	0.6
5:3 tuplet quaver			

Triplet double dotted semiquaver		7/12	$0.\overline{583}$ (0.583)
Septuplet quaver		4/7	$0.\overline{571428}$ (0.571)
Septuplet nested in quintuplet quaver tied to demisemiquaver			
Septuplet nested in triplet dotted quaver			
Quintuplet nested in triplet quaver		8/15	$0.5\overline{3}$ (0.533)
Semiquaver		1/2	0.5
Quintuplet semiquaver tied to quintuplet hemidemisemiquaver			
Triplet dotted semiquaver			
Quintuplet nested in 4:5 tuplet semiquaver			
Quintuplet nested in quintuplet dotted semiquaver		12/25	0.48
Septuplet nested in quintuplet quaver		16/35	$0.\overline{4571428}$ (0.457)
Triplet nested in triplet quaver		4/9	$0.\overline{4}$ (0.444)
Triplet nested in 4:5 tuplet semiquaver		5/12	$0.41\overline{6}$ (0.417)

Quintuplet semiquaver		2/5	0.4
Quintuplet nested in triplet dotted semiquaver			
Septuplet nested in triplet quaver		8/21	$0.\overline{380952}$ (0.381)
4:3 semiquaver		3/8	0.375
11-tuplet nested in 4:5 tuplet nested in quintuplet semiquaver		4/11	$0.\overline{36}$ (0.364)
Triplet nested in triplet nested in quintuplet quaver		16/45	$0.3\overline{5}$ (0.356)
Triplet nested in quintuplet nested in triplet quaver			
Septuplet nested in quintuplet dotted semiquaver		12/35	$0.\overline{3428571}$ (0.343)
Triplet semiquaver		1/3	$0.\overline{3}$ (0.333)
Sextuplet semiquaver			
6:5 tuplet nested in quintuplet semiquaver			
Quintuplet nested in quintuplet semiquaver		8/25	0.32
Quintuplet dotted demisemiquaver		3/10	0.3
5:3 tuplet semiquaver			

Triplet nested in triplet nested in triplet quaver		8/27	$0.\overline{296}$ (0.296)
Triplet double dotted demisemiquaver		7/24	$0.291\overline{6}$ (0.292)
Septuplet semiquaver		8/28	$0.\overline{285714}$ (0.286)
Quintuplet nested in triplet semiquaver		8/30	$0.2\overline{6}$ (0.267)
Demisemiquaver		1/32	0.25
4:5 tuplet nested in quintuplet demisemiquaver			
7:4 tuplet nested in quintuplet semiquaver		8/35	$0.\overline{2285714}$ (0.229)
Triplet nested in triplet semiquaver		2/9	$0.\overline{2}$ (0.222)
Sextuplet nested in 6:5 tuplet nested in quintuplet semiquaver			
Quintuplet demisemiquaver		1/5	0.2
Triplet nested in 5:3 tuplet semiquaver			
Quintuplet nested in quintuplet nested in quintuplet dotted demisemiquaver		24/125	0.192
Triplet nested in quintuplet nested in triplet semiquaver		8/45	$0.1\overline{7}$ (0.178)

Triplet demisemiquaver		1/6	$0.\overline{16}$ (0.167)
Sextuplet demisemiquaver			
Quintuplet nested in quintuplet demisemiquaver		4/25	0.16
Quintuplet dotted hemidemisemiquaver		3/20	0.15
5:3 tuplet demisemiquaver			
Triplet nested in triplet nested in triplet semiquaver		4/27	$0.\overline{148}$ (0.148)
Septuplet demisemiquaver		8/56	$0.\overline{142857}$ (0.143)
Sextuplet nested in quintuplet demisemiquaver		2/15	$0.1\overline{3}$ (0.133)
Quintuplet nested in triplet demisemiquaver			
Quintuplet nested in quintuplet nested in quintuplet demisemiquaver		16/125	0.128
Hemidemisemiquaver		1/8	0.125
Septuplet nested in quintuplet demisemiquaver		4/35	$0.1\overline{142857}$ (0.114)

Triplet nested in triplet demisemiquaver		1/9	$0.\overline{1}$ (0.111)
Sextuplet nested in triplet demisemiquaver			
Quintuplet hemidemisemiquaver		1/10	0.1
Septuplet nested in triplet demisemiquaver		2/21	$0.\overline{095238}$ (0.095)
11-tuplet nested in 4:5 tuplet nested in quintuplet hemidemisemiquaver		1/11	$0.\overline{09}$ (0.091)
Sextuplet nested in quintuplet nested in triplet demisemiquaver		4/45	$0.0\overline{8}$ (0.089)
Triplet hemidemisemiquaver		1/12	$0.08\overline{3}$ (0.083)
Sextuplet nested in triplet nested in triplet demisemiquaver		2/27	$0.\overline{074}$ (0.074)
Quintuplet nested in triplet nested in triplet hemidemisemiquaver		2/45	$0.0\overline{4}$ (0.044)
Triplet quasihemidemisemiquaver		1/24	$0.04\overline{16}$ (0.042)
Sextuplet nested in triplet nested in triplet hemidemisemiquaver		1/27	$0.\overline{037}$ (0.037)

N.B. quintuplet and triplet/sextuplet durational values are expressed on the score with tuplet brackets as well as with the OFDs of ***10*** and ***12*** respectively.

Appendix C: Catalogue of *Mort Subite* score errors in chronological order.

Page	Instrument	Phase	Bar	Beat	Notated Error	Correction
1	Piccolo	3	3 (3/8)	3	Triplet hemidemisemi-quaver (1/64) note	Triplet quasihemi-demisemiquaver (1/128) note
2	Piccolo	6	3 (3/8)	2	Demisemiquaver (1/32) note	Semiquaver (1/16) note
	Pianoforte (LH)		5 (5/8)	2-3	3:2-tuplet semiquaver (1/16) rest	3:2-tuplet quaver (1/8) rest
	Piccolo		6 (3/8)	5	5:3-tuplet dotted quaver (3/16) rest	5:3-tuplet quaver (1/8) rest
	Pianoforte (LH)		7 (2/8)	1-3	No rest	Inclusion of full bar rest
3	Clarinet	2	3 (3/10)	3	Dotted semiquaver (3/32) rest	Semiquaver (1/16) rest
		4	1 (5/10)	3	Nested 11-tuplet dotted demisemiquaver (3/64) rest	Nested 11-tuplet semiquaver (1/16) rest
			6 (1/12)	3	Nested quintuplet demisemiquaver (1/32) rest	Nested quintuplet hemidemisemi-quaver (1/64) rest
4	Clarinet	4	9 (4/12)	4	Nested triplet hemidemisemi-quaver (1/64) note	Nested triplet demisemiquaver (1/32) note
			10 (2/12)	1	Dotted crotchet (3/8) note	Dotted quaver (3/16) note
	Vibraphone			4	Semiquaver (1/16) rest	Demisemiquaver (1/32) rest
		5	1 (5/10)	1	Quaver (1/8) note	Semiquaver (1/16) note
					No 4:5-tuplet bracket	Inclusion of 4:5-tuplet bracket
		6	1 (2/12)	4	Hemidemisemi-quaver (1/64) rest	Demisemiquaver (1/32) rest
	Clarinet		5 (4/12)	1	5:3-tuplet bracket	5:4-tuplet bracket instead
	Vibraphone (lower)		6 (5/10)	1	6:5-tuplet dotted crotchet (3/8) rest	6:5-tuplet dotted quaver (3/16) rest