Quantum Music – Towards a unified aesthetic

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Dedicated to PR and MF

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1. Introduction: Why *Quantum*?

Since 2009, the focus of my compositional output has been on the formalization of a unified aesthetic, what I term *Quantum Music*. This aesthetic adheres to a strict code of practice informed not just by the composers who have influenced it, but also the society from which it has been created. Although the techniques I have used, developed and adapted in this thesis have in some form been employed and invented by other people (both musical and non-musical), the amalgamation of musical and non-musical influences and techniques in the works submitted herein has resulted in an aesthetic approach unique to me that exists in a broader sense within the wide spectrum of modernist practice and discourse and other forms of quantised music.

A fundamental facet of all music that can be termed 'quantum' is the degree to which it is systematized and *quantized*, with the music born out of the desire to abstract the compositional process and its resulting sonic outcomes. This is most obviously achieved through the decoupling of parameters or variables inherent to the writing of a piece of music (such as pitch and dynamics) and organising each on their own terms. Quantum music is therefore a sub-set of the modernist programme, with its musical and artistic antecedents predominantly formed from composers and artists working in the 20^{th} and 21^{st} centuries.

I initially considered the term Quantum Music in late 2008 or early 2009 during my masters degree at the Royal Welsh College of Music and Drama (RWCMD). I had become increasingly dissatisfied with the words used to define current compositional practice, consisting of a plethora of terms that I found contradictory, corporate and/or devoid of any critical slant. Systems thinking was not a preoccupation with the majority of my music college peers, whose compositional output typically involving traditional tonal archetypes, such as the use of key signatures, cadential progressions, ostinati or repetition and traditional forms. The music was therefore typically conservative in nature and only a few of us could be called ‘experimental’ or *avant-garde*. These works were less ‘academic’ in nature, with the uncritical approach to the act of composition allowing sentimentality, received material and emotional content to prevail that were aesthetically unacceptable to me. The ideals of past aesthetic approaches were not the ideals I wanted to adhere to in my own compositional practice although, as will be shown, this is not to say that these approaches are completely removed from my works, with their manifestation in my own output radically different from their historical, pre-20th century roots.

The following chapters are split into two groups: technical analyses of my own compositions, contextualised with texts relating to broader issues that played an integral role in formalising my aesthetic approach. All the content submitted is informed at some level by non-musical sources, with the term *quantum* intended to invoke a scientific approach to the observer. These non-musical sources have shaped my compositional output by pointing to other ways in which music can be modelled and formed by adopting a clinical, emotionally removed and scientific approach to the creation of art objects which explore mathematics and science, capitalism and the market, the visual arts, politics and Utopia.

The opening section, Why *Quantum?*, gives a broad overview of the various non-musical and musical sources that have informed my compositional output since 2009. Chapter Three groups the three 'proto-quantum' works together as these are predominantly based on ideas from science and different in content and modes of production from the works written from 2012 onwards. The series of works with the prefix '*Objects'* are discussed in Chapters Five, Seven, Nine, Eleven, Thirteen, Fifteen and Sixteen, with these works in particular interrogating the core ideals and methods of construction which form the aesthetic foundation on which my 'mature' or most developed and refined musical works are created. Chapters Four, Six, Eight, Ten, Twelve and Fourteen are considerably shorter than the analytical commentaries, punctuating the texts with wider issues relating to the compositional strategies employed in these works by putting them in the context of other art forms as well as issues relating to political or societal factors. The Discography lists only CD releases or recordings, and in the case of Gordon Downie, provides links to recordings on his website. I have not referenced works I have listened to via streaming sites such as YouTube, or in live performances.

Why *Quantum*?

There are several reasons why I refer to my compositional output using the term 'quantum' instead of 'classical'. In scientific terms, quantum evokes the break in the late 19th and 20th centuries from the prevailing orthodoxy of classical physics, with classical physics in a sense updated or superseded by what would eventually be termed quantum physics. Quantum physics explains physics at the smallest scale, atomic and sub-atomic particles, and I saw parallels in the music written by composers such as Brian Ferneyhough in how their music is expressed on the page, often using impulse units of a hemidemisemiquaver and smaller and with maximalist and hyper-specific note outcomes.

Decades before Brian Ferneyhough, and running concurrently with the advances in the sciences briefly mentioned above, modernism was taking root in the arts, with practitioners in all fields of artistic creation developing new methods and ideals of expressivity and aesthetic approaches that marked a pronounced shift in artistic practice in the first two decades of the 20th century. Modernism and the sciences developed rapidly during this period, with the most devastating manifestation of physics, the nuclear bomb, ending World War II and marking the beginning of so-called High Modernism. Specific musical antecedents for the approaches outlined in this thesis are discussed later in this chapter and throughout the thesis. At the core of this thesis are the sonic outcomes of the works composed and the methods of their construction, which are radically different to traditional compositional practice.

Ideologically opposed to many of the tenets of previous musical and societal epochs, quantum music seeks to redefine the sonic landscape by applying an egalitarian and utopian approach to the creation of artworks. The remainder of this chapter will discuss 'Classical' music and how the term is in large part useless, with broader insights into my shifting ideals on market participation, the politics I ascribe to, the influence of the visual arts, and of course science and mathematics.

'Classical' Music

> **Classical.** Term which, applied to mus[ic], has vague rather than specific meaning[1]

Terms assigned to works created today vary depending on the aesthetic stance of the composer, the companies involved in selling the works to the public, the people consuming the works, and media commentary about the works. Just some of the many terms used to describe these works include Classical, Contemporary Classical, New Music and Contemporary Art Music: none of these terms properly described the music I was and am creating. Some, such as Contemporary Classical, seem to me to be contradictory, whilst the term New Music, co-opted by the likes of BBC Radio 1, is now devoid of any real meaning or critical impetus as the hegemony of chart music (and one could argue of most spheres of music composition) makes it demonstrably false. The term Classical is itself problematic as it has several meanings:

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[1] Kennedy, M. (1994) *The Oxford Dictionary of Music*. Second edn. Oxford, UK: Oxford University Press

> … (1) Music composed roughly between 1750 and 1830 (i.e. post-Baroque and pre-Romantic) which covers the development of the classical symphony and concerto. (2) Music of an orderly nature, with qualities of clarity and balance, and emphasising formal beauty rather than emotional expression (which is not to say that emotion is lacking). (3) Music generally regarded as having permanent rather than ephemeral value. (4) 'Classical music' is used as a generic term meaning the opposite of light or popular music.[2]

Only the first of these four definitions is focused, describing the music of a given time period as well as emphasizing aesthetic and technical developments associated with the music. This is useful as one can distinguish between Classical music and works from other time periods (e.g. Baroque or Romantic) based on their salient characteristics and the modes of production of each period. Using this definition, the term Contemporary Classical is an oxymoron and therefore redundant.

The remaining three definitions are so vague that they can be assigned to music from any period and to certain genres and sub-genres of Pop music[3]. Definition (2), for example, could be used to describe the Tool song 'Lateralus' (from the album of the same name) as it is constructed using Fibonacci principles, providing a framework from which the elements and sections of the song can be ordered, both globally and locally. The lyrical phrasing and syllables in the first verse points to these underlying constructive devices:

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[2] Ibid.

[3] This is Pop music in the broadest sense, including Metal, Rock, Dance (etc.), and their sub-genres.

Black

then

white are

all I see

in my in-fan-cy

red and yel-low then came to be

rea-ching out to me.

lets me see.

The numbers of syllables in each of these lines and phrases are Fibonacci numbers: 1,1,2,3,5,8,5,3. Other examples of the use of the Fibonacci series can be found in the 34-bar introduction and the chorus, where three-bar phrases in which the order of time signatures is 9/8, 8/8, 7/8 (the denominators of these time signatures spelling out the Fibonacci number 987). Given these examples, and the global proportions being roughly that of the golden ratio[4], it would be perfectly valid to describe this song as 'classical', since it adheres to the second definition above.

Using the third definition, one could argue that the body of work produced by the Beatles has a 'permanent rather than ephemeral value' as they have directly or

[4] The final section of the song begins at 06:41, with the song having a total duration of 09:24. In seconds these are 401 and 564 respectively, giving a ratio of 0.711 (the Golden Ratio being 0.618). This deviation from a pure Fibonacci structure is explained in the chorus lyrics '*Over thinking, over analyzing separates the body from the mind.*'

indirectly influenced every band or solo artist since, and their development of the song form (in the Pop sense) and aesthetic trajectories in general gives their music a permanent value. They are the blueprint of what a band should aspire to be: ever evolving, influential and relevant to future generations. By the third definition, the Beatles are classical. The final definition, 'the opposite of light or popular music', can be assigned to music from a plethora of fields, for example avant-garde jazz music.

Of course, no right-thinking person would describe these examples as 'classical' and one would never find these artists in the Classical section of a record shop. The vagueness of definitions 2, 3 and 4 allows the term 'classical' to be exploited by corporations which sell this music and by media outlets such as Classic FM, who exacerbate the problem with programmes like 'Smooth Classics at Seven'[5].

Through its commodification, the term Classical Music has lost its critical function as it is now an umbrella term describing all music in the canon of Western art music. Because the vagueness of the term 'classical' has played a part in the proliferation of the market forces of the culture industry infecting and affecting the impulses and forces behind the creation of art objects, I concluded that my works should strive to negate easy consumption and point towards a more egalitarian and democratic whole. For this to be achieved, these notions and ideas must permeate the entire fabric of the

[5] Classicfmcom. (2019). Smooth Classics at Seven. Retrieved 4 March, 2019, from https://www.classicfm.com/radio/shows-presenters/smooth-classics-seven/

work. This is not to say that one should write music for free (one still needs to survive in our current capitalist society) but that the artist should strive to negate vulture-like market forces by creating art objects that are inherently problematic to consume and realize, thus forcing the consumers to be less passive in their interaction with the art objects in question, and more broadly speaking art in general.

Politics

I had for a long time naively found the notion of selling one's compositional output as somehow wrong because I viewed the market or capitalist enterprise as something inherently bad. Beginning around the time of the economic crash of 2007/08 and the ideologically imposed austerity that followed, my political reasoning was imbued with an anti-capitalist, far-Left and social justice slant. However, incidents by leftist activists on American university campuses such as Evergreen over recent years have made me question the approach, reasoning and underlying ideology of the activists involved and by virtue of a loose association, my own.[6] What is perhaps most important for a composer (or anyone involved in a creative activity) is the freedom to express one's artistic vision, which is related to the notion of freedom of speech. It is evident to me that activists and the far-Left have an issue with free speech, with the

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[6] Youtubecom. (2017). Campus Argument Goes Viral As Evergreen State Is Caught In Racial Turmoil (HBO). Retrieved 4 March, 2019, from https://www.youtube.com/watch?v=2cMYfxOFBBM

deplatforming and loud protesting of speakers on university campuses with different views to their own becoming ever more commonplace. There is no desire to engage respectfully with people with opposing views; instead a viewpoint may be denounced because the speaker is prejudicially viewed as having 'white privilege' or being inherently racist (or not) because of their skin colour, with the meaning of racism now redefined by leftists from the perspective of perceived or real historic inequities regarding power relations between the people involved. It is for me very troubling that the left of the political spectrum are acting in this way because using tactics that are regressive and discriminatory in nature, as well as being potentially dictatorial in their desired outcomes, will not win the moral or political high ground.

Freedom of speech and expression is one of the core tenets of Western civilization, granting to those in the West the capacity to speak truth to those in power unhindered by the societal position of the person using this right. We can deduce from history that a society that limits speech is more than likely to become extremely regressive, violent and dictatorial in nature. It is therefore paramount to be alert and fight back against infringements on our rights to freedom of speech and expression because, unchecked, these infringements will lead to societal decline or collapse.

This concerted attempt to restrict freedom of speech has become evident in wider society and not just university campuses. This is even happening in Great Britain, one of the key nations concerned with conceptualizing and implementing the rights of the individual and freedom of speech and expression informed through texts such as *On Liberty* by John Stuart Mill. Mark Meechan, who posts videos online under the name

‘Count Dankula’, was recently fined £800 by a court in Scotland for ‘record[ing] his girlfriend’s pug, Buddha, responding to statements such as ‘Sieg Heil’ by raising his paw.’[7] Even though the judge didn’t think so, context is everything here. ‘[T]he juxtaposition of having an adorable animal reacting to something vulgar’[8] is the premise of the joke, not the perceived outcome of it being ‘grossly offensive… menacing, anti-Semitic and racist [in nature.]’[9] The ability to cause offence is completely subjective given that we are a society of individuals, each with their own viewpoints and degrees of emotional fragility or strength. We can not have the right to not be offended because, in order for there to be any meaningful discussion of opposing views regarding important issues, one must accept the risk of having one’s views or sentiments challenged, in order for a better truth or mode of practice to be formulated.

Although I agree up to a point with activist or Marxist Left views on the machinations of capitalism and the detrimental effects it can have on society, the 2007/2008 crash and its criminal players being the most recent example, we differ on the methods for tackling the issues inherent to the capitalist system (specifically neoliberalism). This has reached a new zenith of idiocy in The United States with the Green New Deal proposed by the likes of Rep. Alexandria Ocasio-Cortez, which plans to make the United States carbon neutral in ten years as well as a list of other unachievable

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[7] Bbccouk. (2018). Man fined for hate crime after filming pug's 'Nazi salutes'. Retrieved 4 March, 2019, from https://www.bbc.co.uk/news/uk-scotland-glasgow-west-43864133
[8] Ibid.

[9] Ibid.

goals.[10] I actually agree with the list of goals stated in the referenced article: for example, providing free higher education is a goal civilized society should aim for because an informed population can make better choices. But aiming to achieve these proposed goals within a decade is unrealistic and likely to fail, or at least fall short, potentially discrediting these commendable goals through ineffective execution. And there is of course the problem of who is going to pay for it.

Market forces

I feel my past opinions on the artist in the context of the market or as part of a capitalist enterprise were unrefined because they did not take into account the realities of existing in our current age. I initially thought that creating art for no monetary gain was the aim of the artist in order for one to be unbound by what I perceived as the evils of capitalism, such as businesses that are too big to fail, thus negating the very notion of a so-called 'free market'. This is of course not true of all businesses and although I believe there is some merit in writing music for no monetary gain composers still need to pay the bills like everybody else. Given the alternative of enslavement by faceless corporations as an unthinking automaton driving the desires of consumerism, it is far more productive to receive a monetary reward through one's

10 Theguardiancom. (2019). Holden, E. What is the Green New Deal and how would it benefit society?. Retrieved 4 March, 2019, from https://www.theguardian.com/us-news/2019/feb/11/green-new-deal-alexandria-ocasio-cortez-ed-markey

art than to be perfunctorily employed and give away one's art for free. Profit-seeking corporations in large part do not care about us or our current circumstances, their goal being to accrue greater levels of capital and influence in and across the market. However, the music industry in particular has been democratized to a large degree in recent years, giving composers and performers various means by which to monetize their output on their own terms without the need for third-party exploitation. For the composer, two potential revenue streams are the printed score and live/recorded performances, as well as funding organisations such as the Arts Council or private benefactors. But in order to engage in market activities and still hold a semblance of integrity, one needs to be hyper-critical of the money one receives, how it has been accrued, and the motivations behind the entities funding the activity.

The score in the digital age exists as a pdf that can be sent to any location in the world in seconds. However, this poses a problem for the composer, as the payment one would normally receive from a publisher from the sale of your scores is no longer accrued from a shared pdf. Aaron Cassidy appears to have squared this circle, detailing in a blog on his website an approach incorporating an e-commerce platform 'which automates pdf downloads and makes maintaining an inventory for bound/physical scores much easier.'[11] I can see a lot of potential in this approach because it circumvents the need for third party involvement and their inevitable fees. Cassidy's is, I believe, a well-reasoned approach that gives complete control and personal autonomy to the producer of the scores, and his blog touches on several

[11] Aaroncassidycom. (2017). A few thoughts on self-publishing. Retrieved 4 March, 2019, from http://aaroncassidy.com/a-few-thoughts-on-self-publishing/

aspects regarding the sale of music in the digital age and the changes in attitudes towards paying for this material.

'[N]ew small-scale digital economies have stepped in to fill the gap left by the implosion of some of the traditional institutional distribution services (witness, for example, the emergence of something like Bandcamp)'[12] is a pertinent point here, as these services have democratized the distribution and sale of recorded music. The digitization of music in conjunction with websites like Bandcamp, iTunes and Soundcloud have revolutionized the music industry, giving greater access and a means by which to release one's music. Bandcamp gives full artistic control to the artist, allowing one to release whatever one desires, at a price set by the producer of the work. It is also another example of circumventing third parties, with a record label no longer a prerequisite to the release of an album. It has allowed an artist like Buckethead to release 275 albums since 2011[13]; a feat no record company would undertake given the additional costs accrued in producing physical copies for each release, as well as marketing and advertising fees. This is where websites like Bandcamp, coupled with a reduction in the cost of recording music, have empowered performing artists and composers to engage with the market on their own terms and without the need for predatory third-party interference.

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[12] Ibid.

[13] Bucketheadpikescom. (2019). Bucketheadland. Retrieved 4 March, 2019, from https://music.bucketheadpikes.com

The artist therefore must create and embody their own means of production, so that the only forces present are those of the artist. When they owned the sole means of production, 'middle-men' and record company executives were able to determine the trajectory of recorded music by releasing the music they deem to be most saleable and easy to consume. This created large corporate profits but stifled creativity by homogenizing artistic output. Straying from this corporate vision is therefore a political act of defiance against the consumerist mindset. Of course, there are artists who have overcome these barriers but they are in the minority. The pop charts present a clear example of how the machinations of the record industry, or capitalism itself, can manipulate the creative output of artists and, by extension, the music world in general.

With the reduction in record sales for most artists, and fewer artists getting the so-called ‘big record deals’ that were common in the past, the recording artist/composer/musician is required to forge other revenue streams that are not always related specifically to music. Pop music has always coupled artist and corporation for advertising purposes although it used to be frowned upon to ‘sell out’ and accept corporate backing. Now this is actively undertaken by almost all pop musicians and most TV advert breaks feature either a song by a famous artist or the use of their image to sell a product, the worst offenders being those who need it the least, artists like Beyoncé or Elton John.

Corporate creep seems to be an unstoppable force within popular music, be it the artist as the face of a clothing brand or the corporate sponsorship of music festivals.

Corporations use artists to increase their profit margins and launder their corporate ideology, providing soft-power through the accrual of cultural and symbolic capital. This extends throughout the arts in general, with corporate sponsorship infecting all fields, such as the marriage of the Tate Modern and BP, or the Costa Book Awards. But has the world of art music and so-called 'high art' been affected by corporate and capitalist interests? I will show that performers, composers and institutions involved in the production, performance and broadcasting of music have all been affected in similar ways.

Sponsorship from wealthy benefactors is not new in music. The act of being a patron of the arts has a long history, inherently linked to the controlling forces of a given era. Whoever held the power of a given time period patronized the arts to flaunt their wealth and power and had the final say as to what was produced, how it should sound and/or look and who would be the producers of the art. An 'underground' of artists may have existed, an *avant-garde* producing work outside official channels to challenge or critique the status quo, but those artists with the greatest public attention were those that created works for the elite to consume, whether the elite was a religious institution, the Monarchy, politicians, or, as it is today, corporations.

This is not to say that the wealthy do not bequeath monies to *avant-garde* art; the Swiss conductor Paul Sacher commissioned several works from leading composers throughout the 20th century. In 1934 Sacher 'married sculptor Maja Sacher-Stehlin, the young widow of Emanuel Hoffmann, heir to the chemical concern Hoffmann-La

Roche.'[14]

> Through his marriage, Mr Sacher eventually came to control a majority of the voting shares of Roche Holding—a stake that was at the core of a fortune estimated at between $17 billion and $20 billion which catapulted him into the ranks of the world's ten richest people. He never permitted his musical career to eclipse his corporate responsibilities. For almost 60 years, from 1938 until his retirement in 1996, Mr Sacher was an active member of the board of Roche and so only too aware of the controversies that seemed constantly to dog the profitable pharmaceutical group.[15]

The article goes on to list the company's criminal activities, which range from the 'relentless pursuit of a whistle-blower' to their involvement 'in a global price-setting cartel on vitamins.' When one is receiving patronage from the benefactors of a corporation's profits, one needs to be wary of the company's business practices and ethics in order to avoid enabling these enterprises further.

Patronage is not solely directed towards composers through commission fees but is prevalent at the institutional level as well. In his article *Philanthrocapitalist manifesto*, Gordon Downie delineates in great detail the methods by which symphony orchestras and other arts institutions receive extra funds from the philanthropy of

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[14] Upicom. (1999). UPI Archives. Retrieved 4 March, 2019, from https://www.upi.com/Archives/1999/05/27/Wealthy-arts-patron-Paul-Sacher-dies/3199927777600/

[15] Economistcom. (1999). Paul Sacher - Obituary. Retrieved 4 March, 2019, from https://www.economist.com/obituary/1999/06/03/paul-sacher

wealthy donors and how that affects the compositional output of the composers engaged with the institution, such as Judith Weir or the then composer-in-residence at the New York Philharmonic (NYP), Magnus Lindberg.[16] This corporate/composer partnership with the NYP is dressed up as a 'commitment and dedication to the "music of our time"', but 'is in name only…merely part of a wider marketing, branding and promotional strategy.'[17]

As was the case with Pop music, art music also has practitioners that feel the need to use their image and/or music for the purposes of advertising. Eric Whitacre was 'named a TUMI Global citizen…as part of the TUMI Spring 2014 collection.'[18], Esa-Pekka Salonen was the star of, and his music appeared in, an Apple iPad advert[19], and Myleen Klass has her own Littlewoods swimwear range.[20]

Whilst BBC Radio 3, paid for through the BBC licence fee and not through advertising, is the preeminent and most respected radio station for art music in Britain, Classic FM which is owned and controlled by the Jersey-based Global Radio Group Ltd., actively courts corporate sponsorship through advertising. Classic FM's

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16 Weeklyworkercouk. (2011). Downie, G - Philanthrocapitalist manifesto. Retrieved4 March, 2019, from https://weeklyworker.co.uk/worker/852/philanthrocapitalist-manifesto/

17 Ibid.

18 Ericwhitacrecom. (2014). Eric Whitacre becomes Tumi global citizen. Retrieved 4 March, 2019, from https://ericwhitacre.com/news/eric-named-tumi-global-citizen

19 Youtubecom. (2014). Composer/conductor Esa-Pekka's Verse Orchestrating for iPad #Apple. Retrieved 4 March, 2019, from https://www.youtube.com/watch?v=c-sNjcAIkpY

20 Youtubecom. (2013). Myleene Klass Swimwear Collection. Retrieved 4 March, 2019, from https://www.youtube.com/watch?v=wClSsRbNUi4

Advertise with us section on its website, states 'Classic FM's groundbreaking vision was to build not simply a radio station, but a powerful brand in its own right.'[21] As Classic FM's 'aim is to provide world class commercial activity in all that it does', its output and musical ethos is not to enable critical thought but to:

> provide audiences with a much-needed oasis on the UK radio dial – a tranquil, calm space where listeners can relax and unwind. The station plays familiar classical music alongside less known pieces, all chosen to uplift or soothe: simply put, it's the perfect antidote to life in the 21st century.[22]

With corporate paymasters to please, Classic FM is firmly rooted in the need for music to be an aid to relaxation and escapism or to invoke certain moods.[23] Like all good capitalist entities, the need to perpetually increase profit margins and market control is a driving force behind all its activities. The not-for-profit organization Corporate Watch found that Global Radio Group Ltd. (which owns other radio stations as well as Classic FM) paid no UK tax 'after sending more than £200 million through tax havens.'[24] Corporate Watch 'found that huge interest payments on loans it has taken from its owners through the Channel Islands Stock Exchange have wiped

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[21] Classicfmcom. (2019). Advertise with us. Retrieved 4 March, 2019, from https://www.classicfm.com/contact/advertise-with-us/

[22] Ibid.

[23] Classicfmcom. (2019). Mood - Discover Music. Retrieved 4 March, 2019, from https://www.classicfm.com/discover-music/mood/

[24] Corporatewatchorg. (2013). Capital and Heart Radio owners pay no UK tax after sending millions offshore. Retrieved 4 March, 2019, from https://corporatewatch.org/classic-fm-capital-and-heart-radio-owners-pay-no-uk-tax-after-sending-millions-offshore/

out its taxable profits in the UK.'[25]

Corporate creep has infected all artistic mediums and is unlikely to be held back any time soon. Successive governments on both sides of the political spectrum have enabled this takeover of the arts by allowing corporations to launder their corporate ideologies through the arts. To avoid being tarnished by association, the artist is required to research which companies or persons are funding their work, for example in commission fees or prize money. To retain any sense of artistic integrity one needs to push back and challenge the corporate mindset.

Utopia: The dialectic between the individual and the group

For me the act of composition is not inherently individualistic in nature, with the sole creator forming and constructing works according to their own means of expression. Although one exists as part of various sub-sets of society (one's family, friends, colleagues, sex, race, class, gender etc.), I feel a focus on the freedom of the individual to pursue whatever peaceful activity they desire is paramount to achieving a more egalitarian society for all. Oscar Wilde saw the importance of the individual in *The Soul of Man*, although his predictions that '[u]nder Socialism… [t]here will be no people living in fetid dens and fetid rage, and bringing up unhealthy, hunger-pinched children in the midst of impossible and absolutely repulsive surroundings'[26] has been

[25] Ibid.

[26] Wilde, O. (1990). *The Soul of Man and Prison Writings*. Oxford: Oxford University Press, p.2

demonstrably proved wrong when one looks at former and current socialist or communist states such as Venezuela or Russia. Wilde goes on to state that 'Socialism itself will be of value simply because it will lead to Individualism'[27], although this could in a sense be inverted, where Individualism would lead to and form of Socialism; when every individual is maximally free, everybody will be maximally free to do as they please within the constraints of (good) law.

Utopian (or dystopian) constructs portrayed through literature, be that *Animal Farm* by George Orwell or the Culture series of Iain M. Banks, are universally orientated towards the interactions between the individual and the group, with this dialectic found in all of the works I have written for this thesis. The tyranny of the individual and of the group are two sides of the same coin, with the unchecked power of either over the other being the worst possible outcome. It is these barriers to utopia, either actualised or theoretical, that I find most intriguing in relation to the construction of artworks.

The most evident of the utopian constructs in my works is the use of time signatures, with Chapter Two explaining the mechanics of each work's construction in order to show the egalitarian and heterarchical constructs that form the foundations on which the work as a utopian object can be situated. However, as the work is further conceptualized and the formalization of systematic devices is completed, the final work actively pushes against this utopian construct, imposing technical and logistical

[27] Ibid.

barriers on the performers by problematizing the execution of its internal objects, typically through the hyper-specification of impulse outcomes and the high level of abstraction.

Although, as I have mentioned, I disagree with several of the activist Left's policies and critical reasoning, as well as the methods of resistance enacted by violent groups such as Antifa, I share in principle (but not design) the desire for a more equal and egalitarian society and it is one of the fundamental tenets of the compositional approach that is the focus of this thesis, with parameters such as time signature or pitch-class content mediated in such a way as to promote a heterarchical framework in and from which the work is created and exists. This is why serial techniques, and systems-thinking in general, are key to creating works of this nature: they provide the composer with a wealth of techniques, processes and methods of construction realization that can provide a cohesive underlying methodology to a work's construction. This I believe stems from the early application and general understanding of what is known as the twelve-tone or dodecaphonic technique, where all pitch classes are equal to all others, uprooting Western art music from its traditional melodic and harmonic foundations.

It is not hyperbolic for me to state that serial techniques played a key role in radicalising me politically when I was younger. With each pitch class being equal to all others, serialism has the potential to be a fundamentally egalitarian method of construction: it 'is a tendency that *rejects hierarchical modes* of operation *in favour of heterarchical modes* of operation. It is thus a tendency that emphasizes equivalence or equality between the constituent parts of an art object.'[28] The universal application of these modes of production across all object strata[29] results in equality permeating the entire fabric of the work. Given our current sociopolitical and economic climate, where successive governments since Margaret Thatcher's have played a role in subjugating the working class (for example, through the weakening of unions, the demonization of those receiving unemployment benefits and income inequality), to create art that actively pushes against this mindset is for me the only valid aesthetic position an artist can take today.

Unashamedly utopian in conception and construction, my compositional output since 2009 has been formed in the wake of the economic crash of 2007/8 and the resulting state-backed bailouts of those deemed 'too big to fail'. One might smile at the irony here if the burden for propping up the so-called 'free market' was not disproportionally funded by those who played no part in bringing the world to its knees. Unlike the wealthiest in society, the working and lower middle classes do not have the capital reserves adequate to pay for the costs of corporate incompetence and criminality, so the Conservative governments since 2010 have attempted to recoup the costs through an aggressive agenda of austerity, cutting public services under the guise of 'efficiency savings', achieved through reducing staffing and funding levels, limiting pay increases to 1%, and increasing privatization. This mentality is not just present in the Conservative Party by also in the Labour Party as well, with the

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[28] Kennethwoodsnet. (2008). Interview with Gordon Downie – Part one. Retrieved 4 March 2019, from http://kennethwoods.net/blog1/2008/03/05/gordon-downie-interview-part-one-forms-7/

[29] See Chapter Eight for the delineation of object strata

remnants of New Labour still present to some degree in the Parliamentary Labour Party today.

To adhere to an aesthetic approach that does not comply to these standards, instead approaching the creative act in a manner that enables egalitarianism to permeate the entire work, strategies need to be implemented that can be employed at all object strata. The utopian approach that is present in all my works is predicated on two assumptions: first, that attempting to reach Utopia is a worthwhile pursuit; and second, that as part of a capitalist consumerist society, it is highly unlikely to be achieved.

In the analytical texts of my compositions since 2009 there is a focus on how the works are constructed and the equal or relatively equal distribution of instrumental forces and material content within them. The complexity and near-impossibility (in relation to society's current state) of the effective formation and management of a utopia are key to understanding some of the reasons why the music I write is inherently difficult to realize. Just like the sociopolitical and economic forces that are hindering our arrival at Utopia, the levels of virtuosity and technical sophistication required from performers attempting my works, as well as the inherent difficulties that problematize the act of performance (notational detail, tuplet tiling and superimposition, high levels of abstraction and non-linearity, etc.), are all built into the work at a fundamental level, thus making any perfect rendering of it nearing impossible. The works are therefore in a constant state of flux and although they exhibit high degrees of structural and notational specificity and rigidity, the manner in which the constituent parts of each work are realized in performance results in a broken and fragile aesthetic, with the works becoming ever more crystalline and fragmented in my most recent works (*Objects 4-7*).

Systems thinking, cold abstraction and the visual arts

The proliferation of systems thinking in 20^{th} century art music has provided the composer with a means by which to reduce the encroachment of ingrained personal views, choice or emotional whim. This is not to say that the composer has no influence over the outcome of the work in question, rather that a large proportion of the tasks required for the construction of a piece of music can be preprogrammed or realized by making significantly fewer decisions, in a sense automating the various assignment tasks through a common technique or collection of techniques. The act of streamlining the compositional process in this way is one of the principal tasks of the works in the *Objects* series, and stems from finding strategies that would enable a cohesive and unifying system for the hyper-segmentation and specification of the compositional process.

This deliberately 'cold' or 'clinical' approach to the compositional process is in part a result of background research into mathematical and scientific advances at the end of the 19^{th} century and throughout the 20^{th} century, the results of which have given us even greater resistance to our only real oppressor, nature. With a desire to abstract the compositional process to something more akin to the scientific method, the musical objects that appear in the work have the potential to project higher levels of abstraction whilst reducing its mimetic content. Since my form of Quantum music rejects religiosity and other forms of 'affective tokens'[30], one is forced to delineate new strategies and methods for the creation of sonic objects that do not rely on provoking an emotional response from those consuming the work. For this to be achieved the artist must control their tendency to manipulate sonic outcomes through personal choice or whim.

Composers throughout the 20th century and beyond have sought new means by which to order the internal mechanisms that give the work its shape. Through his use of the *I Ching*, John Cage 'intended to be free from the dictates of taste or memory', and was partly able to remove 'composerly control'[31] by employing chance processes to determine sonic outcomes. Coupled with these chance operations, 'the *Music of changes* is rigorously controlled in every aspect other than its linear organisation.'[32] What remains from this process is a mode of production based in some part on probabilistic outcomes. The defining characteristics of these outcomes, i.e. silence or sound, are not indeterminate, with the possibilities mapped out prior to their assignments. In his *Music of changes* (1951):

> [C]harts were subjected to a rational control: of the sixty-four elements in a square eight times eight…thirty-two were sounds, thirty-two silences. The thirty-two sounds

[30] Downie, G. (2004). 'Aesthetic Necrophilia: Reification, New Music, and the Commodification of Affectivity.' *Perspectives of New Music, 42*(2), p.266.

[31] Jensen, M. (2009). John Cage, Chance Operations, and the Chaos Game: Cage and the "I Ching"' *The Musical Times, 150* (1907), p.98.

[32] Ibid., p.98.

> were arranged in two squares one above the other, each four by four. Whether the charts were mobile or immobile, all twelve tones were presented in any four elements of a given chart, whether a line of the chart was read horizontally or vertically.[33]

As the *I Ching* is probabilistic in nature, the same outcomes can be achieved more quickly and efficiently using mathematical operations and computational processes.[34] Richard Toop's article 'Four Facets of 'The New Complexity'' played an important role in delineating methods for organising works along these principles, notably Richard Barrett's use of stochastic processes such as Markov chains.[35] The logical quantization of each key systematic device, outlined in the analytical sections of Toop's article, provided several disparate research streams, with each composer's interests not wholly the same as the others, apart from one.

Iannis Xenakis is a key influence on all the composers mentioned in Toop's article, and it is Xenakis who has made the most significant contribution to developing a purely mathematical approach to the creation of musical objects. Although extremely difficult for non-mathematicians to understand, his book *Formalized Music: Thought and Mathematics in Composition*, is a key text in the field of stochastic music, containing an array of compositional techniques for composers to adopt.

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[33] Cage, J. (1999). *Silence: Lectures and writings*. London: Marion Boyars Publishers Ltd, p.26.

[34] The website www.random.org was used to assign variables in all my works that use random processes.

[35] Toop, R. (1988). 'Four Facets of "The New Complexity".' *Contact*, 32 (Spring), p.38.

Xenakis writes, '[A]ll sound is an integration of grains, of elementary sonic particles, of sound quanta'[36], and this sentence had a profound effect on my compositional output as at the same time I was researching the basics and history of quantum physics. As a non-scientist, my research into quantum physics was elementary, focusing on introductory popular science books for the layperson. For example, Max Planck's term 'energy quanta'[37] is given to the 'smallest quantity of radiant energy, equal to Planck's constant times the frequency of the associated radiation'[38], or $e = hf$. The notion of small packets of energy has been a preoccupation in my music, notably in strategies for the partitioning of the time space as well as the three- and four-point gestures used extensively in works from *Objects: Object Distributions* onwards. These point gestures act as the fundamental elements or building blocks in all of the works with the *Objects* prefix, and they are in this sense analogous to the 'energy quanta' mentioned above, fundamental particles or DNA in biology.

As is shown in Chapter Three, aspects of physics are incorporated in my compositional practice in the three proto-quantum works. These were attempts at a musical equivalence or manifestation of the properties of a scientific system (for example, quantum spin or entanglement) but do not strictly adhere to the mathematics underpinning the properties referenced. Attempts at expressing mathematical or scientific systems in music is fraught with difficulties, especially so when referring to

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36 Xenakis, I. (1992). *Formalized Music: Thought and Mathematics in Composition*. New York: Pendragon Press, p.43.

37 Mcevoy, J & Zarate, O. (2004). *Introducing Quantum Theory*. Cambridge: Icon Books Ltd., p.40.

38 Dictionarycom. (2017). Quanta – definition. Retrieved 04 March, 2019, from http://www.dictionary.com/browse/quanta

states or theories relating to quantum physics, although that is not to say a music literally based on quantum music hasn't been theorized. Volkmar Putz and Karl Svozil released a paper in 2015 titled 'Quantum music'[39], in which they delineate a theoretical approach to the creation of music based on quantum states. Theoretically their approach is very interesting, in that it outlines another means by which to quantize the variables of a work probabilistically that can be researched further. However, there are physical impracticalities in the approach the authors propose:

> Pointedly stated, a truly quantum music never renders a unique listening experience – it might not be uncommon for part of the audience to hear different manifestations of the quantum musical composition made up of all varieties of successions of tones. For instance, one listener may hear Mozart's A Little Night Music, K 525, whereas another listener Prokoviev's Le pas d'acier, Op 41, and a third one would enjoy a theme from Marx's Autumn Symphony (1921). We could perceive this as quantum parallel musical rendition – a classical audience may perceive one and the same quantum musical composition very differently.[40]

There are obvious technological barriers to overcome in the performance of a 'truly quantum music', and it is seemingly impossible to perform such a work on acoustic instruments. However, in the realm of electronic music I can see potential in this approach, with one method of overcoming the impracticalities mentioned being the audience members wearing headphones for the duration of the work.

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[39] Put, V, Svozil, K., 'Quantum music', Soft Computing (volume NN), 1-5, 2015

[40] Ibid., p.2.

There are works, such as Xenakis's *Herma,* that successfully bridge this divide, in respect to the application of probabilistic mathematical functions in music. It will be shown in the early works (up to and including *Objects 2*) how I incorporated probabilistic or random systems in the compositional process. It will also be shown how this method of composition was superseded by a purely point gesture based approach in the works from *Objects 3.1* onwards. After *Entanglement*, the works are no longer explicitly formed using musical equivalents of aspects relating to science, as I came to the conclusion that the expression of these in music was an act of surface-level mimesis and so invokes the representative in art; this is dealt with in more detail in Chapter Four. However, it will be shown that the compositional tool I term 'entanglement' is used in almost all of the works presented here, becoming more of a coupling device for antipodean extremes within parametric systems than a scientific metaphor.

Even though the works move away from the invocation of scientific metaphors or probabilistic outcomes, in all of them the pre-compositional and compositional determinants are mediated logically and systematically through the decoupling and gradation of the parameters that constitute an art object. This hyper-segmentation or systematization of the creative process is a form of what Gordon Downie delineates as 'top-down, functional decomposition… a means of breaking down or deconstructing a problem, process or goal into successively more detailed steps.'[41] This process provides the composer with 'a systematic and transparent mode of production, the

[41] Weeklyworkercouk. (2010). Downie, G - *In the very fabric of art*. Retrieved 4 March, 2019, from https://weeklyworker.co.uk/worker/801/in-the-very-fabric-of-art/

semantic content and signifying capacity of [which] can be more precisely determined.'[42] I feel this process is akin to creating a sculpture in stone, where the defining of parametric profiles and trajectories through the modular process of top-down decomposition is equivalent (in a metaphorical sense) to the gradual chipping away of a stone monolith until the desired aesthetic outcome is achieved.

Influences from the visual arts are outlined broadly in Chapter Six, with Pablo Picasso's Cubist period and Piet Mondrian's De Stijl period cited as two initial influences. The one defining characteristic shared between these two distinct forms of Modernism, as well as artists and theorists such as Wassily Kandinsky and Kazimir Malevich, is the return to 'first principles', focusing on the fundamental elements that comprise an art object.

The salient characteristics of Cubism, including multiple perspectives/dimensions and angular, geometric shapes and forms, played a notable role in the development of my aesthetic approach, with an essence of it still present to some degree in the most recent works. This is most notable in the multidimensional approach taken in pitch-class projections via combinatorial matrixes and the extensive use of point gestures from *Objects* onwards. With point gestures being permutational in nature, each gesture can be seen as a modified reiteration, a similar or related object from another perspective. However, the major failing of Cubism is its reliance on representation.

[42] Ibid.

No matter how fragmented or distorted the surface of the work is, it is still an image (for example) of a guitar or person, never reaching the purity of abstraction that other artistic aesthetics eventually achieved.

Mondrian's De Stijl period, dominated by grids and variously-sized blocks (or *points* as I explain later[43]) of primary colours surrounded by a demarcated emptiness of white, has parallels in all my works to some degree, although over the course of my research it has manifested quite differently. The obvious examples are the demarcated inter-sectional silences present in *Probability Interpretation*, *Two-Slit Experiments*, *Objects* and *Objects 2*. Its influence on later works is somewhat subtler as inter-sectional silences are no longer employed. Instead, there is a greater focus in these works on the silences *between* the notes or groups of notes. These 'islands' of activity, each varying in size, content and saturation, are analogous to the blocks of primary colours in Mondrian's grid paintings. In *Objects 4* this is exaggerated by assigning the sections with fewest pitch classes the time signature set with the longest combined duration, and the section with the most pitch classes assigned the set with the shortest combined duration.

The deliberate act of reducing the artwork to its basic elements, as discussed in relation to Picasso and Mondrian, is reflected in the use of 3- and 4-Point gestures in the *Objects* series.[44] The large reduction in timbral differentiation through extended

[43] See Chapter Eight.

[44] See Chapter Ten.

instrumental techniques in *Objects 3.1* onwards is a result of this objective, refocusing attention away from surface-level colouristic differences towards other constructive devices such as the form point gestures take or impulse distance and duration.

As well as Mondrian and Picasso's work, there are several others with whom my works has an affinity, not necessarily apparent until several years after first viewing. Lucio Fontana's *Spatial Concept 'Waiting'* (1960), a work I first viewed in the Tate Modern roughly a decade ago, is one such work. The incision in the centre of the canvass, the artwork's sole gesture, surrounded by the remaining canvass and 'backed with strong black gauze',[45] inferring a sense of weight and depth in the artwork, is remarkably striking when viewed. This gesture, surrounded by empty space, is present (unknowingly or subconsciously) in the development of my own aesthetic approach. The distillation and reduction of impulse and pitch-class content in the works from *Objects 2* onwards, the general trajectory of these works is towards a sparser aesthetic, reinforced by dramatically limiting the number of source pitch-class matrixes from which pitched content is derived.

Wassily Kandinsky is at the other end of the chronological spectrum of my compositional output, with my reading of *Concerning The Spiritual in Art* and *Point and Line to Plane* coming after the completion of *Objects 4*. His focus on the basic

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[45] Tateorguk. (2019). Lucio Fontana - *Spacial Concept 'Waiting'*. Retrieved 4 March, 2019, from https://www.tate.org.uk/art/artworks/fontana-spatial-concept-waiting-t00694

elements of the point and line and how they are ordered to create non-figurative art went further than Cubism in its approach, enabling it to reach higher levels of abstraction. The geometric shapes that comprised an object or person in Cubism are now emancipated from surface-level representation and realised as objects in their own right. *Point and Line to Plane* was revelatory but also affirmative (to my aesthetic approach) in its approach to delineating the properties of points and lines and their context in the artwork, or 'plane'. Set forth in this book (and also to some degree in *Concerning The Spiritual In Art*) is a set of logical constructive principles that govern Kandinsky's entire aesthetic approach. On his exhaustive approach he states:

> The investigation should proceed in a meticulously exact and pedantically precise manner… Only by means of a microscopic analysis can the science of art lead to a comprehensive synthesis, which will extend far beyond the confines of art into the realm of the 'oneness' of the 'human' and the 'divine.'[46]

One can draw parallels with the work of another Russian artist, Kazimir Malevich, whose Suprematist works share this same modernist obsession with the geometric and/or fundamental shapes and gestures that govern the formation of art objects at a fundamental level. The methodology proposed by Kandinsky can be seen in the studies *Objects 5* and more acutely in *Objects 6.1-3.*

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[46] Kandinsky, W. (1979). *Point and Line to Plane*. New York: Dover Publications, p.21.

This rational approach to deriving the fundamental properties of an art object is in essence the same approach I took in forming the quantum aesthetic outlined above and in the following pages, with the compositions presented chronologically to highlight the developmental trajectory and refinement of this aesthetic approach. The non-musical sources outlined above have all shaped and informed my compositional practice. There are no literal examples or commentaries on the subjects discussed above; instead they have provided the foundations and framework from which my quantum aesthetic has been conceptualised and constructed. The remainder of this introduction will focus on the musical antecedents of the compositions submitted and will attempt to delineate some innate characteristics linking the composers or works mentioned. It will also provide the reader with a deeper understanding of the reasoning for certain system traits or configurations in the works submitted and how they relate to composers mentioned.

Antecedents, broadly speaking

As the title of this thesis suggests, at the core of my research is a desire to formulate a cohesive set of compositional tools and systematic devices that will form the foundations of an aesthetic approach that prioritises equality between the constituent parts of each work or group of works. The historical roots of this desire for unity in musical works are found in the Classical era with the four-note motif in Beethoven's *Symphony No.5* (1808) and this was carried through into the Romantic era for example with the use of an *idée fixe* in Berlioz's *Symphonie fantastique: épisode de la vie d'un artiste* (1830). This 'cyclic' use of motific material is present in other works from this era, ‘most notably as ‘thematic transformations’ in the symphonic poems of Franz Liszt and as leitmotifs in the operas of Richard Wagner.’[47] [48] Building the work from a limited set of root materials, as in the Beethoven example[49] is, I feel, a more economical approach to the creation of music and is an approach I exaggerate in my works from *Objects 2* onwards by focusing and reducing the musical content and structural systems to what I term ‘point gestures’, typically consisting of three or four values. Chapter Eight discusses how this affects the manifestation of the works’ various components; the unifying force weakening and eroding more traditional notions of for example ‘melody and accompaniment’ is imbued in the point gestures and their treatment in the works.

Béla Bartók also played a significant role early on, with remnants of his structural devices still present in my most recent works. I found Bartók’s music most interesting in respect to his structural principles and methods, as well as in how he derived pitch centres and their relationships, both of which are tackled in the first two chapters of Ernő Lendvai’s *Béla Bartók: An Analysis of His Music*. ‘The pole-counterpole relationship is the most fundamental structural principle in Bartók’s music, in respect to both small and large forms,’[50] Lendvai writes, and one will see from the analytical texts of the compositions submitted here that axial relationships play an important

[47] Britannicacom. (2019). Encyclopedia Britannica. Retrieved 4 March, 2019, from https://www.britannica.com/art/idee-fixe

[48] There are of course numerous other examples of this approach but there is no need here to extensively list and Classical and Romantic eras have not been the focus of my compositional research.

[49] This is not to say that all of the 5th Symphony is built from this one four-note motif but that it is a fundamental binding agent for several melodies and rhythmic devices throughout the work.

[50] Lendvai, Ernő (1971), *Béla Bartók: An Analysis of His Music*, London: Kahn & Averill, p.4.

role in the configuration and trajectory of systems within my own works. Using what I go on to refer to as 'entanglement', these axial relationships are employed in order to effectively mediate between the extremities of each system: for example, few to many, loud to quiet, or high to low.

Bartók's extensive use of the Golden Section (GS) and Fibonacci series also provided initial insight into a means by which to partition the time-space in the pre-compositional process, thus providing the composer with a structural outline or foundation from which the work can be built. This method of construction deploys an initial decision point (in the case of Bartók's structures the decision to use GS proportions and Fibonacci numbers) to set off a chain reaction of assignments, i.e. sketching structural changes at specific points relating to Fibonacci numbers.[51] Methods such as these can be used to automate the compositional process to varying degrees, and can be viewed as the early beginnings of my interests in systems thinking, partitioning and the quantization of the compositional process.

Since serial techniques are an important compositional trait in music that is of a 'quantum' nature, the Second Viennese School, in particular Arnold Schoenberg and Anton von Webern, played a pivotal role in the development of my own aesthetic approach. These are discussed in more depth in the chapter titled 'The •', where I outline a brief history of the 'point' in the visual and sonic arts, with Schoenberg's

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[51] Ibid., pp.20-29 (fig. 16-23)

use of *Klangfarbenmelodie* in his Five Pieces for Orchestra (1909), in particular the third movement *Farben.*

The techniques that Schoenberg developed, as outlined in Haimo's *Schoenberg's Serial Odyssey*, were developed further by the American composer Milton Babbitt. His techniques included combinatoriality, partitioning and multidimensional set projections, some of the core techniques that will be outlined in the following chapters. But from an aesthetic and sonic standpoint, I find a lot of Schoenberg's music to be quite conservative and traditional in nature, especially the later works, such as the rhythmic tuttis in bars 37-39 of the String Trio, Op. 45 or the regressive sound world of the Theme and Variations, Op.43a/b.

As I outline in Chapter Ten (The •), it was the music of Webern that informed the point-based approaches of Boulez, Stockhausen and Goeyvaerts (et al.) during the 1940s and 50s, not that of Schoenberg. It is the economical, crystalline and fragile nature of Webern's serial works that form one of the aesthetic 'nodes' in quantum music. Webern achieved a higher level of abstraction than Schoenberg, especially in his tendency towards pointillist, sparse and transparent textures and timbral effects that were to be an important influence on the students of Olivier Messiaen during the 1940s and 50s.[52]

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[52] See Chapter Ten.

Before commenting on the students of Messiaen, the influence of Milton Babbitt should be explored. Like Iannis Xenakis in Europe, Babbitt has played a pivotal role in the development of serial and mathematical techniques in music, with Andrew Mead's book on the composer providing the reader with an abundance of techniques, his 'first published compositions reveal[ing] the degree to which he had assimilated and expanded upon Arnold Schoenberg's and Anton Webern's developments of twelve-tone compositional thought.'[53] Babbitt's *Composition for Four Instruments* (1948) is an important influence on my aesthetic approach, most importantly in its splitting or partitioning of the quartet into the various sub-ensembles available, as well as the pitch-class selections in the opening clarinet solo.[54] Example 2.3 on page 58 of Mead's book provides an example of deriving complementary ensembles, a device I use in several of my works.[55] This partitioning process is manifest across several aspects of the works, notably in the splitting up of the time spaces to delineate areas within the work that are assigned content (or lack thereof).

In Europe and the post-1945 era, the key influences are the students of Olivier Messiaen and the composers associated with the Darmstadt Summer School during the 1950s. In the aftermath of the Second World War composers such as Karlheinz Stockhausen and Pierre Boulez sought, as the modernist adage states, to 'Make it New!'. As Peter Gay states, '[t]he jaunty slogan that Ezra Pound introduced for his fellow rebels before the First World War, 'Make it New!,' tersely summed up the

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[53] Mead, A. (1994) *An introduction to the music of Milton Babbitt*, New Jersey: Princeton University Press, p.54.

[54] Ibid*., Mapping trichordal pathways*, pp.54-123.

[55] In particular *Objects 4* and *Objects 7.*

aspirations of more than one generation of modernists.[56] This core tenet of the modernist programme implies for me the need to resist and remove the excesses of Late Romanticism from musical discourse, part of the aesthetic 'distillation' process so prevalent in my work from *Objects* onwards. The music of Igor Stravinsky's late period, notably *Epithaphium* (1959) and *Movements for piano and orchestra* (1959), were also an influence in this process but situated towards the end of my Masters degree at RWCMD, with the two works mentioned being good examples of how Stravinsky was able to strip his music of the historical excesses mentioned above (although for Stravinsky this was Neoclassicism).

As well as the integral serial works of Boulez et al., Iannis Xenakis is another important composer for my quantum aesthetic and he was an important influence on the so-called 'New-Complexity' composers portrayed in Richard Toop's article 'Four Facets of 'The New Complexity''.[57] Xenakis is pivotal here because of his single-minded approach to the creation of music, with his background in architecture and mathematics furnishing him with new tools to determine compositional outcomes. These are extrapolated at length in his book *Formalised Music: Thought and Mathematics in Composition*[58], and it was his use of stochastic processes that heavily influenced the 'proto-quantum' works discussed in Chapter Three.

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[56] Gay, P. (2009). Moder*nism: The Lure of Heresy.* London: Vintage Books, p.4.

[57] Toop, R. (1988, Spring). 'Four Facets of "The New Complexity"'. *Contact,* p.32.

[58] Xenakis, I. (1992). *Formalized Music: Thought and Mathematics in Composition,* New York: Pendragon Press.

The Toop article mentioned above was integral to my initial research and formalisation of a unified aesthetic approach. Stemming from a common link to Brian Ferneyhough, the composers mentioned in the article (and I would submit the music of James Erber here as well) to me invoked the spirit of 'Make it New!' more so than the composers associated with the so-called 'Manchester School': Harrison Birtwistle, Peter Maxwell Davies and Alexander Goehr. The composers in the Toop article, and by association Brian Ferneyhough, exhibit higher levels of information saturation at both the level of the score and its sonic outcomes in performance. This is a trait exhibited in all of my works, but to different degrees throughout. For example, the level of notational detail present in the proto-quantum works and *Objects* and *Objects 2* is significantly different to the works from *Objects 3.1* onwards, in part from the removal of extended techniques in the latter.

The removal of extended techniques was in part informed by the practice of Gordon Downie, a composer whose written and compositional output has challenged my own preconceived notions on music composition and the role of art in capitalist society for several years now. He is a composer I will often reference in this thesis, with several of his compositional tools and strategic devices being appropriated and adapted in my own music, in particular his method of generating rhythm, or 'temporal partitioning'[59] as he terms it, as well as 'top-down decomposition' (the hyper-segmentation of the compositional process) which I discuss further in Chapters Eight and Ten.

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[59] Downie, G. &. Pace, I. (2006/07). Gordon Downie and Ian Pace: A Dialogue. *The Open Space Magazine*(8/9), p.203.

There are of course composers and aesthetic practices that I have not mentioned in the previous pages, notably left-leaning composers such as Kurt Weill, Cornelius Cardew and Louis Andriessen, as well as spectral composers such as Gérard Grisey and Tristan Murail. I had already progressed from the works of Béla Bartók to the post-1945 music of the integral serialist composers before I had heard any of Kurt Weill's music, and even though Weill's output is obviously important within the context of the early modernists, his aesthetic is too simplistic and amateur-sounding for me to give it an extended attention. Although written in this idiom 'to promote social programs and ideologies [by] entertaining common people rather that intellectual elites'[60], I believe this music approaches the problem from the wrong perspective. Music infused with Left-wing politics seems to exist (broadly speaking) either as works rooted in songs (as well as more traditionally situated concert works) arranged using 'simple triadic harmony'[61], or in the highly complex scores of composers such as Luigi Nono and Gordon Downie, as well as my own. Writing in such a simplistic idiom for the purpose of 'entertaining common people' is in a sense a form of bigotry, as the composer is assuming that the 'common people' can only be helped out of their situation or enlightened about the tyrannies of capitalist society by music as a dumbed-down entertainment. The 'common people' targeted by Weill's music are situated well within the axioms of the culture industry but 'the masses are

[60] Palisca, V. (1996). A History of Western Music. (5th ed.). New York: W W Norton & Company, p.713.

[61] Ibid.

not primary, but secondary, they are an object of calculation; an appendage of the machinery.'[62]

The simplistic, cabaret- or pop-infused music of Kurt Weill are more readily assimilated into the culture industry than the dense works of composers such as Luigi Nono, whom one could argue is situated at the other end of this spectrum of Left-wing composers. The same can also be said for the music of Cornelius Cardew, especially works such as his 'Smash The Social Contract' (1977), which have for me (especially in today's current political climate) the feeling of overt virtue signalling composed in a Pop idiom. However, he was important in the development of the graphic score and contemporary performance practice with works such as *Treatise* (1963-67) and, although elements of improvisation are strictly forbidden in the works I produce, I am sympathetic to the desires of some performers and composers who use both graphic scores and improvisation in performance to extend the reach and limitations of music creation.

There is also Louis Andriessen, one of the more politically orientated composers working today and one of the key Dutch composers of his generation. Since his early serial works he has developed an aesthetic that is a fusion of several disparate musical idioms, such as Jazz and American Minimalism, two influences that I care little for in my own work. His is a more refined approach to musical political action than

[62] Adorno, T. (2001). *The Culture Industry*. UK: Routledge, p.99.

Cardew's but works such as *Workers Union* (1975), with its seemingly constant rhythmic tutti, is an aesthetic approach I find wholly uninteresting.

Finally, Spectralism is a notable omission from my research interests, although I have often found spectral music fascinating, such as Gérard Grisey's *Les espaces acoustiques – III – Partiels* (1975) and Tristan Murail's *Ethers* (1978). The music of John Croft is also pertinent here in works such as *Intermedio III* (2012), which marries solo bass clarinet and electronics most effectively.[63] As a composer exclusively writing for acoustic instruments spectral music is very distant the constructivist aesthetic practices that have formed the core of my research. Spectralism's focus on timbre is, however, a potential research thread in the future, with my most recent work, *Objects 7: Trio Migrations* (2019), containing several of the qualities that I see in spectral works, in particular stasis, sparsity and a greater focus on the inner sonorities of the objects realised.

Summary

The purpose of the previous pages was to map out some of the salient characteristics of the quantum aesthetic I promote in this thesis and to position it as a sub-set of

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[63] Sonicspacesprco. (2012). Sonic Spaces newsroom - Composer John Croft wins Prix Ton Bruynèl 2012. Retrieved 4 March, 2019, from http://sonicspaces.pr.co/31523-composer-john-croft-wins-prix-ton-bruynel-2012

Modernism. As with Modernism itself, these influences are from disparate fields of the arts and espouse different aesthetic approaches as well as drawing on mathematics and the sciences, politics and utopia. Broader societal factors play an important role in formulating the deeper reasoning behind the technical-aesthetic aspects of my work. Principally these are enacted to promote equality in and between each work's constituent parts to create utopian objects, both at the smallest and largest scales. However, as will be shown in the works and texts that follow, these sonic realities are extremely difficult to create perfectly, with the works being in a sense on the edge of collapse at any given point. Even though they are robustly constructed and structured, the works are extremely fragile in nature, especially after the proto-quantum works, becoming more disparate, cold and static as the thesis progresses.

Writing music for me is a very solitary act, and I do not typically listen to the works of others when I am writing, to avoid outside influences as much as possible. The sole purpose of my time when composing is in formulating the particular mechanics of the work(s) being written. I will more often than not have a broad plan for the work sketched roughly in my head, usually in how I am going to partition the instrumental forces present and the objects being projected therein. The systems of the work(s) are then formulated from the development of the initial kernels of an idea.

There are times, as when I have discovered that a notation does not clearly express content, that I have investigated scores of other composers to look for precedents. For example, *Objects 4* and *5* required me to research vocal notation, and it was through this process that I confirmed what *not* to write in these works. The objects in these works express trichords and tetrachords, with the instrumental and vocal forces expressing the same objects in combination and without idiomatic instrumental writing. I discovered that the overt theatrics and plethora of extended singing techniques in Luciano Berio's *Sequenza III* (1965) were irrelevant to the goals of *Objects 4* and *5*, with the vocal parts in these works realised as having a defined or undefined pitch depending on the 'word partition' present, so these could be differentiated using two different note heads (normal and crossed).

Although some of the techniques or methodologies I incorporate in my works have antecedents in the work of other composers as well as practitioners in other fields of art, this is not typical of my output. One could make a link between my work and Gordon Downie's, in that what I term 'point gestures' and the impulse strategies from *Objects 4* onwards come from the works of Downie, and we are both explicitly point-based composers, but the strategies that I have initiated in my own works have been developed along shared but different paths. Whereas Downie is concerned more with developing methodologies from computer science for the creation of music, my works use the point gestures only as the principal constructive device from *Objects 3.1* onwards.

2. Broad constructive principles

After formulating the conceptual outline and basics of the work to be written, i.e. the instrumentation or technical-aesthetic goals, I find delineating strategies for time signatures is an important early component of the compositional process. It is useful to define the space(s) in which the music will be situated, delineating the time-space parameters that will inform the methods by which the composition is realised. When these are in place, one can then check the outcomes against other parametric strategies formed in the pre-compositional process, such as impulse content, and test the validity of the projected outcomes within each time-space. Take for example a 2/8 bar: only a crotchet in duration, the system for impulse content must take into account that the time-space is very small, so assigning an abundance of impulses to this bar would be problematic. This is not to say that a 2/8 bar cannot have a high degree of activity within it, as extremes of high and low impulse content can exaggerate or reinforce strategies in place for the mediation and projection of systems such as time-space saturation. This is particularly true for works of mine with the *Objects* prefix and will be discussed later.

The following text outlines the strategies used and their evolution across the works submitted, delineating the fundamental aspects and organisational devices behind the processes used and linking these to broader aesthetic reasoning. It will also consider how the trajectory of the time signature parameter across the works reflects the ‘distillation’ process mentioned in the introduction; for example, from the first to the most recent work in the *Objects* series there is a reduction from sixty to five different time signatures, and only one in *Objects 6.1*.

As I said earlier, a fundamental facet of my approach to composition is the desire to create works that are egalitarian and democratic in nature, and this is clearly evident in my use of time signatures. Each work takes as its basis different source sets of time signatures, typically (but not exclusively) delineated into classes according to denominator-type. However, in none of the works is there any sense of weak or strong beats, so none of the time signature are 'felt' in the traditional sense of the term (such as 3/4 bars invoking a waltz). This is most evident with works prefixed *Objects*, where time-space partitioning becomes highly specified and devoid of traditional connections to metre, or to the difference in metric phrasing between simple and compound time signatures.

***Probability Interpretation* for cello and double bass (2009)**

As will be explained in Chapter Three, time signature (t-Sig) denominator classes (dcs) in *Probability Interpretation* (/8, /16, /32) are each assigned one of three types of material: double-stopped dyads (/8), glissandi (/16), and un-sustained points (/32). Each denominator class (dc) contains twelve sequential numerator values and are listed in *Table 2.1*. Each t-Sig is assigned once in the work, giving a total of 36 bars, with the totality split into twelve three-bar sections separated by silences of 2, 4, 6, 8, 10 or 12 seconds. Each t-Sig manifests in one of three states that are determined by the t-Sig's size in demisemiquaver units. As a result of this, each t-Sig shares its demisemiquaver value with 0, 1 or 2 other dcs and are listed in *Table 2.2*.

/8	/16	/32
2/8	14/16	26/32
3/8	15/16	27/32
4/8	16/16	28/32
5/8	17/16	29/32
6/8	18/16	30/32
7/8	19/16	31/32
8/8	20/16	32/32
9/8	21/16	33/32
10/8	22/16	34/32
11/8	23/16	35/32
12/8	24/16	36/32
13/8	25/16	37/32

Table 2.1

1 T-Sig		2 T-Sigs	3 T-Sigs
2\8	25\16	10/8, 20/16	7/8, 14/16, 28/32
3\8	26/32	11/8, 22/16	8/8, 16/16, 32/32
4\8	27\32	12/8, 24/16	9/8, 18/16. 36/32
5\8	29\32	15/16, 30/32	14/16, 7/8, 28/32
6\8	31\32	17/16, 34/32	16/16, 8/8, 32/32
13\8	33\32	20/16, 10/8	18/16, 9/8, 36/32
19\16	35\32	22/16, 11/8	28/32, 7/8, 14/16
21\16	37\32	24/16, 12/8	32/32, 8/8, 16/16
23\16		30/32, 15/16	36/32, 9/8, 18/16
		34/32, 17/16	

Table 2.2

As is shown in Chapter Three, the content assigned to each dc is superimposed in bars where more than one is present, such as 10/8 and 20/16 (*Table 2.2*), and are performed on either one or two instruments. These are not just superimpositions of the different types of material used, instead the supplementary material (the material not from the root t-Sig class, for example the 20/16 material in the 10/8 bar) is modified through a process called 'tunnelling', with the supplementary material employing parametric variables of the root dc to alter its original realisation within its dc. The dc material-types, their parametric make up and how they change when combined with other dcs are discussed at length in Chapter Three.

***Two-Slit Experiments*, for solo piano (2010)**

Two-Slit Experiments shares similarities with *Probability Interpretation*, but the dcs now contain 18 sequential numerators that are dovetailed with adjacent t-Sig classes, so some numerator values are present in more than one class (*Table 2.3*).

/8		/16		/32	
2/8	11/8	11/16	20/16	19/32	28/32
3/8	12/8	12/16	21/16	20/32	29/32
4/8	13/8	13/16	22/16	21/32	30/32
5/8	14/8	14/16	23/16	22/32	31/32
6/8	15/8	15/16	24/16	23/32	32/32
7/8	16/8	16/16	25/16	24/32	33/32
8/8	17/8	17/16	26/16	25/32	34/32
9/8	18/8	18/16	27/16	26/32	35/32
10/8	19/8	19/16	28/16	27/32	36/32

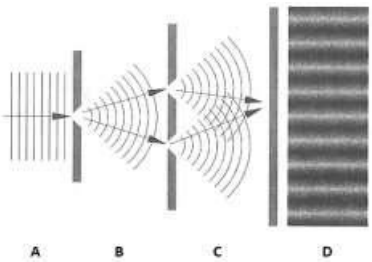
Table 2.3

1 T-Sig (0)		2 T-Sigs (1)	3 T-Sigs (2)
2/8	25/16	5/8 - 20/32	6/8 - 12/16 - 24/32
3/8	27/16	10/8 - 20/16	7/8 - 14/16 - 28/32
4/8	21/32	11/8 - 22/16	8/8 - 16/16 - 32/32
15/8	23/32	12/8 - 24/16	9/8 - 18/16 - 36/32
16/8	25/32	13/8 - 26/16	12/16 - 6/8 - 24/32
17/8	27/32	14/8 - 28/16	14/16 - 7/8 - 28/32
18/8	29/32	11/16 - 22/32	16/16 - 8/8 - 32/32
19/8	31/32	13/16 - 26/32	18/16 - 9/8 - 36/32
19/16	33/32	15/16 - 30/32	24/32 - 6/8 - 12/16
21/16	35/32	17/16 - 34/32	28/32 - 7/8 - 14/16
23/16	37/32		32/32 - 8/8 - 16/16
			36/32 - 9/8 - 18/16

Table 2.4

Each t-Sig is assigned once in the work, giving a total of 54 bars, with the totality split into eighteen three-bar sub-sections, each containing one of each dc. Unlike *Probability Interpretation*, in *Two-Slit Experiments* there are four types of material assigned to the three t-Sig classes, delineated from a pictorial representation of the two-slit experiment, reproduced from Chapter Three, below.

Each of the four demarcated zones in *Ex.3.2.1* is used to delineate four material-types: A – 1-12 pitch classes (pcs) realised as a sustained single pitch or chromatic cluster, B – 2-24 pcs realised as sustained points, C – 4-48 pcs realised as demisemiquaver dyads that are staccato in nature, D – 1-16 5- or 6-note semitonal clusters spanning the entire range of a standard 88 key piano and always played staccato. Material-types A and B are assigned to /8 and /16 classes respectively, with C and D assigned to the /32 class.



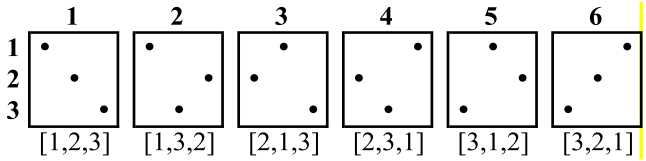
(*Ex.3.2.1*)

As was mentioned above, each three-bar section is assigned one of each dc, with the order determined through the combination of indeterminate (random number generators) and determinate (point gestures) processes. The outcomes of this process are shown in *Table 2.5*, below.

3	**2**	**6**	**4**	**5**	**1**	**5**	**3**	**2**	**4**	**6**	**1**	**4**	**1**	**5**	**3**	**2**	**6**
/16	/8	/32	/16	/32	/8	/32	/16	/8	/16	/32	/8	/16	/8	/32	/16	/8	/32
/8	/32	/16	/32	/8	/16	/8	/8	/32	/32	/16	/16	/32	/16	/8	/8	/32	/16
/32	/16	/8	/8	/16	/32	/16	/32	/16	/8	/8	/32	/8	/32	/16	/32	/16	/8

Table 2.5

It will become apparent over the course of this thesis that what I term ‘point gestures’ play an increasingly prominent role in the compositional systems and expressive ideals of the aesthetic formulated. The smallest point gestures used are three-point gestures (3-Pgs), with the six variants shown in *Ex.2.1*.



Ex.2.1

With /8 assigned to '1', /16 to '2', and /32 '3' (high to low in each gesture), one 3-Pg will assign the fundamental dcs for three bars. The 18 columns in *Table 2.5* above represent the 18 three-bar sub-sections in the work. To assign for 18 sub-sections each gesture is assigned three times, and this is determined by using a random number generator to create three sets of six values (1-6). The three outcomes are [3,2,6,4,5,1], [5,3,2,4,6,1] and [4,1,5,3,2,6], shown on the top row of *Table 2.5*.

***Entanglement*, for French horn and bass trombone (2010)**

As in *Probability Interpretation* and *Two-Slit Experiments*, sets of time signatures were formed based on denominator class, with this work containing four: /8, /16, /32 and /64, shown in *Table 2.6*. Each class has 12 t-sigs, giving 48 in total. As can be seen in *Table 2.6*, some numerator values for each dc are shared with the adjacent dcs. This notion of overlapping or merging is not only evident in the fundamental time signatures (F-Sigs), but is a key constructive tool in this work, being employed to form new time signatures that are not necessarily present in *Table 2.6*. The merging of t-Sigs reduces the total bar content from 48 to 27 bars, split into three main sections:

bars 1-12, 13-15 and 16-27, with specific types of t-Sig assigned to each of the three sections and assigned in such a way as to form a near equilibrium between the sections of the work. As in the two previous works, the t-sigs in *Table 2.6* are split into three distinct groups: those that share a temporal space size with no others, with one other and with two others. In the two earlier works the t-sigs that share the same temporal space size with one or two others had their respective materials superimposed but this is not the case in *Entanglement*. The t-sigs instead are used to infer merging principles based on how 'complete' the t-sigs are.

This 'completion' principle is based on how many other t-sigs share the same temporal space value; the least 'complete' being those that do not share a temporal space value with another t-sig to the most 'complete' being those that share their space with two others. The t-sigs that share their temporal space size with none or one other are assigned to the outer sections of the work, with the central three bars assigned t-sigs that share their size with two others. The trajectories of these assignments in the outer sections are from long to short and short to long respectively, with the central three t-sigs assigned according to a system based on 3-Pgs. The outer two sections have t-Sigs assigned globally using a technique called 'entanglement', an example of an aspect of physics in my works, which as I explained in the Introduction is 'a coupling device for antipodean extremes within parametric systems.'

/8		/16		/32		/64	
2/8	16	8/16	32	14/32	28	20/64	20
3/8	24	9/16	36	15/32	30	21/64	21
4/8	32	10/16	40	16/32	32	22/64	22
5/8	40	11/16	44	17/32	34	23/64	23
6/8	48	12/16	48	18/32	36	24/64	24
7/8	56	13/16	52	19/32	38	25/64	25
8/8	64	14/16	56	20/32	40	26/64	26
9/8	72	15/16	60	21/32	42	27/64	27
10/8	80	16/16	64	22/32	44	28/64	28
11/8	88	17/16	68	23/32	46	29/64	29
12/8	96	18/16	72	24/32	48	30/64	30
13/8	104	19/16	76	25/32	50	31/64	31

Table 2.6

Table 2.7 lists Group 1 t-Sigs and are t-Sigs that share their temporal space size with no others. These are listed from least to most in hemidemisemiquaver content and split into five sub-sets, which are internally ordered along entanglement principles. In sub-group 1 (far left column of *Table 2.7*), t-Sigs are coupled by totalling the numerator values of two t-Sigs so that the total value is 46. For example, 20/64 and 26/64 coupled equals 46/64, the same also being true for 21/64 and 25/64. 22/64 and 23/64 combined gives 45/64 so are assigned to 1-12 and 16-27 respectively. This process is repeated in the other four columns in *Table 2.7*, and as one will see from the table that columns 2 and 3 assigns t-Sigs to sections unequally, with the 2/8 bar, an outlier in the system/table, assigned to bars 1-12 at the end of this process to equalize the variance in outcomes.

	1		2		3		4		5	
1	20/64	A	27/64	A	17/32	A	13/16	A	10/8	A
2	21/64	B	29/64	B	19/32	B	15/16	B	11/8	B
3	22/64	A	31/64	C	21/32	C	17/16	B	12/8	B
4	23/64	B			23/32	B	19/16	A	13/8	A
5	25/64	B			25/32	A				
6	26/64	A							2/8	A
	A	1-12	A/B	1-12	A	1-12	A	1-12	A	1-12
	B	16-27	C	16-27	B/C	16-27	B	16-27	B	16-27

Table 2.7

Bars 1-12		Bars 16-27	
9/8	72	3/8	24
8/8	64	14/32	28
7/8	56	30/64	30
11/16	44	18/32	36
9/16	36	22/32	44
15/32	30	14/16	56
28/64	28	16/16	64
24/64	24	18/16	72

Table 2.8

The remaining t-Sigs to assign to the outer sections are the bars that share their temporal space with one other, listed in *Table 2.8*. As is shown, the t-Sigs are listed in bars 1-12 from longest to shortest, with their entangled partner (the t=Sig that has the same hemidemisemiquaver content) assigned to the corresponding antipode (for example, 9/8 and 18/16 are assigned to the first and last positions respectively).

<table>
<tr><th colspan="2">Bars 1-12</th><th colspan="2">Bars 16-27</th></tr>
<tr><td>13/8</td><td rowspan="2">2-1</td><td>21/64</td><td rowspan="3">3-2</td></tr>
<tr><td>10/8</td><td>23/64</td></tr>
<tr><td>19/16</td><td rowspan="3">3-2</td><td>3/8</td></tr>
<tr><td>9/8</td><td>25/64</td><td rowspan="3">3-2</td></tr>
<tr><td>8/8</td><td>14/32</td></tr>
<tr><td>7/8</td><td rowspan="3">3-2</td><td>30/64</td></tr>
<tr><td>13/16</td><td>31/64</td><td rowspan="2">2-1</td></tr>
<tr><td>25/32</td><td>18/32</td></tr>
<tr><td>11/16</td><td rowspan="2">2-1</td><td>19/32</td><td rowspan="3">3-2</td></tr>
<tr><td>9/16</td><td>21/32</td></tr>
<tr><td>17/32</td><td rowspan="2">2-1</td><td>22/32</td></tr>
<tr><td>15/32</td><td>23/32</td><td rowspan="3">3-2</td></tr>
<tr><td>29/64</td><td rowspan="3">3-2</td><td>14/16</td></tr>
<tr><td>28/64</td><td>15/16</td></tr>
<tr><td>27/64</td><td>16/16</td><td rowspan="2">2-1</td></tr>
<tr><td>26/64</td><td rowspan="2">2-1</td><td>17/16</td></tr>
<tr><td>24/64</td><td>18/16</td><td rowspan="4">3-2</td></tr>
<tr><td>22/64</td><td rowspan="3">3-2</td><td>11/8</td></tr>
<tr><td>20/64</td><td>12/8</td></tr>
<tr><td>2/8</td><td></td></tr>
</table>

Table 2.9

Table 2.9 lists the resulting t-Sig order for bars 1-12 and 16-27. As is shown, the t-Sigs are grouped in two or three sub-groups and labelled '2-1' or '3-2'. These denote the basic merging principles for the t-Sigs assigned, with 2-1 and 3-2 denoting two to one and three to two t-Sigs respectively. The columns titled Bars 1-12 and Bars 16-27 contain 20 and 19 t-sigs respectively, so for each to be reduced to 12 t-sigs requires bars 1-12 to have four 2s (2-1) and four 3s (3-2), 16-27 five 3s and two 2s. These are assigned using a random number generator, with the rule that 2s and 3s were only allowed to appear a maximum of two times consecutively, with the outcomes being:

1-12: 2,3,3,2,2,3,2,3 = 1,2,2,1,1,2,1,2

16-27: 3,3,2,3,3,2,3 = 2,2,1,2,2,1,2

For a bar to not be fully assimilated into another, the most that an F-sig can be merged by is its total length minus 1. So, for 13/8 and 10/8 in *Table 2.9*, the value will be 9 (10-1). To assign exactly where the merge-point will be, a random number generator using the values 1-9 was employed in this example. With '4' the outcome of the random number generator and shown in *Ex.2.2*, the new t-Sig created is 19/8 and can be verified in bar 1 of the score.

13/8 | | | | | | | | | | | | |

10/8 | | | | | | | | | |

Ex.2.2

The process outlined in the previous paragraph is employed in all other t-sig groups in *Table 2.9*. In all cases, the denominator-type of the second bar (10/8 in *Ex.2.2*) is used as the unit of t-sig merge. *Table 2.10* shows the outcomes of this process, with a skeleton score of these outcomes shown in Appendix 3.3.3.

Bars 1-12				**Bars 16-27**			
F-Sigs	**Unit**	***P()***		**F-Sigs**	**Unit**	***P()***	
1/2	Q	1-9	4	24/25	HDSQ	1-22	20
3/4	SQ	1-17	12	25/26	HDSQ	1-23	10
4/5	Q	1-7	2	27/28	HDSQ	1-27	2
6/7	SQ	1-12	11	28/29	HDSQ	1-29	16
7/8	DSQ	1-24	20	30/31	HDSQ	1-35	25
9/10	SQ	1-8	8	32/33	DSQ	1-20	12
11/12	DSQ	1-14	12	33/34	DSQ	1-21	1
13/14	HDSQ	1-27	16	35/36	DSQ	1-27	8
14/15	HDSQ	1-26	26	36/37	SQ	1-14	1
16/17	HDSQ	1-23	3	38/39	SQ	1-16	13
18/19	HDSQ	1-19	19	40/41	SQ	1-21	21
19/20	HDSQ	1-15	8	41/42	Q	1-11	5

Table 2.10

As combining two F-sigs automatically creates a new t-sig, there is only the need to derive new t-sigs when three F-sigs are merged to create two t-sigs. As there are two bars created from the three that were merged, the initial process of deriving the new t-sigs was by splitting each merged bar into two relatively equal parts:

	F-Sigs	**Merged Total**	**Split**
A	3,4,5	39 SQ	20/19
B	6,7,8	37 DSQ	19/18
C	13,14,15	42 HDSQ	22/20
D	18,19,20	31 HDSQ	16/15
E	24,25,26	19 DSQ	10/9
F	27,28,29	65 HDSQ	33/32
G	32,33,34	49 DSQ	25/24
H	35,36,37	71 DSQ	36/35
I	40,41,42	41 SQ	21/20

Table 2.11

	F-Sigs	**1-6**	**New t-Sigs**	
A	3,4,5	4	23/16	16/16
B	6,7,8	6	24/32	13/32
C	13,14,15	6	27/64	15/64
D	18,19,20	5	20/64	11/64

Table 2.12

From the ‘Split’ column in *Table 2.11* were derived nine sets of 6 merged-bar splits (see Appendix 3.3.4). A random number generator was used to determine which split is assigned. One will notice that the F-Sig set [13,14,15] is an anomaly as the difference between the two numbers is two and not one: this was done to remove the possibility of two 21/64 bars as an outcome. As the outcomes are evident in the score, only those for bars 1-12 are used as examples in *Table 2.12.*

	With two others		
1	4/8	8/16	16/32
2	5/8	10/16	20/32
3	6/8	12/16	24/32

Table 2.13

The only remaining t-Sigs to assign are for bars 13-15 and are listed in *Table 2.13*. As there are only three bars, only one of each t-Sig group (1, 2 or 3) is used. For this to be achieved, two 3-Pgs were assigned using a random number generator. These two gestures are used to assign firstly the t-Sig group and then the denominator-type (1 = /8, 2 = /16, 3 = /32). The 3-Pgs assigned were [2,3,1] and [3,2,1], giving the t-sigs 20/32 (2-3), 12/16 (3-2), 4/8 (1-1), bars 13, 14 and 15 in the score.

The broad architectural processes used for t-Sig assignments in *Entanglement* are never used in this context again in the works that follow. Although forms of merging can be seen in systems for tuplet tiling in *Objects* and *Objects* 2, the ‘merging principle’ when used for t-Sig assignments was not compatible with processes that I would later develop for this parameter. I have come to see the various systematic devices in *Entanglement* as superfluous, unnecessarily complicating the process of t-Sig assignments. This overt complicating imperative is most obvious in the score's numerous irrational tuplets ratios, and is intended to problematise the act of realisation by erecting barriers to the realisation of a 'perfect' performance, or what Brian Ferneyhough calls 'the establishment of audible criteria on meaningful inexactitude.'[64] It also draws parallels with the notion of an unrealisable Utopia, the technical and notational barriers to realisation in the score analogous to the hypothetical barriers denying the realisation or functioning of a utopian ideal.

In *Entanglement* the work's material content is either sustained or unsustained, with the number of unsustained impulses increasing towards the central three bars and decreasing thereafter. T-Sig denominator classes are no longer assigned specific types of material as in *Probability Interpretation* and *Two-Slit Experiments*, with the works from *Objects* onwards dedicated to refining a point-based approach employing point gestures to define the sonic landscape of each work (or collection of works). Although not programmatic, the proto-quantum works as essentially mimetic in nature[65] as they incorporate sonic outcomes whose intent is to express a scientific principle, for example the two-slit experiment in *Two-Slit Experiments* or quantum spin in *Probability Interpretation*.[66]

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[64] Ferneyhough, B. (1998). *Brian Ferneyhough - Collected Writings*. Oxon: Routledge, p.263.

[65] See Chapter Six.

[66] See Chapter Three.2 and Three.1 respectively.

***Objects: Object Distributions*, for solo double bass (2012)**

Objects: Object Distributions takes a different approach to determining t-Sig use and the content within. There are five sets of twelve t-Sigs demarcated by dc (*Table 2.14*), and unlike in *Probability Interpretation* and *Two-Slit Experiments*, t-sigs of equal size (i.e. 7/4 and 14/8) are not superimposed in this work. There is no need to superimpose the t-Sigs because each dc does not have an assigned material-type, the t-Sigs mediated by deriving a saturation level, which is the percentage of pitch-classes (pcs) to t-Sig temporal size in hemidemisemiquaver (hdsq) units. With each t-Sigs used once the work is 60 bars in duration, split into twelve groups of five t-Sigs related by saturation level and separated by twelve silences ranging from 14 to 25 seconds.

The 60 t-sigs in *Table 2.14* are ordered linearly by hdsq content, from largest to smallest, and assigned a p-c content value of 1-60 respectively. From these assignments saturation levels were derived for each t-sig, with the results of the 24 largest t-sigs shown in *Table 2.15*.

T-Sig	In hdsq	T-Sig	In hdsq	T-Sig	In hdsq	T-Sig	In hdsq	T-Sig	In hdsq
2/4	32	**14/8**	112	**26/16**	104	**38/32**	76	**50/64**	50
3/4	48	**15/8**	120	**27/16**	108	**39/32**	78	**51/64**	51
4/4	64	**16/8**	128	**28/16**	112	**40/32**	80	**52/64**	52
5/4	80	**17/8**	136	**29/16**	116	**41/32**	82	**53/64**	53
6/4	96	**18/8**	144	**30/16**	120	**42/32**	84	**54/64**	54
7/4	112	**19/8**	152	**31/16**	124	**43/32**	86	**55/64**	55
8/4	128	**20/8**	160	**32/16**	128	**44/32**	88	**56/64**	56
9/4	144	**21/8**	168	**33/16**	132	**45/32**	90	**57/64**	57
10/4	160	**22/8**	176	**34/16**	136	**46/32**	92	**58/64**	58
11/4	176	**23/8**	184	**35/16**	140	**47/32**	94	**59/64**	59
12/4	192	**24/8**	192	**36/16**	144	**48/32**	96	**60/64**	60
13/4	208	**25/8**	200	**37/16**	148	**49/32**	98	**61/64**	61

Table 2.14

The 60 t-sigs were then grouped together into 12 sub-groups according to saturation levels, with each group containing 5 t-sigs (see Appendix 5.1). These sections are assigned globally by projecting a 12-note set derived from the 24-note quartertone set (P-0) used as the basis for pitched material in the work, with '0' being the least saturated and 'e' the most. The order of the five t-sigs within each group was determined using a random number generator, with the outcomes shown in *Table 2.16*. Assigned on a gradient, with '1' being the least saturated and '5' being the most, the numbers 1, 2, 3, 4 and 5 were assigned to give the order of t-sigs in each 5-bar sub-group. To avoid repetition, these were assigned in such a way that none of the internal assignments of 1, 2, 3, 4 or 5 and the last and first values were the same in adjacent sections.

T-Sig		p-c	Saturation	T-Sig		p-c	Saturation
13/4	208	60	28.85%	**9/4**	144	48	33.33%
25/8	200	59	29.50%	**18/8**	144	47	32.64%
12/4	192	58	30.21%	**36/16**	144	46	31.94%
24/8	192	57	29.69%	**35/16**	140	45	32.14%
23/8	184	56	30.43%	**17/8**	136	44	32.35%
11/4	176	55	31.25%	**34/16**	136	43	31.62%
22/8	176	54	30.68%	**33/16**	132	42	31.82%
21/8	168	53	31.55%	**8/4**	128	41	32.03%
10/4	160	52	32.50%	**16/8**	128	40	31.25%
20/8	160	51	31.88%	**32/16**	128	39	30.47%
19/8	152	50	32.89%	**31/16**	124	38	30.65%
37/16	148	49	33.11%	**15/8**	120	37	30.83%

Table 2.15

Section	T-Sig Order				
0	2	5	4	3	1
2	3	1	2	5	4
1	5	2	1	4	3
4	4	3	5	1	2
5	5	4	3	2	1
3	4	3	1	5	2
7	3	2	5	1	4
6	5	3	4	2	1
8	2	1	5	3	4
e	3	5	4	2	1
9	2	4	5	1	3
t	1	2	3	4	5

Table 2.16

***Objects 2: Four-Point Gestures*, for String Quartet (2012)**

Objects 2 is one of the few works submitted that uses t-Sigs from only one denominator class, with *Objects 2* using 11 t-Sigs from 2/4 to 12/4. Each of the eleven t-Sigs is treated as a defined section in its own right and are framed by twelve silences derived from multiples of 3 (3, 6, 9… 36 seconds in duration). This distillation of a section to a single bar is reinforced in the gestural content assigned to each, where only one type of gesture is employed in each bar. For these t-sigs to be ordered globally an 11-note set was derived from a 12-note set. The set used was from an earlier proto-version of this work that was less concise and more convoluted than this final version.

Step 1	0	2	1	4	5	3	7	6	8	e	9	t
Step 2	0	2	1	4	5	3						
						7	6	8	e	9	t	
Step 3	(Above +4)											
	4	6	5	8	9	7	6	8	e	9	t	

The three steps above show the three stages from which the 11-note set is derived. Step 1 is the original 12-note set (0 = C); Step 2 shows the second hexachord shifted one place to the left; Step three shows the final set used for assigning t-sigs. With the first hexachord transposed up a major third (giving the shared overlap value of 7), the final set in Step 3 contains only eight different values: 4, 5, 6, 7, 8, 9, t and e. As the pitch-class set for the work is a 24-note quartertone set the pitch-class content is in groups of 12, giving 8 possible values: 12, 24, 36, 48, 60, 72, 84 and 96, assigned to

Step 3 elements 4, 5, 6, 6, 7, 8, 8, 9, 9, t and e respectively. These, as well as the t-sig assigned to each, are shown in *Table 2.17*.

	4	**5**	**6.1**	**6.2**	**7**	**8.1**	**8.2**	**9.1**	**9.2**	**t**	**e**
pcs	12	24	36	36	48	60	60	72	72	84	96
t-Sig	2/4	3/4	4/4	5/4	6/4	7/4	8/4	9/4	10/4	11/4	12/4

Table 2.17

Whilst undertaking my BMus in Composition and Contemporary Music degree at RWCMD, my composition tutor Peter Reynolds said something in a one-to-one lesson that had a profound impact on my compositional output: 'The best string quartets are trios.' It seemed initially contradictory but from that sentence one can surmise that although there is a quartet of performers, a string quartet is in fact made up of several smaller ensembles: solos, duets and trios.

Solos		**Duets**		**Trios**		**Quartets**	
1	Vln.1	1/2	Vln.1/Vln.2	1/2/3	Vln.1/Vln.2/Vla.	1/2/3/4	Vln.1/Vln.2/Vla./Vc.
2	Vln.2	1/3	Vln.1/Vla.	1/2/4	Vln.1/Vln.2/Vc.		
3	Vla.	1/4	Vln.1/Vc.	1/3/4	Vln.1/Vla./Vc.		
4	Vc.	2/3	Vln.2/Vla.	2/3/4	Vln.2/Vla./Vc.		
		2/4	Vln.2/Vc.				
		3/4	Vla./Vc.				

Table 2.18

Bar	**Ensemble**	**Bar**	**Ensemble**
1	Solo	7	Trio
2	Solo	8	Quartet
3	Duet	9	Trio
4	Solo	10	Quartet
5	Duet	11	Quartet
6	Duet/Trio		

Table 2.19

Table 2.18 lists all fifteen variants of ensemble that can be derived from a string quartet. All bars except the sixth bar in the score (6/4) contain only one type of fundamental instrumentation (solo, duet, trio or quartet), with this central bar containing duets and trios in order for each instrumentation-type to be assigned to an equal number of bars (3 for each), as wells as acting as a quasi pivot-point within the work's structure. How these are assigned globally is shown in *Table 2.19*. One should note that the ensembles are entangled (bars 1-11, 2-10, etc.) so that where solos and duets are assigned in bars 1-5, quartets and trios (respectively) are assigned in bars 7-11. As there is only one type of quartet, the only ensembles that needed further assignment systems were solos, duets and trios and are discussed in Chapter Seven.

***Objects 3.1: Solo piece [1]*, for solo bass clarinet (2015)**

As is mentioned in Chapter Six, from this work onwards all parametric assignments are derived using point gestures without the use of random processes, or global pitch-class set projections to determine sectional distributions. Although t-Sigs in this work are derived from five dcs, each class contains only four numerator values, listed in *Table 2.20*.

	t-Sig sets			
1	2/4	4/4	6/4	8/4
2	4/8	6/8	8/8	10/8
3	5/16	7/16	9/16	11/16
4	6/32	8/32	10/32	12/32
5	8/64	10/64	12/64	14/64

Table 2.20

From these are derived five groups consisting of four different denominator classes, with the omitted class assigned using a 5x5 magic square. These groups are:

1. -1 (/4), leaves /8, /16, /32, /64
2. -2 (/8), leaves /4, /16, /32, /64
3. -3 (/16), leaves /4, /8, /32, /64
4. -4 (/32), leaves /4, /8, /16, /64
5. -5 (/64), leaves /4, /8, /16, /32

The work consists of 80 bars partitioned into four macro-sections of 20 bars that are in turn partitioned into five four-bar micro-sections. Each of these five micro-sections is constructed from one of the five groups shown above, with each 20-bar section containing one of each t-sig from *Table 2.20*. Therefore, each t-sig, appearing once per macro-section, appears four times throughout the work. In each occurrence of a given t-sig the micro-partitions are altered through permutation and are discussed in more detail later (see *Intra-bar partitions*, Chapter Nine). The system used to determine the internal denominator class order for each four-bar micro-section is discussed below.

$$\begin{array}{|ccccc|}\hline 25 & 13 & 1 & 19 & 7 \\ 16 & 9 & 22 & 15 & 3 \\ 12 & 5 & 18 & 6 & 24 \\ 8 & 21 & 14 & 2 & 20 \\ 4 & 17 & 10 & 23 & 11 \\ \hline\end{array} \text{ Mod. } = \begin{array}{|ccccc|}\hline 5 & 3 & 1 & 4 & 2 \\ 1 & 4 & 2 & 5 & 3 \\ 2 & 5 & 3 & 1 & 4 \\ 3 & 1 & 4 & 2 & 5 \\ 4 & 2 & 5 & 3 & 1 \\ \hline\end{array}$$

Ex.2.3

Ex.2.3 shows both the 5x5 magic square in its original form on the left and the result under a modulus to give the values 1, 2, 3, 4 or 5 on the right (termed a 5-Pg matrix). Each of the 5 values is assigned to a denominator class (see far-left column, *Table 2.20*). By using four of the five rows from the matrix above (omitting the row highlighted in red which is used as a form of constructive pivot), the four remaining rows (1, 2, 4 and 5) are assigned to bars 1-20, 21-40, 41-60 and 61-80 respectively, giving the omitted denominator set for each micro-section (*Table 2.21*).

Bars	**From *Ex.2.3***	**Omitted dc (per micro-section)**				
1...20	1: [5,3,1,4,2]	5 = - /64	3 = - /16	1 = - /4	4 = - /32	2 = - /8
21...40	2: [1,4,2,5,3]	1 = - /4	4 = - /32	2 = - /8	5 = - /64	3 = - /16
41...60	4: [3,1,4,2,5]	3 = - /16	1 = - /4	4 = - /32	2 = - /8	5 = - /64
61...80	5: [4,2,5,3,1]	4 = - /32	2 = - /8	5 = - /64	3 = - /16	1 = - /4

Table 2.21

More prevalent in this work's constructive devices is the use of 4x4 magic squares, or 4-Pg matrixes, derived using the same methods as the 5-Pg matrix above and shown in *Ex.2.4* below.

9	6	3	16		1	2	3	4
4	15	10	5	Mod.	4	3	2	1
14	1	8	11		2	1	4	3
7	12	13	2		3	4	1	2

Ex.2.4

In *Ex.2.4* the resulting 4-Pg matrix is shown on the right. From this are derived three further 4x4-Pg matrixes based on rows 2, 3 and 4, shown in *Ex.2.5* below. As can be seen, each of these is assigned to a macro-section, becoming the fundamental source for assigning parametric values.

1 Bars 1-20				2 Bars 21-40				Bars 41-60				Bars 61-80			
1	2	3	4	4	3	2	1	2	1	4	3	3	4	1	2
4	3	2	1	1	2	3	4	3	4	1	2	2	1	4	3
2	1	4	3	3	4	1	2	1	2	3	4	4	3	2	1
3	4	1	2	2	1	4	3	4	3	2	1	1	2	3	4

3 4

Ex.2.5

As each 20-bar section is partitioned into five four-bar micro sections, five 4-Pgs are needed to determine the internal denominator class order for each micro-section. As can be seen in *Ex.2.5*, the matrixes are split into four squares, with an additional central square (highlighted in red) making five. The resulting 4-Pgs for bars 1-20 are shown below.

1. [1,2,4,3]
2. [3,4,2,1]
3. [2,1,3,4]
4. [4,3,1,2]
5. [3,2,1,4]

The fifth 4-Pg, in this case [3,2,1,4], is always assigned to the central (third) micro-section and determines the 4-Pg assignments for the first, second, fourth and fifth, with each 4-Pg assigned to the top row of another 4-Pg matrix. This central 4-Pg is analogous to the 5-Pg highlighted in *Ex.2.3*, acting as a constructive pivot around which sectional point gesture sets can be assigned, the results of which are shown in *Ex.2.6*.

Bars 1-4

2	1	3	4
4	3	1	2
1	2	4	3
3	4	2	1

Bars 5-8

3	4	2	1
1	2	4	3
4	3	1	2
2	1	3	4

Bars 9-12

3	2	1	4
4	1	2	3
2	3	4	1
1	4	3	2

Bars 13-16

1	2	4	3
3	4	2	1
2	1	3	4
4	3	1	2

Bars 16-20

4	3	1	2
2	1	3	4
3	4	2	1
1	2	4	3

Ex.2.6

Only the top row of each matrix in *Ex.2.6* is used for determining the denominator class (dc) order. The numbers 1-4 contained in each 4-Pg are assigned to the four remaining dcs after omissions. In *Table 2.21* there are five columns contained under 'Omitted dc (per micro-section)', with each column corresponding to a four-bar micro-section: bars 1-4, 5-8, 9-12, 13-16 and 17-20 (of each macro-section). In each case, '1' is assigned to the dc with the largest unit, with values 2, 3 and 4 assigned to dcs with smaller units. For example, bars 1-4 of section 1 has the /64 dc omitted, leaving /4, /8, /16 and /32. In *Ex.2.6* the top row of this section's 4-Pg matrix has the 4-Pg [2,1,3,4], which gives the dc order as /8, /4, /16, /32. This can be verified in bars 1-4 of the score.

Point gesture matrixes are used extensively in the works that follow, becoming an integral compositional device that brings unity to the constructs in the work. All parameters, global and local, are formed from matrixes derived using similar methods to those above and as was shown above and in greater detail in the dedicated chapters concerning the works from *Objects 3.1* to *Objects 7*, this method of composition enables the composer to create a large amount of possible outcomes from a very limited set of source gestures, typically 3- and 4-Pgs.

***Objects 4: Vocalised Objects – The New Ennui*, for 2 mezzo-sopranos, bass clarinet, French horn, vibraphone and double bass (2010-2016)**

This work is split into four 'Paragraphs', each of which contains six 'word sections' setting a total of 24 words from Christian Bök's book of poetry *Eunoia*, with *Objects 4* setting the section titled *The New Ennui* (which appears on pages 103 to 105 in the first edition copy). As will be outlined in Chapter Eleven, the pitch-class content is initially derived from the words set, which are split into between two and eight word partitions, which multiplied by 3 gives the pitch-class content for that word section. Therefore, the vocalists and ensemble are assigned 1/3 and 2/3 of the material respectively.

Objects 4 is the first work to split t-Sigs, in this case into three smaller t-Sigs of relatively equal size, for example 11/8 is split into 4/8, 3/8, 4/8. There are eight fundamental t-Sigs, three of which are assigned to each word section. As is shown in *Table 2.22*, the t-Sig sets with the longest combined duration are assigned the word section with the fewest pitch classes, to the section with the most pitch classes the shortest duration in order to exaggerate the differences in impulse saturation levels.

t-Sig sub-sets				Duration	P-c content
A	11/8	13/8	17/8	Longest	Fewest
B	13/8	17/8	19/16		
C	17/8	19/16	23/16		
D	19/16	23/16	29/32		
E	23/16	29/32	31/32		
F	29/32	31/32	37/32	Shortest	Most

Table 2.22

The secondary t-sigs are split into 1, 2 or 3 quaver and/or crotchet partitions. For example, 4/8 has 3 partitions: quaver – crotchet – quaver, and these are listed in Appendix 11.2. The rests in Appendix 11.2 are areas in which no impulses occur, with impulses only occurring within the quaver and crotchet partitions that are not assigned as rests.

Fundamental	**Secondary t-Sigs**	**Partitions**
11/8	4/8, 3/8, 4/8	3, 3, 3
13/8	4/8, 5/8, 4/8	3, 3, 3
17/8	6/8, 5/8, 6/8	3, 3, 3
19/16	3/8, 7/16, 3/8	3, 2, 3
23/16	4/8, 7/16, 4/8	3, 2, 3
29/32	5/16, 9/32, 5/16	2, 1, 2
31/32	5/16, 11/32, 5/16	2, 1, 2
37/32	6/16, 13/32, 6/16	2, 1, 2

Table 2.23

The reduction in available impulse partitions from 11/8 (9) to 37/32 (5) shown in *Table 2.23*, coupled with the increase in p-c content (as well as durational differences) shown in *Table 2.22*, further exaggerates and reinforces the relative density or saturation level of a given section. The F-Sigs are internally ordered within the word section using point gestures in a similar way as those used in *Objects 3.1* and are discussed further in Chapter Eleven.

***Objects 5: Vocalised Objects 2 – Five short studies in the superimposition of point gestures*, for two mezzo-sopranos (2017)**

Whereas in *Objects 4* there were six sets of three F-Sigs, each of the five studies in *Objects 5* is assigned a set of four F-Sigs, listed in *Table 2.24*. The total duration (in quaver units) was calculated for each, with the longest to shortest assigned A to E respectively. Combined with the outcomes in *Table 2.25*, this assigns the study with the fewest number of pitch classes the set with the longest total duration, the most with the shortest. The words are split into their respective letters, with the word with the most letters assigned the F-Sig set with the shortest combined duration, the least letters the longest. In *Belvedere* and *Monochord* the number of letters is the same, so vowel content was taken into account to differentiate between the two. With four F-Sigs in each study, all of which are partitioned into three secondary t-Sigs, each study is 12 bars in duration.

T-sig sets				Quavers	
11/8	13/8	17/8	19/16	50.5	**B**
13/8	17/8	19/16	23/16	51	**A**
17/8	19/16	23/16	29/32	45.25	**C**
19/16	23/16	29/32	31/32	36	**D**
23/16	29/32	31/32	37/32	35.75	**E**

Table 2.24

Words	Letters	Vowels	Cons.	P-c	t-Sig set
P a r a l l a x	8	3	5	16	**B**
B e l v e d e r e	9	4	5	18	**D**
G i n g i v i t i s	10	4	6	20	**E**
M o n o c h o r d	9	3	6	18	**C**
T u m u l u s	7	3	4	14	**A**

Table 2.25

Appendix 13.1 lists the assigned 4-Pg matrixes for each of the five studies, with the top row of each used to assign the order of t-Sigs for each study. The values 1-4 assign the corresponding numerator value of the t-Sigs used, with '1' assigned to the lowest value and '4' to the highest. So for *Parallax* the 4-Pg is [2,1,4,3] which gives the t-Sig outcomes 13/8, 11/8, 19/16, 17/8.

***Objects 6.1-6.3 – Studies for 3 wood blocks* (2017-2018)**

Strategies for t-Sig use in *Objects 6.1*, *6.2* and *6.3* are some of the more simplistic in my compositional output, with *Objects 6.1* containing 18 3/4 bars only. As there is nothing more to add with *Objects 6.1* the following text will only focus on *Objects 6.2* and *6.3*.

Objects 6.2: 1P+2sim Gestures

Objects 6.2 uses six different t-Sigs that are split into two groups containing one and two partitions, shown in *Ex.2.7*. One will see from the example that group A t-Sigs successively add a semiquaver rest either side of the central crotchet partition (left to right in *Ex.2.7*) and group B t-Sigs successively add a semiquaver rest between the two crotchet partitions.

Ex.2.7

	t-Sigs	Ptns.
A1	6/16	1
A2	4/8	1
A3	10/16	1
B1	9/16	2
B2	5/8	2
B3	11/16	2

Table 2.26

Each three-bar section contains three different t-Sigs from *Table 2.26*, ordered either A,B,A or B,A,B. Groups A and B are coupled with a defined set of three 3-Pgs, {1,4,5} (A) or {2,3,6} (B), derived from the two fundamental 3x3-Pg constructs (*Ex.2.8*). *Ex.2.9* lists the assignment of fundamental 3-Pgs as well as the method by which the specific t-Sigs are assigned. The entangled 6-Pg [1,4,2,5,3,6] assigns the corresponding 3-Pg to sections 1-6, with its entangled partner (highlighted in red) assigning the specific t-Sigs.

A	**1 - [1,2,3]**
	4 - [2,3,1]
	5 - [3,1,2]
B	**2 - [1,3,2]**
	6 - [3,2,1]
	3 - [2,1,3]

Ex.2.8

Section 1				**Section 2**				**Section 3**			
1 - [1,2,3]	A	3	10/16	4 - [2,3,1]	A	2	4/8	2 - [1,3,2]	B	3	11/16
[3,2,1]	B	2	5/8	[2,1,3]	B	1	9/16	{3,1,2]	A	1	6/16
	A	1	6/16		A	3	10/16		B	2	5/8
Section 4				**Section 5**				**Section 6**			
5 - [3,1,2]	A	1	6/16	3 - [2,1,3]	B	2	5/8	6 - [3,2,1]	B	1	9/16
[1,3,2]	B	3	10/16	[2,3,1]	A	3	10/16	[1,2,3]	A	2	4/8
	A	2	4/8		B	1	9/16		B	3	11/16

Ex.2.9

Objects 6.3: 3sim Gestures

The t-Sigs used in *Objects 6.3* are the same as those used in *Objects 6.2* but with an additional third set containing t-Sigs with three partitions (*Table 2.27*). Like *Objects 6.1* and *6.2*, this work is also in six sections, with each section containing each t-Sig once.

	t-Sig	**Ptns.**		**t-Sig**	**Ptns.**		**t-Sig**	**Ptns.**
1	6/16	1	1	9/16	2	4	14/16	3
2	4/8	1	2	5/8	2	5	8/8	3
3	10/16	1	3	11/16	2	6	18/16	3

Table 2.27

The order of the t-Sigs is determined by using a 3-Pg and 6-Pg; 3-Pgs order the t-Sigs with one partition and 6-Pgs the t-Sigs with two and three partitions. In each 9-bar section, t-Sigs with one partition are assigned to bars 1, 5 and 9 and t-Sigs with two and three partitions are assigned to bars 2-4 and 6-8. The outcomes for section 1 are listed in *Table 2.28*, below.

	Bar 1	**Bar 2**	**Bar 3**	**Bar 4**	**Bar 5**	**Bar 6**	**Bar 7**	**Bar 8**	**Bar 9**
[1,3,2]	[1				3				2]
	6/16				10/16				4/8
[1,2,4,3,5,6]		[1	2	4		3	5	6]	
		9/16	5/8	14/16		11/16	8/8	18/16	

Table 2.28

As in *Objects 6.2* (*Ex.2.9*) the diagonal 3-Pg from the 3-Pg matrix assigned is used to order the t-Sigs with one partition from *Table 2.27*, assigned on a gradient with '1' assigned to the shortest, '3' to the longest t-Sig. The fundamental assignments for 3-Pgs and 6-Pgs are listed in *Table 2.29*, below.

6-Pgs		**3-Pgs**	**Diag.**
[1,2,3,4,5,6]	Not used		
[1,2,4,3,5,6]	Section 1	1 - [1,2,3]	[1,3,2]
[1,3,2,5,4,6]	Section 2	5 - [3,1,2]	[3,2,1]
[1,3,5,2,4,6]	Section 3	4 - [2,3,1]	[2,1,3]
[1,4,2,5,3,6]	Section 4	3 - [2,1,3]	[2,3,1]
[1,4,5,2,3,6]	Section 5	2 - [1,3,2]	[1,2,3]
[1,5,3,4,2,6]	Section 6	6 - [3,2,1]	[3,1,2]
[1,5,4,3,2,6]	3-Pgs		

Table 2.29

***Objects 7: Trio Migrations*, for nonet (2018)**

As is extensively explained in Chapter Sixteen, in each of the six sections of this work the nine instruments (flute, clarinet, bassoon, French horn, trumpet, bass trombone, violin, viola and cello) are split into a root trio and a complementary ensemble derived from the remaining six instruments and ranging in size from solo to sextet. The work was originally conceived as having the fundamental trio ensemble always playing at a metronome mark of quaver = 60, with the complements playing in up to three different tempi derived using five factors of the number 60: 2, 3, 4, 5 and 6, with these values also used for t-Sig numerators. The t-Sigs used are 2/4, 3/4, 4/4, 5/4 and 6/4. Three sub-sets were delineated from these five and assigned the letters A, B and C:

{2,3,4,5,6}			Ratio	Q =			Ratio	Q =			Ratio	Q =
A - {2,3,4}	**A**	**1**	2:4	30	**B**	**1**	3:5	36	**C**	**1**	4:6	40
B - {3,4,5}	{2,3,4}	**2**	2:3	40	{3,4,5}	**2**	3:4	45	{4,5,6}	**2**	4:5	48
C - {4,5,6}		**3**	3:4	45		**3**	4:5	48		**3**	5:6	50
		4	4:3	80		**4**	5:4	75		**4**	6:5	72
		5	3:2	90		**5**	4:3	80		**5**	5:4	75
		6	4:2	120		**6**	5:3	100		**6**	6:4	90

Table 2.30

As *Table 2.30* shows, six tempi were derived using ratios from the three values in each set, with two sets (A/B, A/C or B/C) appearing in each of the six sections. Each of these sections is partitioned into six sub-sections, based on the six variants of trio possible from a nonet considering the number of instrumental families (F) and the number of ranges (R, based on vertical position in the score). Listed below are the instruments numbered (1-9) and the six variants of trio (1F3R, 2F3R, etc.).

		Trio				**Variants**	**Per section**
1	Fl.						
2	Cl.	1F3R	{1,2,3}	{4,5,6}	{7,8,9}	3	1
3	Bsn.	2F3R	{1,2,6}	{1,2,9}	etc.	18	3
4	Hn.	2F2R	{1,2,4}	{1,2,5}	etc.	36	6
5	Tpt.	3F1R	{1,4,7}	{2,5,8}	{3,6,9}	3	1
6	Tbn.	3F2R	{1,4,8}	{1,5,8}	etc.	18	3
7	Vln.	3F3R	{1,5,9}	{1,6,8}	etc.	6	1
8	Vla.						
9	Vc.						

Table 2.31

As can be seen in the 'Per section' column of *Table 2.31*, each trio-type has 3, 6, 18 or 36 variants in total, and within each section there are 1, 1, 3 and 6 of these variants assigned respectively. Totalling the 'Per section' column of *Table 2.30* (1+3+6+1+3+1) gives 15 trios per section, and with two bars per trio this gives 30 bars for each of the six macro-sections. 2F3R, 2F2R, 3F2R and 3F3R trios are each assigned once across the work and 1F3R and 3F1R trios are assigned twice.

With two t-Sig sets assigned to each 30-bar section, the six trio variants above are split into two groups of three trios, with Group 1 consisting of eight two-bar sections, Group 2 seven. In the far left of *Table 2.32* there are six couplings of t-Sig sets, with the first letter assigning t-Sigs to Group 1 and the second letter to Group 2. The root entangled 6-Pg used for the work, [1,5,3,4,2,6], is used to assign the t-Sig set couplings for each of the six sections (highlighted in red, first row down).

			Sections 1-6					
			1-1	2-5	3-3	4-4	5-2	6-6
1 - A/B		1F3R	A	C	B	B	A	C
2 - A/C	**Group 1**	2F2R	A	C	B	B	A	C
3 - B/C		3F1R	A	C	B	B	A	C
4 - B/A		2F3R	B	A	C	A	C	B
5 - C/A	**Group 2**	3F2R	B	A	C	A	C	B
6 - C/B		3F3R	B	A	C	A	C	B

Table 2.32

With the basic t-Sig sets assigned to each of the six sections, 6-Pgs are used again to assign the specific ratios listed in *Table 2.30*. In Chapter Sixteen it is explained that six entangled 6-Pgs were derived from the fundamental [1,5,3,4,2,6] by rotating the first three values ([1,5,3]) one space to the left and assigning the entangled values to the corresponding antipode in the second half of the 6-Pg (see left of *Ex.2.10*), and were used to assign the basic complementary ensembles (1-6 performers) for each trio-type. To order t-Sigs these 6-Pgs have order position 1,2,3 and 4,5,6 switched so, for example, [1,5,3] from [1,5,3,4,2,6] now appears in the second half of the 6-Pg, [4,2,6] in the first. These are listed on the right in *Ex.2.10*.

	Compliments	**t-Sigs**
1	[1,5,3,4,2,6]	[4,2,6,1,5,3]
2	[5,3,1,6,4,2]	[6,4,2,5,3,1]
3	[3,1,5,2,6,4]	[2,6,4,3,1,5]
4	[4,6,2,5,1,3]	[5,1,3,4,6,2]
5	[2,4,6,1,3,5]	[1,3,5,2,4,6]
6	[6,2,4,3,5,1]	[3,5,1,6,2,4]

Ex.2.10

The 6-Pgs are used to assign t-Sigs to each trio-type globally in three groups: 2F2R, 2F3R/3F2R, and 1F3R/3F1R/3F3R. In *Table 2.33* the trio-types are listed chronologically from section 1 to 6, with a set of six 6-Pgs assigned to each group by using the first three values of [1,5,3,4,2,6] (see Appendix 2.1 for the full list).

		1		[1,5,3,4,2,6]				**5**		[5,3,1,6,4,2]	
	1	[4,2,6,1,5,3]	**S1**	**1**	[4,2,6,1,5,3]		**1**	[1,3,5,2,4,6]	**S1**	**5**	[6,4,2,5,3,1]
	2	[2,6,4,3,1,5]	**S2**	**5**	[3,5,1,6,2,4]		**2**	[3,5,1,6,2,4]	**S2**	**3**	[5,1,3,4,6,2]
2F2R	**3**	[6,4,2,5,3,1]	**S3**	**3**	[6,4,2,5,3,1]	**2F3R**	**3**	[5,1,3,4,6,2]	**S3**	**1**	[1,3,5,2,4,6]
	4	[1,3,5,2,4,6]	**S4**	**4**	[1,3,5,2,4,6]	**3F2R**	**4**	[2,6,4,3,1,5]	**S4**	**6**	[4,2,6,1,5,3]
	5	[3,5,1,6,2,4]	**S5**	**2**	[2,6,4,3,1,5]		**5**	[6,4,2,5,3,1]	**S5**	**4**	[2,6,4,3,1,5]
	6	[5,1,3,4,6,2]	**S6**	**6**	[5,1,3,4,6,2]		**6**	[4,2,6,1,5,3]	**S6**	**2**	[3,5,1,6,2,4]

		3		[3,1,5]		
	1	[2,6,4,3,1,5]	**S1**	**3**	[4,2,6,1,5,3]	[4,2,6]
	2	[6,4,2,5,3,1]	**S2**			[1,5,3]
1F3R **3F1R** **3F3R**	**3**	[4,2,6,1,5,3]	**S3**	**1**	[2,6,4,3,1,5]	[2,6,4]
	4	[3,5,1,6,2,4]	**S4**			[3,1,5]
	5	[5,1,3,4,6,2]	**S5**	**5**	[5,1,3,4,6,2]	[5,1,3]
	6	[1,3,5,2,4,6]	**S6**			[4,6,2]

Table 2.33

As the process is the same for each section, the following text will outline the process for section 1 only (bars 1-30 in the score). In *Table 2.32* the t-Sig sets assigned to section 1 are A (1F3R, 2F2R, 3F1R) and B (2F3R, 3F2R, 3F3R). One can see from *Table 2.33* and *Table 2.34* that 2F2R trios are ordered using the 6-Pg [4,2,6,1,5,3], 3F2R and 2F3R share [6,4,2,5,3,1] and 1F3R, 3F1R and 3F3R are ordered using [4,2,6].

	Bars	**Trio**	**t-Sig set**	**From 6-Pg**	**Ratio**	**Met. Mark**	**t-Sigs**
	1,2	1F3R	A	4	4:3	80	3/4 3/4
[4,2,6,1,5,3] 2F2R	3,4	2F2R	A	4	4:3	80	3/4 3/4
[6,4,2, 3F2R	5,6	2F2R	A	2	2:3	40	3/4 3/4
5,3,1] 2F3R	7,8	2F2R	A	6	4:2	120	2/4 2/4
[4 1F3R	9,10	2F2R	A	1	2:4	30	4/4 4/4
2 3F1R	11,12	2F2R	A	5	3:2	90	2/4 2/4
6] 3F3R	13,14	2F2R	A	3	3:4	45	4/4 4/4
	15,16	3F2R	B	6	5:3	100	3/4 3/4
	17,18	3F2R	B	4	5:4	75	4/4 4/4
	19,20	3F2R	B	2	3:4	45	4/4 4/4
	21,22	2F3R	B	5	4:3	80	3/4 3/4
	23,24	2F3R	B	3	4:5	48	5/4 5/4
	25,26	2F3R	B	1	3:5	36	5/4 5/4
	27,28	3F1R	A	2	2:3	40	3/4 3/4
	29,30	3F3R	B	6	5:3	100	3/4 3/4

Table 2.34

As mentioned at the start of this section, the ratios assigned gave a tempo for the complementary ensemble, with the second number in the ratio assigning the t-Sig numerator. However, during the pre-compositional process the superimposition of multiple tempi resulted in significant notational issues in regards to spacing that would have taken too long to rectify. As the work became ever more refined and defined in the pre-compositional process it became apparent that the use of different tempi superimposed was an unnecessary complication. Although the notational issues played a role, the system devised for the distribution of gestures was more significant removing this aspect of the work as it already in part allowed for the superimposition of different gestures, on the trio and complement, so doing this using a different tempi was superfluous to the desired outcomes. This is explained in greater detail in Chapter Sixteen.

The strategies outlined in the previous pages offer a plethora of possible compositional strategies for the allocation of time signatures. Their use has shifted significantly from the first two proto-quantum works, where specific material-types were assigned to different time signature denominator classes as well as the superimposition of said material when a time space shares the same length as another from a different class. One can see a significant shift from *Probability Interpretation* to *Objects 7* in both the total number of different time signatures used and the sonic palette that the works employ, which I have previously termed a ‘distillation process’ whereby the compositional process and use of material becomes ever more sparse.

Although there is a noticeable shift in sonic outcomes across the works, what remains a constant throughout is that each work’s most fundamental construct, the framework of bars in which it exists, exhibits high levels of egalitarian and heterarchical traits that form the foundation from which this can imbued in all other mediated parameters. However, this foregrounding of the egalitarian nature of the work’s construction is only evident after analysing the score because, as stated at the start of this chapter, no pulse or sense of weak or strong beats is evident in any of my works, and there are no pronounced sonic markers from which the listener could gather such information easily.

This stems back to the evolution of the visual arts from the late 19th century to present day, where the modernist programme emancipated the arts from representational forms to higher levels of abstraction. As a composer situated in this modernist 'tradition', expressing the obvious is not an option in art; it is more in line with the entertainment industry than with my own vision of art. The use of time signatures, as well as the musical objects expressed in the works, combine with all other mediated parameters to produce free-floating and fragile sonic outcomes that are inherently problematic to realise.

3. Three proto-quantum works: 2009 – 2010

Being the first pieces written, the three ‘proto-quantum’ works are the initial attempts at a quantum aesthetic. One of the main focal points for each of the works was to set about devising egalitarian constructive devices across all mediated parameters. This is most easily observed in the use of time signatures, with each work using all available time signatures once. As discussed in Chapter Two, *Probability Interpretation* and *Two-Slit Experiments* use time signatures as a means by which to superimpose different types of material within the same time-space. *Entanglement* uses a different system to order its sets of time signatures, which is by superimposing and merging the bars partially in order to form time signatures of new length(s).

Entanglement is also different from *Probability Interpretation* and *Two-Slit Experiments* by the way in which it uses the pitch-class content assigned in the work. With the pitch-class content expressed as a line on each instrument (with the pitches realised on a gradient of close to wide proximity), there is no superimposition of different forms of material besides sustained or un-sustained impulses. A key motivation for this is that the majority of fundamental time signatures are merged with one or two others depending on the somewhat similar considerations found in *Probability Interpretation* and *Two-Slit Experiments*, described in the text on *Entanglement* as being more or less ‘complete’, and is used to delineate t-Sigs that can or can not be merged with others.

Heavily dependent on stochastic processes and notions from physics to delineate sonic outcomes, these works do not share the same level of abstraction that the later works achieve. Random processes were used extensively to reduce composer input and intent, with the ability of myself to assign outcomes through personal choice limited due to the random processes deciding the final outcomes. As well as reducing the degree to which the composer can determine outcomes through personal choice or emotional whim, it is also a reflection of the probabilistic nature of physics at the quantum level. Where classical physics is deterministic in nature and has been used successfully for centuries to accurately describe the world we see, the laws of classical physics break down at the smallest scales (such as the mechanics of fundamental particles, for example), with the development of quantum physics showing that at the smallest levels the laws of physics are *indeterminate* in nature, or random. To reflect this, the global structures in these works are typically ordered using pitch-class set projections at the largest scale (i.e. a large, defined section within a work), and random processes at the smallest scale (i.e. within a bar).

Some, but not all, of the compositional techniques present in these works were used or developed in the later works. As my aesthetic approach, some of the techniques outlined below were no longer required due to their inadequacy in efficiently assigning outcomes, a lack of mathematical and/or scientific knowledge, or by being superseded by more aesthetically and technically robust constructive and expressive methods.

Representation, or how the material within the work is constructed and projected, plays an important role in all of the works present in this thesis. It is also, due to aesthetic development, not completely consistent throughout, with the proto-quantum works expressing higher levels of surface level mimesis through devices such as the sonic representation of quantum spin in *Probability Interpretation,* or interference clusters in *Two-Slit Experiments,* representing the interference pattern created at the final stage of the scientific experiment from which the work gets its name.

3.1 *Probability Interpretation*, for cello and double bass (2009)

Like *Two-Slit Experiments* and *Entanglement*, *Probability Interpretation* took as its initial conception point an aspect or idea from physics, in this case the 'probability interpretation':

> **Probability interpretation** The interpretation suggested by Max Born that the *wave function* allowed only the probability of finding a particle at a particular location to be calculated. It is part and parcel of the idea that *quantum mechanics* can generate only the relative probabilities of obtaining certain results from the measurement of an *observable* and cannot predict which specific result will be obtained on a given occasion.[67]

These ideas from physics are only used to delineate fundamental material or modes of production for each work. From *Objects: Object Distributions* onwards, the modes of production employed in the proto-quantum works become more refined, with the works and my research no longer having a focus on ideas and theories from physics.

The key notion I took from the quote above is that there are only 'relative probabilities of obtaining certain results from the measurement of an *observable* and [that one] cannot predict which specific result will be obtained on a given occasion.'

[67] Kumar, M. (2009). *Quantum: Einstein, Bohr and the great debate about the nature of reality*. London: Icon Books Ltd, p.381.

From this I took an '*observable*' to be a musical object or event and a 'given occasion' to be a specific section within the work. This can be extrapolated further to the perspective of the listener, whereby the somewhat random-sounding nature of the realised work results in the listener not knowing with any real certainty what will be heard next. This of course is negated somewhat on repeat listenings of the same performance, but between different performances this is not the case as the inherent difficulty and physicality involved in realising the work means that it can never be realised perfectly or in exactly the same way in every performance. The following text will not focus on the indeterminate processes employed in the work but will instead focus on how the various material-types used in the work are formed, either in pure or modified form.

There are three fundamental material-types in the work, with each being assigned to a specific t-Sig denominator class (dc):

1. Dyads (/8s)
2. Glissandi (/16s)
3. Staccato points (/32s)

As was mentioned in Chapter Two, within time spaces of similar length, the combination of two or three t-sigs allows for the superimposition of two or three material-types, distributed between one or two instruments. This enables the parametric values of a given material-type to be transferred or 'tunnelled' into another, resulting in object modification. Before moving on to object modification, an outline of the broad trajectories for each dc is needed to provide a basis from which one can examine how and why the objects have been modified in the way that they have and what their salient characteristics are. At this point only an examination of the material in t-sigs in which there is only one type of material is required. This is to show the material in its 'pure form', unmediated by other material-types. Objects expressed in modified form will be discussed after.

/8s

Ex.3.1.1

As with all /8 class material:

- The temporal space in which the objects occur is always within the bass range of the instrument assigned
- The whole of the bar is subdivided into equally-sized impulse points, with the first always being expressed as a rest

Whilst these are held invariant throughout, the values for other parameters alter depending on their place within the linear realisation of a given dc (i.e. 2/8, 3/8… 13/8, see *Table 2.1*, Chapter Two). Within the context of a singular t-sig, for example the 2/8 shown in *Ex.3.1.1*, the micro-level detail assigned to the object(s) can be invariant or variant. In this example there are 4 accent-types, each assigned 3 times. In opposition to this, the dynamic marking is *ffff* throughout, so is held invariant. The projection of differing systems of realisation is an integral feature of my works and is achieved by de-coupling the parameters from their traditional combinations or contexts. By applying gradients to the parametric values the time it takes to determine the properties for each dc or t-Sig and composer choice after the systems have been delineated and enacted, is significantly reduced.

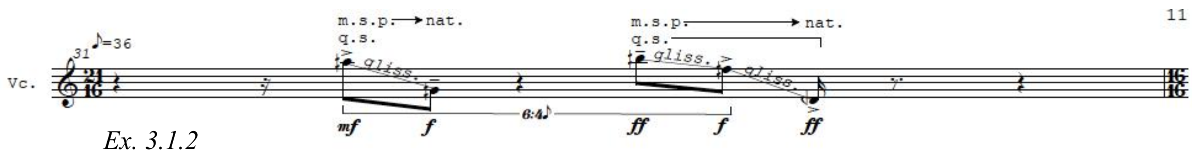
By doing so, the material expressed resists the appropriation of received material as the objects expressed are built from the ground up according to the principles delineated in the compositional process and not through the use of handed-down constructs such as form or other musical configurations informed by so-called ‘good practice’. The specific assignments that govern the realisation of objects within a t-Sig are not directly governed by the whim or ingrained desires of the composer but are instead logically delineated through small changes in the linear projection of the dc. By allowing systems to govern the outcomes of events within the work, with material being constructed and realised (for example the partitioning of material between instruments or instrumentation-types) using heterarchical as opposed to hierarchical methods of realisation, a more egalitarian approach to the creation of art objects can be achieved.

As shown below in *Table 3.1.1*, the quantising of material into discreet units, or 'quanta', is used to differentiate between t-Sigs within a dc. From 2/8 through to 13/8, the bars (in their pure form) become sparser, with fewer impulses and covering larger temporal distances. As there are bars with two or three material-types present and with all bars being assigned globally in a more or less random fashion, this linear progression is not heard or projected in any noticeable way in performance. Instead the bars become micro-events in the sense that even, although they are grouped together into 12 3-bar micro-sections, the specific t-sig assignments within these groups are delineated by the superimposition of systems governing the order of t-sig assignments specific to each dc. Similar systems and modes of realisation to those in *Table 3.1.1* are employed for /16 and /32 classes.

Bar	Tp-Layer	No. Pcs	Impulses	Dynmics	Accents
2/8	13:8	24	12	1	4
3/8	12:12	22	11	2	4
4/8	11:8	20	10	3	3
5/8	10:10	18	9	4	3
6/8	9:6	16	8	5	2
7/8	8:7	14	7	6	1
8/8	7:8	12	6	6	1
9/8	6:9	10	5	5	2
10/8	5:5	8	4	4	3
11/8	4:11	6	3	3	3
12/8	3:12	4	2	2	4 (2)
13/8	2:13	2	1	1	4 (1)

Table 3.1.1

/16s



Ex. 3.1.2

There are stark differences between /8 and /16 material, with tuplets no longer spanning the entire bar but being 'framed' by rests/silence. In some instances not all of the material will appear within the tuplet, with these 'outside' impulses being assigned using random processes. There is also a change in register, with /16 material always assigned to the treble register of the instrument(s) assigned. Gradated linear realisations are used to mediate the various parameters, including the number of glissandi, dynamics, impulse/pitch-class content, accents, tuplet-type and playing technique. This mode of production, whereby gradients of parametric values are applied to the linear realisation of a dc, is similarly employed in the /32 class.

/32s

Ex. 3.1.3

One can see that material assigned to the /32 class is the most fractured of all the material-types, always being realised without incorporating tuplets and as separated demisemiquavers, with a pitch range spanning four 12-note regions starting from the low C of each instrument (the double bass using the C extension). Where the /8 and /16 material would be assigned only to the bass and treble regions respectively, in /32 bars the difference in temporal displacements between successive notes, and the notes collectively, is far wider than in the other two dcs.

The following sections concentrate on the combination of two or three dcs. These sections will explore how the parametric assignments of the fundamental class are 'tunnelled' into either one or two other classes, and I will show that the slight altering of the parametric assignments of a given object dramatically changes those objects both visually and sonically.

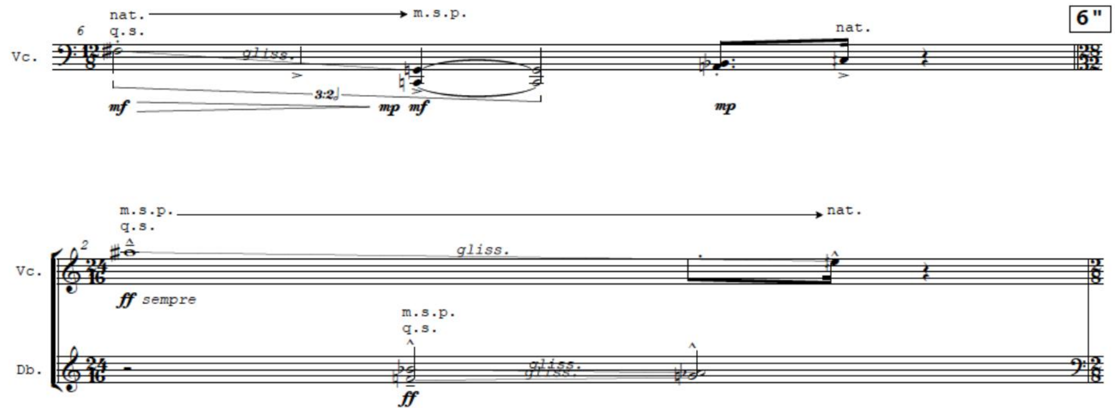
Object modification

Object modification is the key compositional process in *Probability Interpretation* and will be the focus of the following two sections. As mentioned above, in instances where t-sigs from different dcs are equal in size (such as 22/16 with 11/8, or 14/16 and 28/32 with 7/8), the combination of two or three similar t-sigs results in the 'tunnelling' of parametric values from one dc to the others present. For material contained in t-sigs that are not the fundamental of the bar in question (such as 20/16 in 10/8, or 14/16 and 28/32 in 7/8), the general rule for how the material is realised in these sections is that the relationship between the fundamental and non-fundamental t-sigs is non-reciprocal: the fundamental t-sig's parametric values are the only values that can be tunnelled into other dcs' objects.

Fundamental t-sig plus one other

As there are no instances in which /8 and /32 dcs combine as a pair, this section will only examine the combinations of 1) /8 and /16 and 2) /16 and /32 classes. In both examples, the realisations for each t-sig will be used to examine how the material has or has not been modified in each.

1. [**12/8**, 24/16] – [**24/16**, 12/8]



Ex.3.1.4

In *Ex.3.1.4*, the global assignments relating to impulse content for each dc present remain the same, albeit realised differently. There are no omissions of material in these examples but at other points in the work the superimposition of multiple dcs required material to be omitted because of the impossibility of their realisation. In these instances, the material for the *fundamental* t-sig would always be kept intact, resulting in omissions in the other parts.

The key features of the two material-types present in *Ex.3.1.4* are:

- 12/8: Four pitch classes expressed as two dyads and with differing articulations. There are two dynamic levels and all the material is realised in the bass clef. The playing techniques assigned are nat., q.s. (quantum spin) and m.s.p. (molto sul pont.).

- 24/16: Two pitch classes expressed as two points linked by a glissando and employing invariant articulation-types. There is one dynamic level and all material is realised in the treble clef. The playing techniques assigned are nat., q.s. and m.s.p.

In 12/8, because the /8 material must be fully realised, the glissando from the first point of the /16 material to the second point must be broken at the point where the dyad is assigned. The same glissando in the 24/16 bar is fully realised, being able to move from start to finish unbroken.

In 24/16, glissandi have been applied to the dyads and there are uniform articulation and dynamic level assignments between all parts. Where the /8 and /16 material in the 12/8 bar is realised in a relatively rigid fashion, in the 24/16 bars this is less so, given the nature of glissandi in combination. As can be seen, in /8 bars, dyads are not tunnelled into the /16 class material. Instead, other parametric values such as the articulation content are used to modify the assigned content.

2. [**17/16**, 34/32] – [**34/32**, 17/16]

By comparing the two realisations in *Ex.3.1.5* one will notice that in the 17/16 bar the first two points of the /32 material have been omitted. Mentioned above, the fundamental class will always be fully realised when combined with a t-sig of another class. Because of the restrictions of a solo instrument and the fact that the first two points of the /32 class appear within the area of the 5:4 tuplet in the /16 class, these impulses must be omitted. In the 34/32 example there are no restrictions on the material because there are two instruments, with both assigned a different material-type.

Ex.3.1.5

The key features of the two material-types present are:

- 17/16 has 9 pitch classes expressed as 9 semiquavers, with 5 glissandi in total. All the material appears in the treble range of the instrument and within a pitch range of roughly 2 octaves. There are 5 dynamic values and 2 types of articulations.
- 34/32 has 8 pitch classes, expressed a staccato demisemiquaver points dispersed over roughly 4 octaves. There are 4 dynamic values and 3 types of articulations.

As in *Ex.3.1.4*, the most obvious way in which the two realisations of the same material diverge is in how the material has been vertically displaced: 17/16 covers the range of the treble stave (roughly 2 octaves) whereas 34/32 incorporates both bass and treble ranges (roughly 4 octaves) and can be seen to have a relatively large effect on the difference between glissandi in both examples. In 17/16, the glissandi are limited to a narrow range, never exceeding the interval of a major 7^{th}, and are limited to the treble stave. However, in 34/32 the same glissandi are now spread across both the treble and bass ranges, creating glissandi spanning over 2 octaves in places. Because /32 material is realised as staccato points, the glissandi in 34/32 incorporate the use of finger glissandi as the articulations assigned are staccato in nature so the bow will be released from the string before the full duration of the point has been realised.

From the two examples outlined in this section, one will notice that not all the parameters are tunnelled from the fundamental class to that which it is combined with. In 12/8, the dyads of the /8 class are not tunnelled to the /16 class, and similarly in the 24/16 bar the dyads in the /8 class material are not realised as single points connected by glissandi. This restriction on the parameters tunnelled from the fundamental class to that which it is combined with results in each class keeping its distinct character, albeit in a modified form.

Fundamental t-Sig plus two others

Ex.3.1.6

As shown in Chapter Two (*Table 2.2*), there are 9 instances in which three dcs are combined within the same time-space. As the material is realised using the same compositional techniques in all 9 instances, only the set of t-sigs consisting of 8/8, 16/16 and 32/32 will be used, as in the previous section, to examine how the material has or has not been modified in each. From the three t-sigs shown in *Ex.3.1.6,* the tunnelling of certain parameters from the fundamental dc to the other dcs present gives sonic realisations in stark difference to each other. The material content for each dc is:

- 8/8: 6 double-stopped dyads in the bass range of the instrument, 6 dynamic levels (*mp – ffff),* 1 articulation (∧) and nat. playing technique.
- 16/16: 10 pitch classes appearing in the treble range of the instrument, 5 glissandi, 5 dynamic levels (*p – ff*), 4 articulations (∧, >, - and ·) and m.s.p. playing technique.
- 32/32: 12 pitch classes appearing throughout the bass and treble ranges, 6 dynamic levels (*pppp – mf*), 4 articulations (∧, >, - and ·) and s.p. (sul pont.) playing technique.

1. [**8/8**, 16/16, 32/32]

The /8 class material in the 8/8 t-sig from *Ex.3.1.6* is realised in its pure form, with all impulses appearing at their assigned location with none being omitted. Although each of the /8 class impulse points has been realised in the cello part, there are of course reductions in the durational values of this material. Because the articulation-type assigned to 8/8 is ∧, the impulses have an inherent reductive trait so will naturally be reduced in duration. One can also see in the top stave that the cello part incorporates some of the /32 class material. This may seem like a contradiction, as I have stated above that 'the material for the *fundamental* t-sig would always be kept intact.' However, with the assignment of '∧' articulations to the bar, the sonic results of the material assigned with this articulation will be of a detached, marked and percussive nature, so the durations of the assigned impulses will obviously sound shortened. This enables the performer to be able to play impulses from the /32 class between the /8 class dyads that appear shortened (dyads 3, 4 and 5) as these impulses would not be possible in the double bass part.

The /16 class material in this bar (double bass part) has been modified to incorporate 7:4 tuplets within the glissandi. This is common to all /16 class glissandi in bars where /8 is the fundamental class (7/8, 8/8, 9/8, 10/8, 11/8 and 12/8; bars 19, 23, 34, 1, 11 and 6, respectively). From these bars one will notice that the tuplet-types assigned form a linear progression, from a 3:2 tuplet in 12/8 to a measured tremolo (8 impulses) in 7/8. These assignments are directly related to the time-point layer assignments for the /8 class, listed in *Table 3.1.1* above.

The /32 class material in this bar (partitioned between the cello and double bass parts) remains relatively the same as it does in its original form, but is modified, like the /16 class material, by the assignment of invariant articulation-types (^ only) and a restricted temporal range in which it can appear (bass range of instruments). The total content is also somewhat reduced by assimilating one of the pitch classes into a glissando (4th /32 pitch class is contained within the 3rd 7:4 glissando). The dynamics assigned to the /8 class are also tunnelled into the /16 and /32 material.

2. [**16/16**, 8/8, 32/32]

With the material now assigned to the treble register, the 16/16 bar in *Ex.3.1.6* has the /8 class assigned to the double bass part and the /16 and /32 classes assigned to the cello part. There has been a decrease to only 5 dynamic values (*p – ff*) and with an increase in articulation-types to 4 (^, >, - and ·). The 16/16 bar is generally quieter, less abrasive and detached than the realisations in the 8/8 bar.

The /8 class material in the 16/16 bar is less fractured than that in the 8/8 bar example. Aided by the cello part's capacity to combine the /16 and /32 class materials, the double bass part concentrates solely on material from the /8 class. In this instance, the dyads are all connected by glissandi, with instances of finger glissandi being incorporated when the accent assigned is staccato in nature (either ^ or ·). The playing technique assignments in the double bass part are a reflection and augmentation of the assignments of the /16 class cello part, and whilst all of the impulses incorporate the q.s. technique, the movement from s.p. to m.s.p. is present throughout but is treated differently depending upon the material-type.

With the /16 and /32 material realised in the cello part, the impracticalities of superimposing multiple objects on a single instrument results in some of the /32 material being assimilated into the /16 material. This is achieved by the combination of double stopping and glissandi. As the double-stopped impulses only occur at the start of single note glissandi (for example, the 7th impulse in the cello part) these do not have the same sonic qualities as the double-stopped impulses in the double bass part because only one of the pitches has a glissando assigned. By referring to the double bass part in the 32/32 bar of *Ex.3.1.6* one can see that some of the impulses/pitch classes are assimilated into the glissandi assigned.

3. [**32/32,** 8/8, 16/16]

32/32 is the most fractured of the three realisations in *Ex.3.1.6*, most evidently manifested in the reduction of durational values for all materials present. Although the articulation content is the same as that of the 16/16 bar, the dynamics assigned (*pppp-mf)* are in large part at the quietest end of the spectrum, which in combination with the assigned playing techniques increases the fractured nature of the bar.

Both /8 and /16 classes are assigned to the cello part (top and middle staves, respectively). For the material to be superimposed effectively on the same instrument, some of the /16 glissandi (the 2nd and 4th) had to be omitted. Because /32 is the fundamental class, the vertical pitch displacements span the entire range of the instruments. The /8 class material is now dispersed over roughly 4 octaves and there are similar displacements in the /16 class material, with a noticeable difference in the distance a glissandi travels compared to those assigned in the 16/16 bar. Because some of the articulations assigned are of a staccato nature, the 2nd and 3rd glissandi are played as finger glissandi.

The /32 class material in the double bass part is realised in its pure form. As the playing technique is held invariant throughout, the articulation-types and changing dynamic assignments act as a counterpoint to the uniformity of the playing techniques. This treatment of playing techniques is in opposition to how the playing techniques are realised in the cello part. One will notice that the playing technique parameter of the /32 class is not tunnelled into the /8 class and is only slightly tunnelled into the impulses incorporating glissandi (s.p. → m.s.p.).

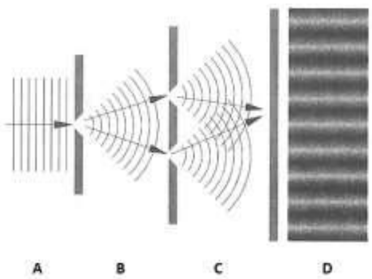
As I have shown, the tunnelling of parameters from one class to one or two others results in stark differences in how the material is realised both visually and sonically. By slightly altering the parametric values of a musical object, one can deconstruct and/or reconstruct the object from a different perspective. Being the first proper research into a unified aesthetic, there are some aspects of the work that are somewhat ad-hoc in nature, with perhaps some of the realisations being not as true to the work's principles as they should be, thus causing the integrity of the work to suffer somewhat. Nonetheless, given the sheer number of individual assignments in the work that have adhered strictly to the systems in place, the instances where the conceptual and constructive integrity of the work falters are minimal.

To create works of this nature, one must partition the workload by devising systems and constructive devices so that each parameter of the work is rigorously mediated and gradated in conjunction with all other parameters. The total systemisation of the work, determining each facet by logical reduction instead of emotional will, reduces the employment of ‘received material’: musical configurations or ‘objects’ that are preformed and have been handed-down through the various musical epochs. Avoiding received material in one's work is essential to critique the music one produces, the medium for which it is composed and by extension the society within which it was created. By employing these modes of production, the composer can work objectively and critically, clinically constructing works that achieve high levels of abstraction yet have a uniformity of conception and realisation.

It is through the abandonment of received material that the composer can create new means by which to construct art objects, and with traditional tonality (in the Western sense) shunned, one needs to abandon the hierarchical forms inherent to it. Through the compositional systems outlined above, form is now a by-product of the pre-compositional process, from which the systems and data sets of the work are realised, modified and applied in order for the form to take shape. Form is no longer governed by an historical imperative or imposed 'from above' but is instead realised through the gradual superimposition of systems governing every parameter of the work.

3.2 *Two-Slit Experiments* (2010): Partitioning, indeterminacy and initial research into the use of point gestures to determine macro- and micro-level parametric assignments

Composed in 2010, *Two-Slit Experiments* takes as its principal source of material a pictorial representation of the two-slit experiment, shown in *Ex.3.2.1*.



Ex.3.2.1

As shown, there are four stages to the experiment, demarcated A, B, C and D. From this are derived four material-types that were in turn assigned to bars of a specific denominator class:

A. /8 dc. 1-12 pitch classes (pcs), always realised as a sustained single pitch or chromatic cluster.

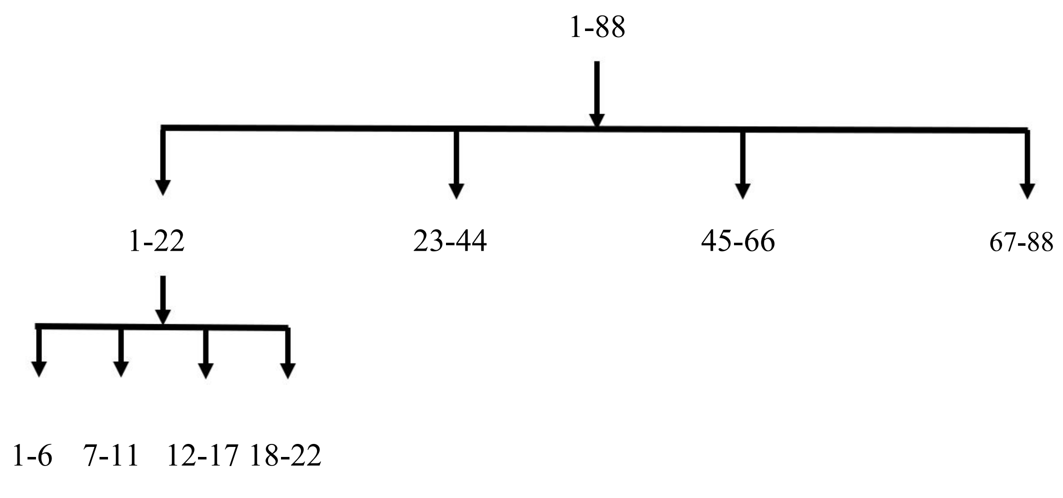
B. /16 dc. 2-24 pcs, always realised as sustained points.

C. /32 dc. 4-48 pcs, always realised as demisemiquaver dyads that are staccato in nature.

D. /32 dc also. Realised as 5- or 6-note semitonal clusters spanning the entire range of a standard piano and always played staccato.

As was the case in *Probability Interpretation*, there are instances in which t-sigs from different classes share the same temporal space value as one or two others, and some t-sigs that do not. These were listed in Chapter Two (*Table 2.4*), so within a bar there can be 1, 2, 3 or 4 material-types superimposed.

Each of these four material types is assigned to specific temporal regions of the piano, and in the initial stages of the compositional process the focus was on how to partition the piano in an effective way in order to present the different material-types objectively and cohesively. Taken as a whole, the standard piano has 88 keys.



Ex.3.2.2

In the tree diagram above, the 88 keys of the piano are partitioned into 4 regions consisting of 22 keys, with '1' being the lowest A of the piano and '88' the highest C. These four regions are then partitioned further into 6- and 5-note semitonal clusters, or interference clusters (ics), of which there are a total of 16. The partitioning in 1-22 above is repeated in the other 3 partitions (23-44, 45-66 and 67-88). As an example, *Table 3.2.1* shows the lowest 4 interference clusters which appear in the 1-22 pitch range. Highlighted in red are the 6-note clusters, in black the 5-note clusters. The specific assignments of interference clusters within a time-space are determined using stochastic processes, or random number generators, which are discussed later.

	1-22		
2	11 – G	22 - F#	**4**
	10 – F#	21 – F	
	9 – F	20 – E	
	8 – E	19 – D#	
	7 – D#	18 – D	
1	6 – D	17 – C#	**3**
	5 – C#	16 – C	
	4 – C	15 – B	
	3 – B	14 – A#	
	2 – A#	13 – A	
	1 – A	12 – G#	

Table 3.2.1

As well as partitioning of the piano keys to create interference clusters, the keys are also partitioned further for each dc, determining the vertical pitch displacement of the pitch classes assigned. The temporal space assignments for each dc reflect the general trajectory of material relations in the work, whereby the /8 dc has the least amount of material (1-12 pcs), the /16 dc having 2-24 pcs, and with finally the /32 dc having the most with 4-48 pcs (as well as interference clusters). This relates back to *Ex.3.2.1*, where as one moves from A through to C/D there is a move away and spreading out from an initial centre (A) towards an area encompassing all possibilities (C/D). Appendix 3.2.1 shows the temporal-space regions for each dc (highlighted in red).

Reading from left to right, one can see that the temporal-space allowance for each dc is double that of the previous class and spreads out from the initial central 22 keys in the /8 dc, to the 22 keys either side of the /8 dc giving the /16 dc a total of 44 keys, with finally the /32 dc having all 88 keys, partitioned into 4 regions of 22 keys (1-22, 23-44, 45-66, 67-88).

The combination of indeterminate and determinate systems in the compositional process has been a focus of mine and is employed on several levels in the work. As determinate and indeterminate systems are so closely related within the work it would be futile to discuss one without referencing the other so they are clarified together.

There are two ways in which indeterminacy is employed in this work. Either random processes alone (such as with interference cluster assignments, impulse points and tuplet placements) or random processes coupled with 3- or 4-point gestures (such as in *Table 2.5*, Chapter Two). Random processes alone are realised in two different ways and can be Markovian or non-Markovian in nature. Markovian and non-Markovian processes often appear within the same dc, with the dc split into 2 groups of 9 t-sigs (1-9, 10-18). Simplistically, a Markovian process is one in which the outcomes of one group are dependent on the outcomes of a previous group, and my interest in these processes stems from Toop's 'Four Facets of The New Complexity' article, as well as the music and writings of Iannis Xenakis. Determinate processes, such as outcomes produced through point gesture assignments, have in a sense properties or outcomes that can be predicted given enough prior knowledge. These will be discussed in relation to the material content for each t-Sig class below. Because the material content is not affected by dc superimposition, score examples will only be of bars containing one dc, specifically bars 9 and 54 (/8 class), 10 and 51 (/16 class) and 3 and 19 (/32 class).

Each dc is assigned distinct constructive principles regarding tuplet placement and realisation:

- /8 class tuplets last for the full duration of the bar, partitioning it into successively larger and fewer impulses
- The /16 class begins by encompassing the whole bar, but where it differs from the /8 class is that non-tuplet points are successively added either side of the tuplet assigned, whilst the area in which the tuplet appears is reduced.
- The /32 class has its tuplets successively reduce in total impulse content whilst successively increasing the time-space (in demisemiquaver units) in which it is realised.

The skeleton realisations of the above bullets are shown in Appendix 3.2.2.

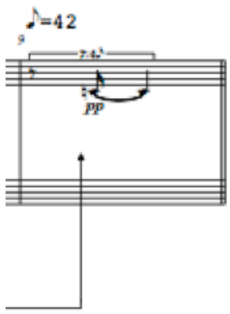
/8 class

The pc content of /8 bars is determined by employing a system that successively adds a semitone up from the pitch-class assigned, followed by a semitone down, until the aggregate is complete. *Table 3.2.2* shows how this is realised by projecting P-0 ([0,1,4,2,3,5,e,t,7,9,8,6]) across the linear representation of the /8 class, with the pitches of the set used as the fundamental T-level for the pitches within the cluster.

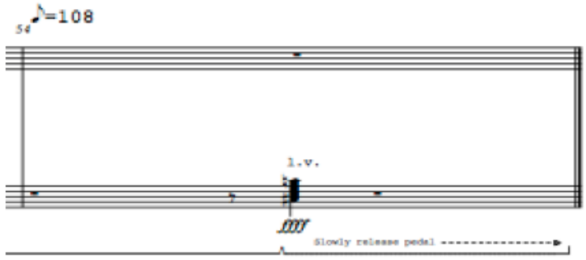
No. of p-c	T-Sig	p-c assigned
1	2/8, 3/8	**0**
2	4/8	**1**,2 (one up)
3	5/8, 6/8	3,**4**,5 (one up, one down)
4	7/8	1,**2**,3,4 (two up, one down)
5	8/8, 9/8	1,2,**3**,4,5 (two up, two down)
6	10/8	3,4,**5**,6,7,8 (three up, two down)
7	11/8,	8,9,t,**e**,0,1,2 (three up, three down)
8	13/8	7,8,9,**t**,e,0,1,2 (four up, three down)
9	14/8,	3,4,5,6,**7**,8,9,t,e (four up, four down)
10	16/8	5,6,7,8,**9**,t,e,0,1,2 (five up, four down)
11	17/8,	3,4,5,6,7,**8**,9,t,e,0,1 (five up, five down)
12	19/8	1,2,3,4,5,**6**,7,8,9,t,e,0 (six up, five down)

Table 3.2.2

Ex.3.2.3 and *Ex.3.2.4* are taken from bars 9 and 54 from the score, and these are the extremities of the /8 class, with 2/8 having the fewest pitches (1), and 19/8 the most (12). Referring back to *Table 3.2.2*, 2/8 has one pitch class (0, C natural) and 19/8 has the full aggregate, with F sharp the fundamental pitch and situated in the central partition of 22 keys shown in Appendix 3.2.1.



Ex.3.2.3



Ex.3.2.4

The impulse point within the bar for these two examples is derived slightly differently for each. As mentioned earlier, the t-Sigs for each class are split into two groups of nine sequential numerators, and for the /8 class these are 2/8-9/8 and 10/8-19/8. For 2/8-10/8, the entire bar has a tuplet assigned, with the tuplet numerators reducing from 7 to 2 from 2/8 to 10/8 (7:4 to 2:10 respectively). This can be seen in *Ex.3.2.3*, where the tuplet spans the entirety of the bar. For the impulse point, the first is never assigned in order to reduce any sense of a strong beat occurring, and for 2/8 to 10/8 a random number generator was used to decide which impulse point (minus the first) is assigned the cluster. The impulse then lasts the remainder of the bar. The random number generator gave the outcomes 3,5,4,2,5,3,2,3,2 (2/8-10/8 respectively), giving the third impulse assigned in *Ex.3.2.3*. For 11/8 to 19/8 tuplets are not used, instead there is only one impulse point available, determined by successively adding a quaver rest at the start of the bar. So, with 19/8, the ninth t-Sig of the sub-set 11/8-19/8, has nine quaver rests at the start of the bar and this can be seen in *Ex.3.2.4*.

/16 class

The /16 class is split into two groups, 11/16-19/16 and 20/16-28/16, and like the /8 class, the first group (11/16-19/16) has tuplets assigned and the second does not. In Appendix 3.2.2, as the number of possible impulse points increases the space in which it is situated decreases (2:11-10:3). As these reduce in size, possible impulse points outside of the tuplet increases, with the impulse outside of the tuplet assigned by random processes. The impulse/pc content for 11/16 to 19/16 is 2,2,4,6,6,8,10,10,12, with as many of these impulses as possible being allotted within the tuplet assigned. When there are more pcs than there are impulse points within the tuplet, a non-repetitive random number generator was used to assign which non-tuplet impulse point(s) are assigned. For 20/16 to 28/16, a non-repetitive random number generator was used that assigned the *omitted* impulse points.

Ex.3.2.5

Ex.3.2.6

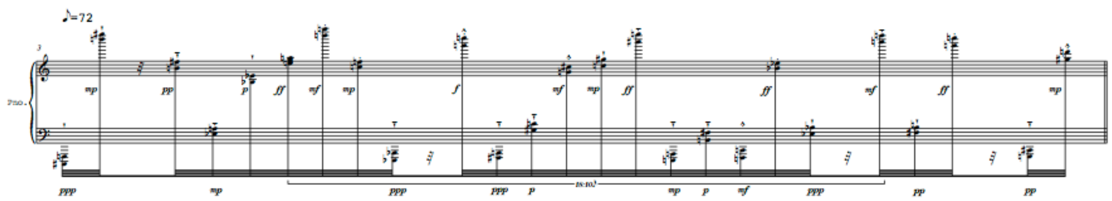
In *Ex.3.2.5* (19/16), above, there are twelve pitch classes assigned and only 10 available impulse points with the tuplet. The impulse points outside of tuplet are always expressed as semiquavers, with the total number of semiquaver impulse points calculated for each bar and a random number generator used to assign the impulse point(s). In *Ex.3.2.5* the outcomes for this are 11 and 13. With 22 pitches assigned to 27/16 (*Ex.3.2.6*), there are five omitted impulse points, assigned through a random process, with the outcome being 3, 7, 15, 19 and 23. This was achieved through a Markovian process, whereby in a linear realisation of 20/16 to 28/16, the omitted impulse numbers are not repeated in adjacent t-Sigs.

/32 class

The /32 class has two forms of material, demisemiquaver dyads and interference clusters that are both played staccato. Within a linear realisation, from 20/32 to 37/32, the number of dyads decreases whilst the number of interference clusters increases. Both the starting point for tuplets and impulse points for both forms of material are determined by random processes, with interference clusters assigned to the remaining impulses after the dyad positions had been finalised.

Split into two sets of nine t-Sigs, 20/32-28/32 has tuplets assigned and 29/32-37/32 does not. The outcomes for the first group are 3,7,9,6,1,2,5,8,4. *Ex.3.2.7* shows bar 3 (21/32), whose tuplet position outcome is the second value, 7, from the first group's outcomes, and as can be seen the tuplet begins on the 7th impulse point. In this bar there are a total of 29 possible impulse points, so to assign all of the 24 dyads a random process was used to picked five values between 1-29 (inclusive) and omitted those impulses, with the outcome being 3, 7, 11, 23 and 27. To assign the interference cluster a five-value random number generator was used with '2' the outcome, and this equates to '7' from the dyads outcome, therefore assigning the interference cluster to the 7th impulse point.

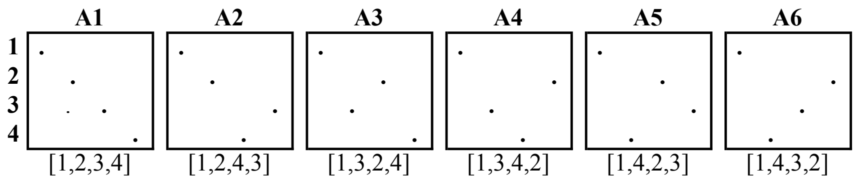
Ex.3.2.8 is a 37/32 bar, so appears at the other end of the /32 class spectrum, with two dyads and 16 interference clusters present. The dyads were assigned first, with the random outcome being impulse points 36 and 37. 16 of the remaining impulse points are assigned interference clusters, with the outcomes being impulse points 3, 4, 7, 8, 9, 10, 15, 16, 17, 19, 20, 21, 28, 30, 33 and 35.



Ex.3.2.7

Ex.3.2.8

The inherent efficiency of this process results in the fundamental architecture of the work being constructed in a relatively short time period. This reduction in the workload is reflected at the micro-level, where 4-pgs are used to assign the gestural content within /32 bars. Whilst the use of 3-Pgs is limited to the assignment of macro-level variables in this work (see Chapter Two, *Table 2.5*), the use of four-point gestures (4-Pgs) in this work takes this further by assigning both macro- and micro-level variables. There are 24 permutations of the numbers 1, 2, 3 and 4, of which the first 6 are shown in *Ex.3.2.9*.



Ex.3.2.9

In Appendix 3.2.1, the /32 dc is shown to employ the full range of the piano, partitioned into four 22-key regions. To each of these regions is assigned a 4-Pg value: 1 – 67-88, 2 - 45-66, 3 – 23-44, 4 – 1-22. This allows the key regions in which a dyad is to appear to be determined by assigning 4-Pgs to each bar in the class. The pc content for /32 material appears in multiples of four, giving 4-48 pcs. As these are dyads the impulse content is 2-24 impulses, giving between 0.5 and 6 4-pgs needing to be assigned to each bar. These are assigned from 20/32 to 37/32, most to least, and along Markovian principles, whereby a 4-Pg is only assigned again when the remaining 23 4-Pgs have been assigned. *Table 3.2.3* lists the outcomes for t-sigs 20/32 to 24/32, the D19 in 24/32 marking the first of the next group of 24 4-Pg assignments as it is the first repeated point gesture. One should also note that the gestures are assigned in groups of four, with each group containing one of each gesture-type (A, B, C and D).

T-Sig	Impulse.	No. of 4-Pgs	Specific 4-Pgs	
20/32	24	6	C15, A5, B9, D21	C16, D20
21/32	24	6	A6, B12	D19, C17, A3, B11
22/32	22	5.5	C18, B10, A1, D24	B7, D23 (0.5)
23/32	20	5	C14, A4	C13, B8, D22
24/32	20	5	A2	D19, B12, C15, A6

Table 3.2.3

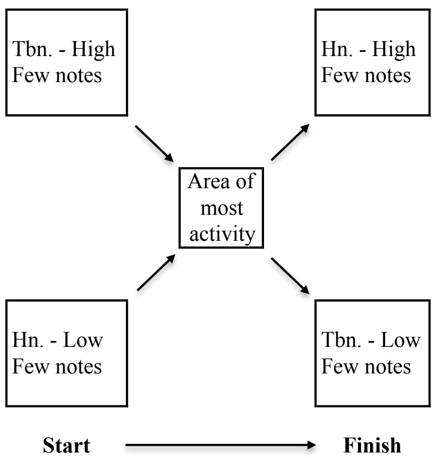
Two-Slit Experiments laid the foundations from which the use of point-gestures to derive macro- and micro-level parametric assignments became a key constructive device in my works. Stemming from initial research into Gordon Downie's *Piano Piece 3*, where Downie uses 3-Pgs to determine the sonic contours of trichordal arrays within the work[68], it became evident to me that this mode of production and realisation can be taken further to incorporate all macro- and micro-level variables pertaining to the construction of a musical object, providing a means by which to create works that had an inherent structural and conceptual integrity, with the various sections of the work relating back to a relatively small set of 3-Pgs and/or 4-Pgs.

[68] Programme note, Ian Pace recital, The Warehouse, London (28 April, 2006)

3.3 *Entanglement*, for French horn and bass trombone (2010)

> **Entanglement** A quantum phenomenon in which two or more particles remain inexorably linked no matter how far apart they are.[69]

Entanglement, for French horn and bass trombone, was completed in 2010 and is the third and final proto-quantum work. Each instrument has a broad global trajectory of high to low (bass trombone) and low to high (French horn). These global trajectories are reflected to a certain degree in all other parametric systems underpinning the work and makes *Entanglement* one of the more linear works in this sense. *Ex.3.3.1* outlines two of these trajectories: vertical-temporal pitch displacement and impulse content.



Ex.3.3.1

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[69] Kumar, M. (2009). *Quantum: Einstein, Bohr and the great debate about the nature of reality.* London: Icon Books Ltd., p.378.

How the impulses are expressed also reflects these trajectories, moving from sustained to un-sustained points moving towards the centre of the work, un-sustained to sustained thereafter. This notion of compositional extremes is a common thread in the works I compose, existing at a fundamental level in every parameter mediated. This is most clearly exhibited in the pitch-class or impulse content variable, which affects the saturation or density of a bar or section. In *Probability Interpretation* and *Two-Slit Experiments* the delineated material types, although mediated separately, are superimposed in bars that contain more than one t-Sig class. As shown in Chapter Two, the t-Sig classes in *Entanglement* are not used in the same way as they are in the other proto-quantum works, with the pitch-class content realised as single pitches on each instrument. These are differentiated by being either sustained or unsustained, with the propensity of each mediated using a statistical approach that is informed by the overarching structure of the work.

The pitch-class content ranges from 4 to 48 pitch classes, and are realised linearly in the work. Coupled with this system are the metronome mark assignments, which decrease towards (but not including) the centre and increase away from the centre, shown in *Table 3.3.1*. As shown in this table, the structural antipodes (bars 1-27, 2-26, etc.) share the same number of pitch classes and metronome marks; this is an example of how the scientific notion of entanglement is expressed in the work, forming links between the entangled bars.

Bar	1	2	3	4	5	6	7	8	9	10	11	12
Pitch Classes	4	6	8	12	16	20	24	28	32	36	40	44
Met. Mark (♪ =)	69	66	63	60	57	54	51	48	45	42	39	36
Bar	**13**	**14**	**15**									
Pitch Classes	48	48	48									
Met. Mark (♪ =)	72	72	72									
Bar	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**
Pitch Classes	44	40	36	32	28	24	20	16	12	8	6	4
Met. Mark (♪ =)	36	39	42	45	48	51	54	57	60	63	66	69

Table 3.3.1

The pitch classes in each bar are partitioned between the two performers and the rules for assigning these are the same as those for other entangled systems. In *Table 3.3.2*, the pitch-class content of a given bar is not necessarily evenly distributed between the performers, so for there to be an equal distribution of pitch classes across the whole work the values are switched in the second half. For example, bar 2 has 6 pitch classes, with 2 in the horn part and 4 in the trombone (2:4). Bar 2's entangled partner, bar 26, therefore has 4 in the horn part and 2 in the trombone (4:2).

Bar	1	2	3	4	5	6	7	8	9	10	11	12
pcs	4	6	8	12	16	20	24	28	32	36	40	44
Ptns.	2:2	2:4	4:4	8:4	8:8	8:12	12:12	12:16	16:16	20:16	20:20	24:20
Bar	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**
pcs	44	40	36	32	28	24	20	16	12	8	6	4
Ptns.	20:24	20:20	16:20	16:16	16:12	12:12	12:8	8:8	4:8	4:4	4:2	2:2

Table 3.3.2

The P-0 set for *Entanglement* is [0,9,t,e,2,1,5,8,7,6,3,4], with '0' being C natural, and is constructed using four 3-2 trichords (using Forte's terminology): [0,9,t], [e,2,1], [5,8,7], [6,3,4]. Also, the second hexachord is the inversion of the first. These sets are combined into combinatorial matrixes consisting of four 12-note sets and using all four forms (P, R, I and RI). Combinatorial matrixes have been used in all of my works except *Objects 6.1-3* and they provide a cohesive foundation from which to build pitch structures. In the works up to *Objects 2*, a large number of matrixes are used, delineated by fundamental sets (F-sets) which are assigned to the top row of the matrix, and the transposition level (T-Level) which determines which of the twelve pitch classes the set is based on.

For T-Levels and F-Sets to be assigned, three separate systems are used:

1. 4-Pgs were used to assign the F-Set type for each bar (P, I, R or RI)
2. Pitch-class set projections were employed to set the T-Levels for each bar
3. 3-Pgs were used to assign the combinatorial partner-type of F-Set assigned in 1 (above)

1. F-Set type for each bar

As these are assigned using 4-Pgs, the four set-types were assigned a number in the 4-Pg: P = 1, I = 2, R = 3, RI = 4. Omitting the central three bars, three 4-Pgs were chosen using a random number generator and assigned to bars 1-12. The three 4-Pgs chosen are C5 – [3,4,1,2], A2 – [1,2,4,3] and B3 – [2,3,1,4] (see Appendix 3.3.1). The outcomes for this are shown in *Table 3.3.3*.

Bar	1	2	3	4	5	6	7	8	9	10	11	12
F-Set	3 - R	4 - RI	1 - P	2 - I	1 - P	2 - I	4 - RI	3 - R	2 - I	3 - R	1 - P	4 - RI
Bar	16	17	18	19	20	21	22	23	24	25	26	27
F-Set	I	R	P	RI	P	I	RI	R	RI	R	I	P

Table 3.3.3

As can be seen, the retrograde of each F-Set in bars 1-12 is assigned at its antipode in bars 16-27, providing another example of entanglement in this work. However, it is not a like-for-like form of entanglement as was shown in *Table 3.3.2* but is instead a form of entangled states that assigns a different form of the object or parameter than in its original manifestation (in bars 1-12). This form of entanglement is used more often in the works that follow, assigning linked differences instead of similarities.

2. Pitch-class set projections

To determine T-levels for the F-sets assigned to each bar two pitch-class sets, R-0 for bars 1-12 and RI-5 for bars 16-27, are used, giving:

R-0: [6,3,4,5,8,7,1,2,e,t,9,0]

RI-5: [e,2,1,0,9,t,4,3,6,7,8,5]

There are a further three different orderings for each C-Matrix that assigns the set-type for the second row of the matrix, which in turn assigns the bottom two rows. For each F-Set, the three permutations of combinatorial partners were assigned 1, 2 or 3, and listed in *Table 3.3.4*, with *Table 3.3.5* listing the resulting c-matrix constructs.

	P	**I**	**R**	**RI**
1	P/I	I/P	R/RI	RI/R
2	P/R	I/RI	R/P	RI/I
3	P/RI	I/R	R/I	RI/P

Table 3.3.4

1	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
P	P	P	I	I	I	R	R	R	RI	RI	RI
I	R	RI	P	RI	R	RI	P	I	R	I	P
R	I	R	RI	P	RI	P	RI	P	I	R	I
RI	RI	I	R	R	P	I	I	RI	P	P	R

Table 3.3.5

The outcomes for bars 1-12 are shown in *Table 3.3.6*. To assign these, nine 3-Pgs were chosen through a random process using the number 1-6 giving the outcomes 2,5,1,4,6,3|1,4,6, which assigned the corresponding 3-Pg to a three-bar sub-group in bars 1-27 respectively.

Bar	**1**	**2**	**3**	**4**	**5**	**6**
F-Set	R	RI	P	I	P	I
3-Pg		2 - [1,3,2]			5 - [3,1,2]	
C-Sets	1 - R/RI	3 - RI/P	2 - P/R	3 - I/R	1 - P/I	2 - I/RI
Bar	**7**	**8**	**9**	**10**	**11**	**12**
F-Set	RI	R	I	R	P	RI
3-Pg		1 - [1,2,3]			4 - [2,3,1]	
C-Sets	1 - RI/R	2 - R/P	3 - I/R	2 - R/P	3 - R/RI	1 - RI/R

Table 3.3.6

It may seem odd to construct such a detailed process for the delineation of a seemingly unimportant parameter like the specific set-type arrangement within a c-matrix. It is unimportant because it has no significant implications for the composition as a whole, just in a very specific sense in relation to the allocation of bar-specific c-matrixes. However, this detailed approach was required at this stage of my development because a plethora of systems and sub-systems were required to be ordered using similar techniques and principles implemented at the start of the compositional process. This is because I feel the need to account for every note in a work: the reason or logic behind its use and realisation for me personally needs to have the ability to trace its assignment back to a given process or collection of processes, with several sub-systems in place that are needed to define the outcomes in such a way as to keep composer input to a minimum.

The pitch-class material assigned is ordered using a simple sieve technique that assigns the vertical tetrachords of the c-matrix assigned, with a random number generator used to pick which of the twelve tetrachords are assigned to a given bar. This was a cumulative process, with previous assignments being used in subsequent bars until in the central three bars full matrixes are realised. The red columns in Appendix 3.3.2 show the sieved tetrachords for bars 1-6. One can also see that the assignments of bars 1-6 are mirrored in their entangled bars, in a sense producing assignments that are built around a central pivot-point, thus entangling tetrachords to their antipodes from either the first or second half of the c-matrix: tetrachords 1-12, 11-2, etc. In fact the whole work functions along the principle of a pivot, and is noticeable in the broad trajectories in *Ex.3.1* and in almost all other systems in the work.

There are two ways in which pitch classes are realised: sustained or un-sustained. To mediate these, statistical gradients were formed that provided a global framework from which assignments can be derived and are listed in *Table 3.3.7*.

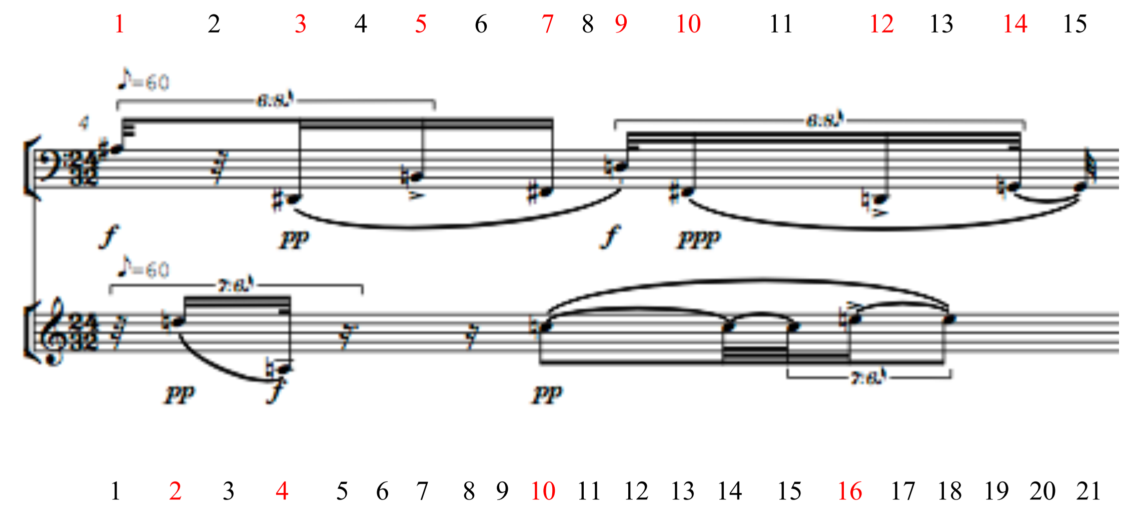
Bars	Sus	Un-sus
1-3	All	None
4-6	3/4	1/4
7-9	1/2	1/2
10-12	1/4	3/4
13-15	None	All
16-18	1/4	3/4
19-21	1/2	1/2
22-24	3/4	1/4
25-27	All	None

Table 3.3.7

Sustained points can either be realised as impulses lasting two or more impulse points, or they are deemed sustained if they appear within a slur. An un-sustained point is a note that has the duration of one impulse point, outside of or at the end of a slurred passage. Bar 4 is used to show how this is realised in practice.

As there are two metronome marks in bar 4, this section will only focus on the 12 notes contained in the section marked Quaver = 60 (*Ex.3.3.2*). In *Table 3.3.7* bars 4-6 have 3/4 impulses sustained and 1/4 un-sustained, giving 9 and 3 respectively. As the horn part has 8 and the trombone has 4 pitch classes, the horn part contains 2 un-sustained impulses and the trombone has 1. *Table 3.3.8* shows the assigned impulse points and coloured in red are those assigned as un-sustained points.

Bar 4



Ex.2.3.2

	Impulse points							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Hn.	1	3	5	7	9	10	12	14
Tbn.	2	4	10	16				

Table 3.3.8

The outcomes for the random number generators that assigned un-sustained points in *Table 3.3.8* are 1 and 5 for horn and 2 for trombone. In *Ex.2.3.2* one can also observe that the two types of point are differentiated from each other by assigning different dynamic levels and pitch ranges for each point-type.

Summary

Although the three proto-quantum works are extensively conceptualised and constructed by applying systems or notions derived from science and mathematics, only entanglement remains throughout the remaining works. Entanglement in quantum composition is primarily a means by which to reduce the number of assignment stages needed to organise macro- and micro-level events, for example assigning complementary ensembles to specific sections or bars. Written between 2009 and 2010, these three works can be viewed as transitional, forming a link between the music written for a Masters degree in 2009 and the initial research undertaken at the start of this PhD the same year. Although these works are not as refined as those in the *Objects* series, and a large proportion of the compositional devices or methods of production and realisation have been either drastically altered or abandoned, they still provided a solid foundation from which the later works were created.

In the Objects series, there is a drastic shift away from references to science, a mimetic approach, towards non-mimetic, point-based construction. Even though each work takes a very different approach in both conceptual and constructive terms, there is a greater sense of unity both within and between these works. With the point gesture providing the foundations for this method, the focus in these works is directed towards reinforcing egalitarianism and democracy through the emancipation of the point to achieve a higher level of abstraction.

4. Notational strategies and the ever-elusive Utopia

The 20th century saw rapid advances in music notation, delineating a plethora of strategies that enabled composers to reformulate the act of composition and performance. The New York School of composers (John Cage, Morton Feldman, Christian Wolff and Earle Brown) were radical in their use of notation, developing methods by which to enable indeterminate outcomes in performance such as open form or undefined (thus for the performer to decide) pitches and impulse duration systems. However, this chapter is not intended as an inquiry into the disparate strands of graphic notation[70], as the works I have composed contain no elements of extended graphic notation besides symbols or text to describe playing techniques. This chapter will instead focus on the artists who have influenced the notational principles I have initiated in my own works.

Notational strategies in the submitted works can be split into two broadly defined groups:

1. *Probability Interpretation* to *Objects 2*
2. *Objects 3.1* to *Objects 7*

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[70] For an overview of graphic notation see Ian Pace's open access paper on the subject at http://openaccess.city.ac.uk/6476/

The works in Group 1 take a maximalist approach with high levels of information saturation in order to specify dynamics, articulations and extended playing techniques, informed musically from the so-called 'New Complexity' group of composers. Although there is still a degree to which the works of Group 2 can be situated within the context of maximalism, this group is more acutely typified by the hyper-specification of points performed without the use of extended playing techniques. The works from *Objects 4* to *Objects 7* share a common technique for impulse derivation based on 'tuplet arrays' that is informed from the compositions of Gordon Downie. As will be shown in the following text, the notational strategies of both groups of works share a common non-musical referent in the visual arts as well as a preoccupation (in the abstract) with utopian constructs, forming the deeper reasoning from which all of my notational strategies are rooted.

Utopia, the perfect society or state where there is maximum equality and freedom for all, is the unattainable goal informing the fundamental essence of the works I compose. Stemming from the twelve-tone or serial techniques developed by the Second Viennese School of composers, my works are rooted in 'a tendency that *rejects hierarchical modes* of operation *in favour of heterarchical modes* of operation. It is thus a tendency that emphasizes equivalence or equality between the constituent parts of an art object.'[71] Although my works strictly adhere to a heterarchical or utopian framework, aesthetic and notational strategies set forth in each of the works,

[71] Kennethwoodsnet. (2008). Gordon Downie Interview - part one. Retrieved 4 March, 2019, from https://kennethwoods.net/blog1/2008/03/05/gordon-downie-interview-part-one-forms-7/

although delineated through egalitarian design, have the effect of hindering or erecting barriers to a 'perfect' realisation of the utopian construct that is the work in question.

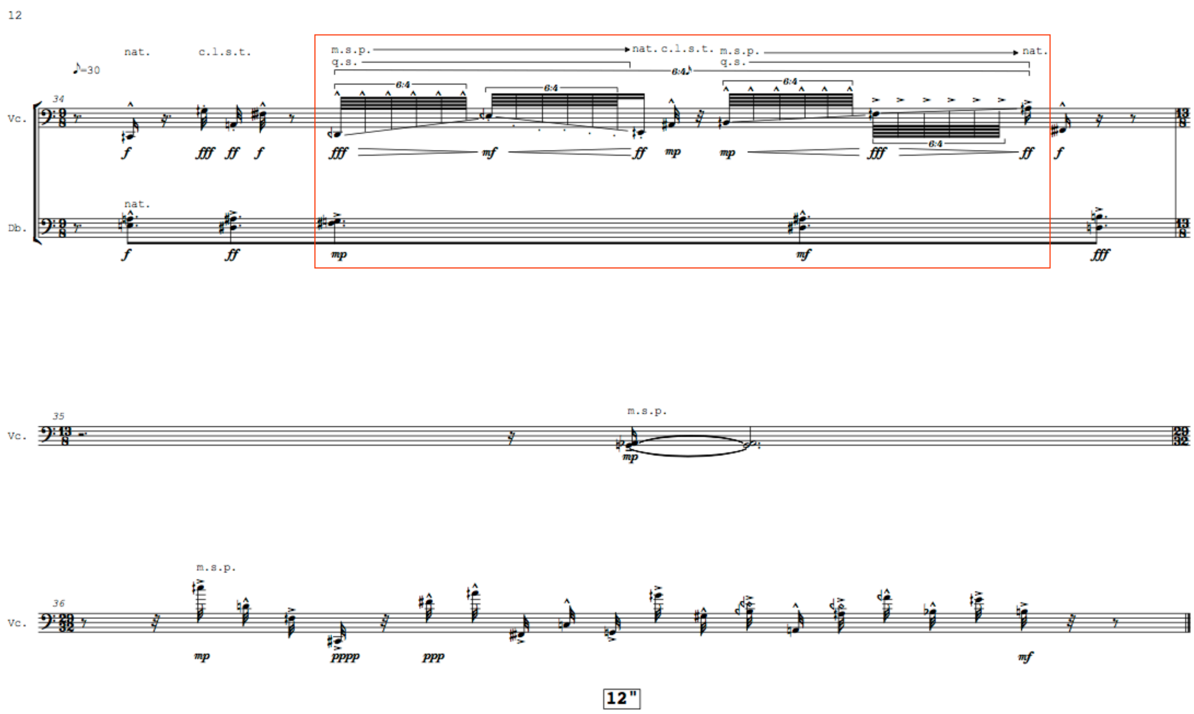
I find the most important aspect of all utopian art is the dialectic between the individual and the group. Typically manifested in literature as the dystopian Other, the unchecked power of the group crushes the individual until it conforms to the prevailing orthodoxy from which it was trying to escape. Through the hyper-specificity of outcomes in pursuit of the emancipation of the Point, the notational strategies outlined below have a broad trajectory linked to the aesthetic goals of the works commented on, with Group 2 concentrating on stripping additional text, extended techniques and symbols from the score in favour of a more exacting approach to impulse specification.

Probability Interpretation to *Objects 2*

These works constitute the most densely notated of the works submitted. The saturation of the time-space is not maximalist throughout, however, with the objects in each bar existing on a gradient of few to many[72]. *Ex.4.1*, taken from page 12 of *Probability Interpretation* demonstrates this, with the top bar exuding the maximalist approach and the central bar the polar opposite containing only one impulse. There

[72] For the specific manifestations in each work the reader should refer to their respective chapters.

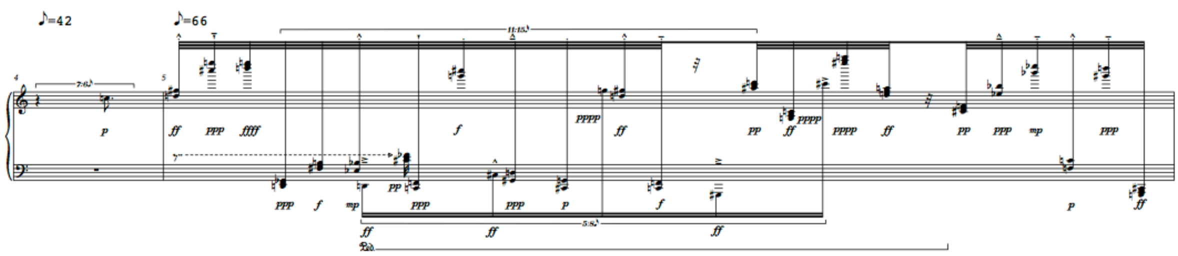
are also differences in this example in how the bars are proportioned, with the area inside the red box in the top system taking up the majority of the bar. This is in stark contrast to the bottom system which has its impulses distributed evenly. Due to the relatively large amount of impulses within the red box in *Ex.4.1*, this area of the score is in effect a magnification of that small area, needed in order to effectively notate the detail within. As can be seen, the impulses within the red box are expressed using a global 6:4 tuplet, with nested tuplets of the same ratio in four of the six semiquaver units of the global tuplet. This is as well as multiple accents, dynamics and playing techniques.



Ex.4.1

One can also see at the very bottom of this example that following the three systems is a duration in seconds, which relates to the length of silence after the section is played. The use of silence as a 'framing' device in this work and *Objects* and *Objects 2* is intended to isolate or demarcate each section's group of objects further, analogous to the use of white in the De Stijl, grid works of Piet Mondrian. Also from De Stijl is the importance of two fundamentals: the vertical and the horizontal. Except dynamic hairpins, slurs (in *Entanglement*) and glissandi, all lines pertaining to tuplet brackets and beaming are never expressed as a diagonal but always as straight horizontal lines (the vertical in this example being the stem).

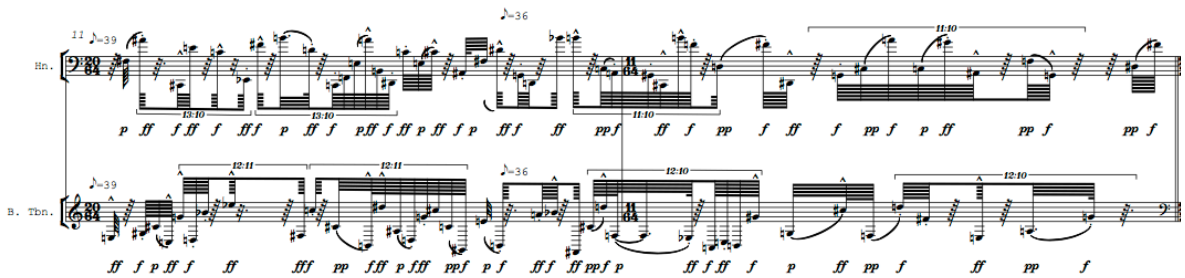
Ex.4.2 shows bars 4 and 5 from *Two-Slit Experiments*. One can see the disparity in impulse content between the two bars, with bar 5 using tiled irrational tuplets based different units (11:15 (demisemiquaver) and 5:8 (semiquaver)), continuous differentiations in dynamic and articulation content, as well as several forms of material content (including dyads, single points and clusters). In addition to this information, each bar is also in a different tempo.



Ex.4.2

Mentioned above and shown in *Ex.4.3* and *Ex.4.4*, *Entanglement* is the only work that uses slurs, with these two examples again showing the extremes of notational outcomes in each work. *Ex.4.4* has visual links to composers such as Brian Ferneyhough in the use of irrational tuplet ratios that can at points traverse bar lines and in the use of extremely small units such as semihemidemisemiquavers.

Ex.4.3



Ex.4.4

The tuplet tiling seen in *Ex.4.2, Ex.4.4* and *Ex.4.5* (the latter being bar 6 of *Objects: Object Distributions*), are examples of the barriers to realisation inherent to utopian constructs mentioned at the beginning of this chapter. The superimposition of material layers expressed as tuplet tiling ensures that the robust egalitarian constructs underpinning the work are actually incredibly fragile and resist an idealised or standardised manifestation in performance. This stems from New Complexity composers such as Brian Ferneyhough, who when questioned on the subject by Richard Toop on the factors determining a 'good performance' of his works stated it was 'the establishment of audible criteria of meaningful inexactitude'[73] that determined the success of the work.

Ex.4.5

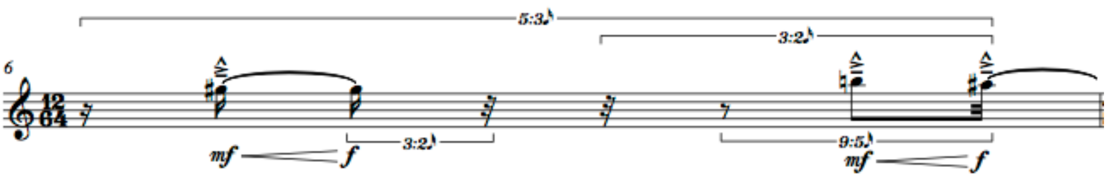
Ex.4.6 is the final example of Group 1, representing a section of bar 10 in *Objects 2: Four-Point gestures*. This is the last work to use silences to frame sections of activity, which in this work are each only a bar in length. With the point gestures in this example distributed between the full quartet of players, the tuplet tiling found in *Objects* above is problematized further because the issues inherent to the realisation of the assigned objects in performance are compounded, thus the rendering of the work-object as a utopian construct is measured by the impossibility of its perfect realisation.

[73] Ferneyhough, B. (1998). *Brian Ferneyhough - Collected Writings*. Oxon: Routledge, p.268.

Ex.4.6

Objects 3.1 to *Objects 7*

Where the works above use time signatures that at times are extremely large in regards to numerator value, the works in Group 2 use sets of smaller numerators or subdivide larger bars into equal or relatively equal sizes. Tuplets in these works are no longer assigned using tiling techniques, with *Objects 3.1* using tuplets at two distinct levels: one level is used to delineate partitions for each bar (typically spanning the totality of the bar), with secondary tuplets used for impulse derivations (see *Ex.4.7)*.



Ex.4.7

Objects 3.1 takes a novel approach to accents, with impulses assigned one, two or three simultaneously. As outlined in Chapter Nine, accents affect the notated score in three dimensions: duration, attack and dynamic shift. Affecting these three parameters has an effect on the score as it is notated, with the performer as a result required to, for example, calculate by how much the notated duration will be reduced, as well as possible changes to the dynamic level assigned.[74]

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[74] A full list of the resulting outcomes are shown after the title page in the score.

The works from *Objects 4* onwards take the point gesture system developed in the previous works and apply it more rigorously, delineating various sub-sets of gesture-types depending on the instrumentation assigned. The aesthetic trajectory of *Objects 4-7* is informed by Gordon Downie's comments on his *Piano Piece 2*, using the point gesture system to further the emancipation of the point:

> The notations developed in piano piece 2 function to further emphasise the autonomy of the point…achieved through the hyper-re-specification of the parametric profile of each successive impulse.[75]

One can see the hyper-specification of impulse assignments in *Ex.4.8*, as well as the two distinct types of notehead. These are used in this work and *Objects 5* to demarcate in the vocal parts impulses that have an undefined pitch as a result of the 'word partition' used.[76]

Ex.4.8

[75] Downie, G. &. Pace, I. (2006/07). 'Gordon Downie and Ian Pace: A Dialogue.' *The Open Space Magazine* (8/9), pp.203-4.

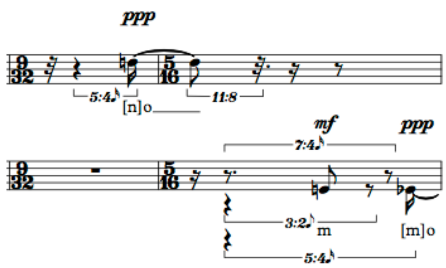
[76] See Chapter Eleven.

Tuplets in *Objects 4-7* derive impulse outcomes (duration and distance) using an 'impulse array', created by superimposing several tuplet layers and calculating the total number of impulse points,[77] and are related to the system Gordon Downie uses in *Piano Piece 1* and *2*, as well as the ensemble works comprising the *Forms* series. With the *exact* impulse duration and distance (between successive impulses) demarcated using the impulse array, there are instances where the rests from another impulse layer are used to demarcate the end point of the impulse. The areas contained within the red boxes in *Ex.4.8* are two examples of this, with *Ex.4.9* showing the position of rests when used for the reasons mentioned above.

Ex.4.9

The impulse arrays in the works from *Objects 4* onwards are all assigned to partitions of either a quaver or crotchet in length. In order to differentiate between different variants of vowel sounds within the words assigned, *Ex.4.10* shows how these are demarcated according to the word 'monochord' (from *Objects 5*). In this example the vowels are delineated using '[n]o' and '[m]o', as in [n]ochord and [m]ono, thus the sounding o's have different mouth shapes resulting in different sonic outcomes.

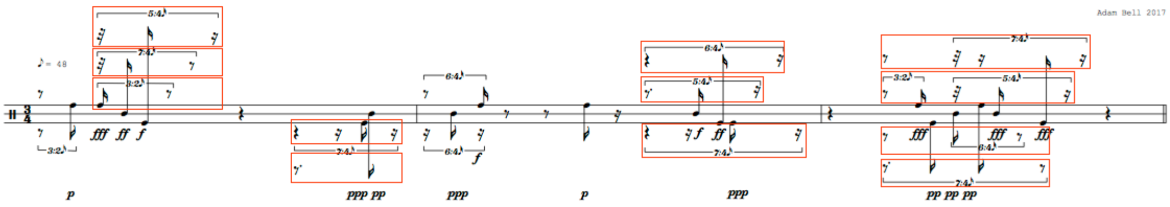
[77] See Chapter Thirteen, *Ex.13.3*.



Ex.4.10

Objects 6.1-3 are written for three woodblocks, so each of the assigned impulses lasts for a single impulse point so there was no need to use secondary tuplet layer to demarcate impulse end-points like in *Objects 4* and *5*. *Objects 6.1-3* have drastically varied impulse outcomes, with *6.2* containing only one tuplet layer per partition, *6.3* one or two layers, and *6.1* is the most difficult to realise with up to three different layers. *Ex.4.11*, *4.12* and *4.13* are all taken from the first three bars of *Objects 6.1*, *6.2* and *6.3* respectively.

As explained in Chapter Fifteen, in *Objects 6.1* the root 3-Pg of each three-bar section has stems pointing upwards, with secondary 3-Pgs notated with stems pointing downwards. Each stem flag corresponds to the tuplet bracket above or below it so that it is clearer defined for the performer where the impulse point is.



Ex.4.11

The hyper-specificity of point assignments are taken to a simplistic extreme in *Objects 6.2,* below, with this work containing only one or two impulses within a partition. The sparsity of outcomes in this work is reflected in the finished score where only three bars are used in each system and stretched across a landscape page format, heightening the sparsity of outcomes further. The top and bottom dynamics in impulses striking two wood blocks are assigned to the top and bottom wood blocks respectively.

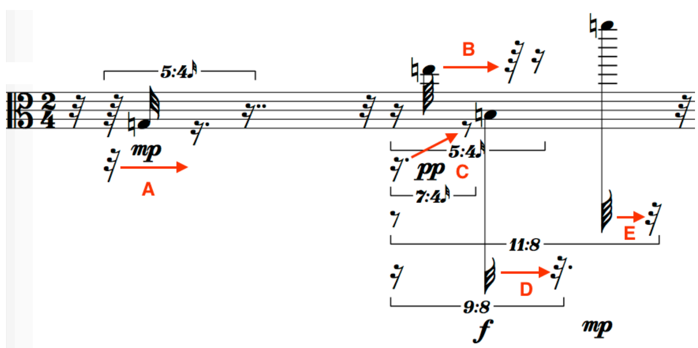
Ex.4.12

Significantly longer than the previous two works, the 162 3Sim gestures[78] in *Objects 6.3* differ minutely in dynamic content between successive impulses. The 3Sim gestures are expressed using one, two or three different dynamic values with the dynamics correlating to woodblock in the same way as they do in *Objects 6.2*.

[78] See Chapter Fifteen.

Ex.4.13

The final work, *Objects 7*, uses the same notational system as *Objects 6.1* in regards to impulse specification. *Ex.4.14* is just one example taken from the Viola part in Bar 7. The G natural above ‘A’ has its initial impulse point within the 5:4 tuplet and its total duration cut off at the dotted-semiquaver rest at the point of the arrow. The E natural at ‘B’ also has its initial impulse point within a 5:4 tuplet with the arrow in this example pointing to the remaining rests in said tuplet. Having these rests outside the stave prevents confusing the durational scope of the following B natural. The arrow at ‘C’ is pointing to the remaining quaver rest of the 7:4 tuplet that is used to demarcate where the E natural stops. The impulse stopping points at ‘D’ and ‘E’ are both within the same tuplet layer, the stems of each impulse extended down so as to be placed at the same horizontal position of its related tuplet rests.



Ex.4.14

I found the notational strategies in *Ex.4.14* to be the clearest way by which to represent clearly the hyper-specification of outcomes in the impulse parameter. There is a significant lack of additional text or symbols in these later scores, except the occasional staccato in *Objects 7* to designate durations of one impulse point. This is in large part due to the removal of almost all extended techniques after *Objects 2*, but also accents have been completely removed (besides the aforementioned staccato) and not systematically ordered like dynamics. This is because the resulting sonic effects of the assigned accents would compromise the exactitude by which the impulses have been designated in scores like *Objects 7*.

Another outcome of the impulse array system for impulse designation is that the impulses tend to be from different tuplet layers, statistically speaking, resulting in the majority of impulses not being joined by beams. The assigned impulses therefore appear more separated and fragmented in the score (such as *Ex.4.14*), furthering the aesthetic trajectory towards greater degrees of point autonomy and emancipation.

Looking at the score examples above there is a clear progression from the earliest, proto-quantum works to *Objects 7*, with *Objects 4* marking the point from which the point gesture system was refined to such a degree that there is greater notational and aesthetic coherence in and between the works. Although *Objects 3.1* initiated a heavily reduced aesthetic, the way in which it is notated can, at points in the work, increase levels of notational redundancy. This is perhaps most evident in the partitioning system (a straightforward example is shown in *Ex.4.7*, above), whereby tuplets that traverse the entirety of the bar were used to delineate 2, 4, 5, 6 or 8 global partitions for each bar. Reflecting on this work after completion it was apparent that these partitioning strategies were superfluous and overcomplicated the issue, something which I largely rectified and refined in *Objects 4-7*.

The maximalist approach found in the first group of works delineated at the start of this chapter erected barriers to the realisation of each work's respective utopian mechanisms and structures through the use of extended techniques (signified using a variety of acronyms or symbols), notational and technical difficulties through tuplet tiling, and the near-constant re-specification of impulse parameters (dynamic, accent, timbre, duration and proximity (vertical and horizontal)), the sheer amount of information on the page and its inherent difficulty of execution in performance results in the hypothetical 'perfect' realisation always out of grasp. This same effect is achieved in the second group by different means. In these works (most acutely from *Objects 4*) almost all of the additional information found in the scores of Group 1 has been removed, giving the scores and works a greater clarity both visually and sonically. With the time signature assignments in Group 2 being more simplified compared to Group 1 (i.e. smaller in size so are more manageable) and extended techniques and their additional text and symbols removed, the barriers to utopia in these works are found at the level of the partition and smaller. The partitioning in the Group 2 works is more refined than in Group 1, splitting the bars into partitions of a crotchet or quaver in which impulses can be assigned, with areas between these impulse partitions wherein no impulses can occur.[79] Splitting the bars in such a way fragments the outcomes further by reducing the capacity of the assigned impulses to affect a sense of strong or weak beats. The bars therefore become the frame in which activity occurs without historical inference that one could assume with, for example, a 3/4 time signature and the waltz.

As shown in the examples above, the impulses assigned in each partition in these later works can appear at extremes of simplicity and complexity, the impulses imbuing a hyper-specificity encapsulated in the use of secondary tuplet layers to mark the end points of impulses. Although the information in the score has been heavily reduced in the timbral sense, impulse duration and distance, although using similar numerical sets as the works in Group 1, through the formulation of impulse arrays Point specification is taken to the extreme.

These notational practices and the rigorous construction and specificity of the objects projected in the most recent works, have the result of making them extremely fragile sonically and physically in the act of attempting a performance. The works inhabit a region where they are in a constant state of flux, teetering on the edge of internal collapse throughout.

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[79] See Chapter Two, *Ex.2.7*, for simple examples of this.

5. *Objects: Object Distributions* (2012), for solo double bass

Objects: Objects Distributions was written between 2010 and 2012 for the double bassist and composer Ashley-John Long and is the first of my works to use the '*Objects*' prefix. The work's constructive principles are similar to those employed in *Probability Interpretation, Two-Slit Experiments* and *Entanglement*, the difference being that from this work onwards there is a greater focus on how the systems used for the quantisation of micro-objects (for example, the vertical displacements of trichords and tetrachords within a bar) can be applied to systems governing the formation of macro-objects (the global ordering of t-sigs or sections, for example).[80] Although this work still employs random processes extensively, the trajectory of the *Objects* series in general moves away from a reliance on random processes for parametric assignments towards gradually employing point gestures exclusively.

As with all of my compositional output, this is an aesthetic approach situated in the extremities of musical discourse. This manifests on several levels within this work, for example in the extremes of pitch-class content (few-many, wide-close proximity, etc.) and in notational and technical extremes such as the varying degrees by which tuplets are superimposed (tuplet 'tiling') or the plethora of performance markings indicating dynamic, articulation and playing technique content in any given bar of the

[80] Chapter Six, *Table 6.1.*

score. Even so, the work still has a defined trajectory in that it broadly moves from (relatively) low to high saturation levels, with tuplets appearing further apart or more separated as the piece progresses.

As explained in Chapter Two, *Objects: Objects Distributions* is split into twelve five-bar sections that are grouped according to their saturation level. To achieve this required a two-step process:

1. The 60 t-sigs are listed from smallest to largest (in hemidemisemiquaver (hdsq) units) and assigned 1-60 pitch-classes respectively
2. The saturation level is then derived by dividing the number of pitch-classes by the size of the bar in hdsq units

Table 5.1 lists the outcomes for the least and most saturated t-sigs (sections ‘0’ and ‘e’, respectively).

		t-Sig	**hdsq**	**p-c**	**Saturation**			**t-Sig**	**hdsq**	**p-c**	**Saturation**
0	1	52/64	52	5	9.62%	**e**	1	9/4	144	48	33.33%
	2	51/64	51	4	78.4%		2	37/16	148	49	33.11%
	3	50/64	50	3	6%		3	19/8	152	50	32.89%
	4	3/4	48	2	4.17%		4	18/8	144	47	32.64%
	5	2/4	32	1	3.13%		5	10/4	160	52	32.5%

Table 5.1

With reference to this table's realisations in the score (pages 1 and 19, respectively), one can see that in both examples the score exhibits a degree of claustrophobia in the way in which it is realised. This is achieved differently in each of these examples. On page 1, this is caused primarily through tuplet tiling, where for most of the bars the impulses are typically confined to the centre (*Ex.5.1*). Additionally, the notes are all sustained so there is little or no gap between impulses.

Ex.5.1

Ex.5.2

On page 19 (*Ex.5.2*), through the fractured yet continuous succession of un-sustained impulses and rapid alteration of dynamic values that are either at the quietest or loudest levels, this bar exhibits the claustrophobia mentioned in the above paragraph principally through the amount of impulses there on the page. With only very short rests between the disjointed, un-sustained impulses with only very few sustained impulses, the music in this bar imposes itself on the performer and listener in a different manner to that in *Ex.5.1*.

This element of claustrophobia only became apparent to me retrospectively and was in no way an active impulse in the creation of this work. During the period in which this work was written (late 2010-2012) I was reading works by writers such as Franz

Kafka and George Orwell, and the worlds these writers imagined in texts such as *The Trial* and *Nineteen Eighty-Four* share the same sense of claustrophobia, isolation and alienation that this work exhibits.

Although the score can seem imposing, there is an underlying fragility in its overall aesthetic, in that it is constantly in a state of flux, never settling into any coherent 'meter' or sense of 'weak' and 'strong' beats. The notation and related attempt at a realisation of the work exaggerates this effect, whether that be in the notational and practical difficulties resulting from the tuplet tiling mentioned above (and seen most prevalently in sections 1, 2 and 3) or the rapid alteration of dynamic values seen in sections 8, 9, t and e. This fragility is achieved through a series of rigidly applied systems that govern the distribution of material content and parametric assignments in the work, including partitioning, extended playing techniques and point gestures.

Partitioning

The partitioning of the time-space at the macro- and micro-level is a key constructive device and is used throughout the *Objects* series. As mentioned above, at the macro-level this work is partitioned into twelve five-bar sub-sections. At the level of the individual bar, each is partitioned globally into 3 macro-partitions, with each of these containing a further three sub- or micro-partitions. These bar partitions are derived using each t-sig's hdsq content and are split as equally as possible. For example, bar 4 (*Ex.5.1*) is in 50/64, so has an hdsq content of 50. Split as equally as possible this gives macro-partitions of 17-16-17. 17 has sub-partitions of 6-5-6 and the 16 has 5-6-

5, with the first impulse point of each micro-partition used as potential tuplet start-points. Although still assigned using random number generators, compared to how tuplet start-points were assigned in *Two-Slit Experiments* and *Entanglement*, the total number has been reduced significantly to 9 for each t-sig (and often fewer when tuplets have larger (by unit size) denominators). *Ex.5.3* is a skeleton score of bar 4, showing the 9 partitions on the bottom stave and start-points for the tuplets assigned.

Ex.5.3

With each tuplet assigned in macro-partition 1, 2 or 3 (1-3 5:4, 4-6 13:24, 7-9 6:4), one will notice that due to the size of the tuplets (in particular 13:24 and 6:4) these tuplets have a more limited set of possible positions: 13:24 can only be assigned to partitions 4 or 5, whilst 6:4 can only be assigned to partition 7.

One could argue that bars like 50/64, where the numerator is a very high number, would have been easier for the performer to conceptualise and internalise if they were split into three smaller bars according to the macro-partitions, giving 17/64, 16/64 and 17/64. If this were enacted in *Ex.5.3*, this would have required the setting of cross-bar tuplets, which is extremely time consuming to set so the original t-sigs are used instead. One should note that it is not until *Objects 4* that the subdivision of large t-sigs into smaller t-sigs is used in the compositional process.

This segmentation or compartmentalisation of a given problem, in this case the placement of tuplets within a bar, into successively smaller tasks is an example of top-down decomposition that enables the problem to be simplified by (in this example) limiting the positioning of objects to successively smaller regions within the bar. One key outcome of this method is a tendency towards a more coherent and uniform approach to object placement that can be extrapolated to all mediated strata within the work.[81]

Playing techniques

The playing techniques parameter was one of the earliest systems to be conceptualised: integral to my thinking was what I termed 'anti-sound'. Similar to the notion of silence in Brian Ferneyhough's Second String Quartet, anti-sound includes the silences between sections, as well as the degrading or obscuring of pitch focus through the use of extended playing techniques. For example, different types of bow positions such as sul tasto and sul ponticello have less of a defined pitch than bowing in normal (nat.) position, with the pitch focus obfuscated to a greater degree the further the bow is from its normal position (for example, sul ponticello becomes more metallic in nature the closer to the bridge it is played), with one hearing the effect more so than the specific pitches in these instances. And this is also true when the wood of the bow is used with techniques such as col legno, which weakens the pitch focus even further than sul tasto and sul ponticello (although when combined the

[81] See Chapter Eight.

effect is of course greater). Similar outcomes are found in pizzicato passages, where in its normal form the pitch still has focus but with Bartok pizzicato the effect of the string hitting the fingerboard obscures the pitch.

Listed in *Table 5.2* are the ten playing techniques used in this work. With each bar having one 'fundamental' technique (bold in the Technique(s) column, *Table 5.3*), each is assigned once every two five-bar sections. In addition to this, the techniques assigned to the previous and following bars are also incorporated into each bar, giving 3 techniques in each. The playing techniques system therefore forms a continuous loop from the last to first bar. Random processes were employed to initially assign each technique, and with a total of three per bar these were ordered within the bar using their corresponding macro-partitions. For example, bar 1 has harmonics, tremolo and col legno assigned to macro-partitions 1, 2 and 3 respectively.

	Technique
1	Naturale
2	Sul Ponticello
3	Sul Tasto
4	Pizzicato
5	Col Legno
6	Harmonic
7	Glissando
8	Tremolo
9	Scratch Note
10	Spiccato

Table 5.2

Bar		Technique(s)	Bar		Technique(s)	Bar		Technique(s)
51	8	Har/**Tre**/CL	**1**	8	Har/**Tre**/CL	**11**	8	Har/**Tre**/Gli
52	5	Tre/**CL**/ST	**2**	5	Tre/**CL**/Spi	**12**	7	Tre/**Gli**/ST
53	3	CL/**ST**/Scr	**3**	10	CL/**Spi**/Nat	**13**	3	Gli/**ST**/CL
54	9	ST/**Scr**/Piz	**4**	1	Spi/**Nat**/ST	**14**	5	ST/**CL**/SP
55	4	Scr/**Piz**/Nat	**5**	3	Nat/**ST**/SP	**15**	2	CL/**SP**/Piz
56	1	Piz/**Nat**/SP	**6**	2	ST/**SP**/Gl	**16**	4	SP/**Piz**/Spi
57	2	Nat/**SP**/Gli	**7**	7	SP/**Gl**/Piz	**17**	10	Piz/**Spi**/Scr
58	7	SP/**Gli**/Spi	**8**	4	Gl/**Piz**/Scr	**18**	9	Spi/**Scr**/Nat
59	10	Gli/**Spi**/Har	**9**	9	Piz/**Scr**/Har	**19**	1	Scr/**Nat**/Har
60	6	Spi/**Har**/Tre	**10**	6	Scr/**Har**/Tre	**20**	6	Nat/**Har**/Spi

Table 5.3

As well as the fundamental technique, there are two others assigned to each bar, derived from the fundamental assignments of the preceding and following bars. So, for bar 1 to have three techniques assigned, the fundamental technique assigned to bar 60 (Har) and bar 2 (CL) are used to 'frame' the fundamental of bar 1 (Tre), giving Har/**Tre**/CL. Each is assigned to one of 3 macro-partitions in the order they appear in the 'Technique(s)' columns in *Table 5.3*.

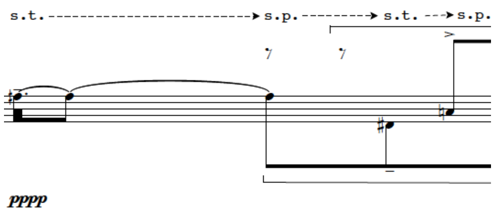
Ex.5.4

In *Ex.5.4* bar 4 is again used to demonstrate how the techniques are assigned within a bar. One will notice that the spaces in which a technique is performed overlap, creating zones within each bar where two techniques meet and can be combined. This is a modified version of principles set out in *Entanglement*, where the notion of merging plays a fundamental role in the delineation of t-Sig assignments in the work. In this work, it is based on partitions within the bar.

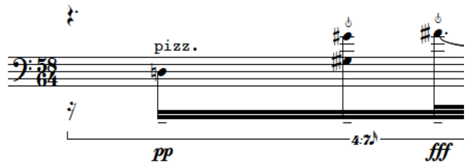
The majority of these combinations are possible but there are instances where, due to other assignments or the impracticalities or impossibility of two techniques combining, substitute or modified techniques were delineated. Two examples of this will be shown: combining sul ponticello with sul tasto (bar 6), and scratch note with pizzicato (bar 9).

Sul ponticello/sul tasto

As sul ponticello and sul tasto are techniques demarcating the position of the bow on the string, it is impossible for an impulse to have both techniques simultaneously on the same instrument when using only one bow. In *Table 5*.3 the techniques assigned to bar 6 are ST/SP/Gli, assigned to macro-partitions 1, 2 and 3 respectively. As sul tasto and sul ponticello cannot be combined, the performer is to slide from one technique to the other, and as sul tasto is assigned to macro-partition 1 and sul ponticello to 2, the order is always sul tasto to sul ponticello (*Ex.5.5*).



Ex.5.5

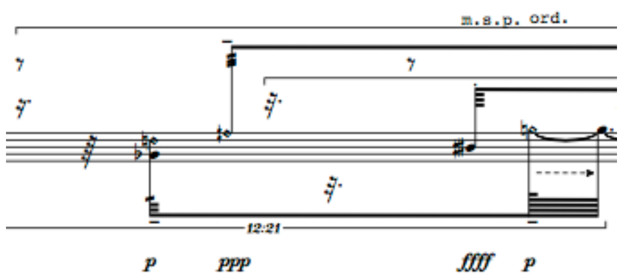


Ex.5.6

Scratch note/pizzicato

As scratch notes are bowed and pizzicato are plucked it is impossible to combine the two so a substitute technique is used. As scratch notes are by their very nature loud, Bartok pizzicato is used as the substitute technique as Bartok pizzicato must be played loudly to be most effective. Bar 9, *Ex.5.5* is as an example of this.

Another example is when harmonics, whether natural or artificial, cannot be realised due to vertical-temporal position (i.e. too low). In this instance, the molto sul ponticello (m.s.p.) effect is used as it shares the same metallic qualities as those found with harmonics. An example of this can be found on the third impulse of bar 11 (D triple-sharp, *Ex.5.7*).



Ex.5.7

Point gestures and the refining of assignment systems using entangled and combinatorial partners

To refine the process of assigning point gestures (Pgs), there needed to be a system in place that limited the total number of Pgs available, thus limiting and streamlining the selection process. Whereas in the proto-quantum works the Pgs were assigned using random processes, in this work this is coupled with sub-groups of linked Pgs (entangled and combinatorial partners) that reduce the total number of Pgs available to smaller sets of potential outcomes.

Entangled partners

Appendix 5.2 shows all 24 permutations of the set {1,2,3,4}, in four groups of six gestures (A, B, C and D). As was the case in *Entanglement*, where bar groups and their contents are entangled with groups at their antipode (i.e. bars 1-3 and 25-27 in *Entanglement*), entangled partners for 4-Pgs are those gestures that appear at their corresponding antipode in Appendix 5.2 (A1-D6, A2-D5, etc.). These are fixed throughout and in all remaining works.

Combinatorial partners

There are nine combinatorial partners for each 4-Pg, and they are those gestures that do not repeat any of the internal order of values in the source set. For example, if the source set is [1,2,3,4], [1,3,4,2] would not be a combinatorial partner because '1' is in the same position in both. As an example, the combinatorial partners for A1 – A6 are shown in *Table 5.4*.

	A1 - [1234]	**A2 - [1243]**	**A3 - [1324]**	**A4 - [1342]**	**A5 - [1423]**	**A6 - [1432]**
1	[2,1,4,3]	[2,1,3,4]	[2,1,4,3]	[2,1,3,4]	[2,1,3,4]	[2,1,4,3]
2	[2,3,4,1]	[2,3,1,4]	[2,4,1,3]	[2,4,1,3]	[2,3,1,4]	[2,3,1,4]
3	[2,4,1,3]	[2,4,3,1]	[2,4,3,1]	[2,4,3,1]	[2,3,4,1]	[2,3,4,1]
4	[3,1,4,2]	[3,1,2,4]	[3,1,4,2]	[3,1,2,4]	[3,1,4,2]	[3,1,2,4]
5	[3,4,1,2]	[3,4,1,2]	[3,2,4,1]	[3,2,1,4]	[3,2,1,4]	[3,2,1,4]
6	[3,4,2,1]	[3,4,2,1]	[3,4,1,2]	[3,4,2,1]	[3,2,4,1]	[3,2,4,1]
7	[4,1,2,3]	[4,1,3,2]	[4,1,3,2]	[4,1,2,3]	[4,1,3,2]	[4,1,2,3]
8	[4,3,1,2]	[4,3,1,2]	[4,2,1,3]	[4,2,1,3]	[4,2,3,1]	[4,2,1,3]
9	[4,3,2,1]	[4,3,2,1]	[4,2,3,1]	[4,2,3,1]	[4,3,1,2]	[4,3,2,1]

Table 5.4

An example of where entangled and combinatorial partners are used in conjunction is in the pitch range system. The system is one of the most detailed in the work, with the following text taking into account systems pertaining to bar partitioning, entanglement, and impulse differentiation.

Pitch Ranges

There are four pitch ranges used in the work and are based on the four strings of the double bass: E, D, A and G. Each range spans a compound tritone and are shown in *Ex.5.8*.

Ex.5.8

These ranges can be separated or combined, so that within a section the material, or *objects*, can be realised over 1, 2, 3 or 4 pitch ranges. As is the case with several other systems governing the work, a global trajectory of few to many and many to few pitch ranges was initially applied to both sustained and unsustained impulses, and are mapped out in *Table 5.5*.

Section	PRs: Sus	PRs: Un-Sus
0,1,2	4	1
3,4,5	3	2
6,7,8	2	3
9,t,e	1	4

Table 5.5

Pitch ranges				
1	2		3	4
1	1/2	2/3	-1	1/2/3/4
2	1/3	2/4	-2	
3	1/4	3/4	-3	
4			-4	

Table 5.6

Pitch range assignments are on the whole derived using 4-Pgs, with 3-Pgs used in sections [4,5,3] and [7,6,8] to order the three pitch ranges for sustained and un-sustained impulses respectively. With the broad trajectories in place (*Table 5.5*), it was then a matter of creating systems to determine the specific pitch range combinations (*Table 5.6*) assigned to each bar/section. To further limit the number of separate assignments, sections are coupled with their entangled partners ([0,2,1] – [e,9,t], [4,5,3] – [7,6,8]). For example, section [0,2,1] has sustained impulses projected over four ranges and in section [e,9,t] the un-sustained impulses are projected over four ranges also. In this instance, the pitch range assignments for un-sustained impulses in section [e,9,t] are the retrograde of pitch range assignments for sustained impulses in section [0,2,1].

Because these assignments are inextricably linked, the outcomes for each fifteen-bar section will be extrapolated further in conjunction with the outcomes in its entangled section. This will follow the next section, which will outline in the broadest terms the mechanism by which 1, 2, 3 and 4 pitch ranges are assigned within each section.

1 Pitch range

The assigned pitch range lasts for the duration of the bar. The twelve macro-sections (0-e) are grouped into four three-section sub-groups (*Table 5.5*), giving a total of fifteen bars in each. With 4-Pg values assigning corresponding pitch ranges (1-1, 2-2, 3-3 and 4-4), 3.75 4-Pgs are needed to assign all ranges across the 15 bars.

2 Pitch ranges

For two ranges to be assigned to each bar, 4-Pgs were split in two, with one 4-Pg assigning the pitch ranges for two bars. Take for example [1,2,3,4]. This is split into two subsets, [1,2] and [3,4], that are then assigned to their allocated bars. Each bar is split into two equal partitions, with one of the two ranges allocated to each. 7.5 4-Pgs and 5 3-Pgs are needed for all pitch ranges to be assigned.

3 Pitch ranges

The same system used to assign one pitch range is employed for three pitch ranges, but in this case the assigned number *omits* that pitch range, thus leaving three ranges to be used in the bar. The order of assignments for these pitch ranges is then ordered using 3-Pgs. Each bar is split as equally as possible into three partitions, with a single range assigned in each.

4 Pitch ranges

With four pitch ranges present, each bar is split into four partitions and allocated a 4-Pg value to each, requiring 15 4-Pgs to assign per 15-bar section.

Each of the above pitch range contents requires several 4-Pgs to assign their allotted ranges across each of the four sub-groups of sections listed in *Table 5.5*. To enable this to be achieved efficiently, sub-sets of four 4-Pgs were delineated that combined entangled and combinatorial partners. This is achieved through the four-step process shown below.

Step 1 – Random number generator (1-24) assigns the starting 4-Pg

Step 2 – Entangled partner of Step 1

Step 3 – Random number generator (1-9) assigns a combinatorial of Step 2

Step 4 – Entangled partner of Step 3

When more than four 4-Pgs are needed this process is repeated but with Step 1 now being a combinatorial partner of the preceding Step 4 4-Pg

[0,2,1] Sustained – [e,9,t] Un-sustained

In sections [0,2,1] and [e,9,t] the sustained and un-sustained impulses (respectively) are assigned to four ranges in each bar (bars 1-15 and bars 46-60). With 15 bars in each, 15 4-Pgs are needed to allocate ranges for [0,2,1] and [e,9,t]. These are assigned using the four-step process outlined above and are listed in *Table 5.7*. *Table 5.8* is the retrograde of outcomes in *Table 5.7* and are used to assign ranges for un-sustained impulses in section [e,9,t]. How these are realised in the score is shown in *Ex.5.9* for section ‘0’ (bars 1-5) and *Ex.5.10* for section ‘t’ (bars 56-60). The pitch ranges and the partitions assigned to are shown on the bottom staves in both examples.

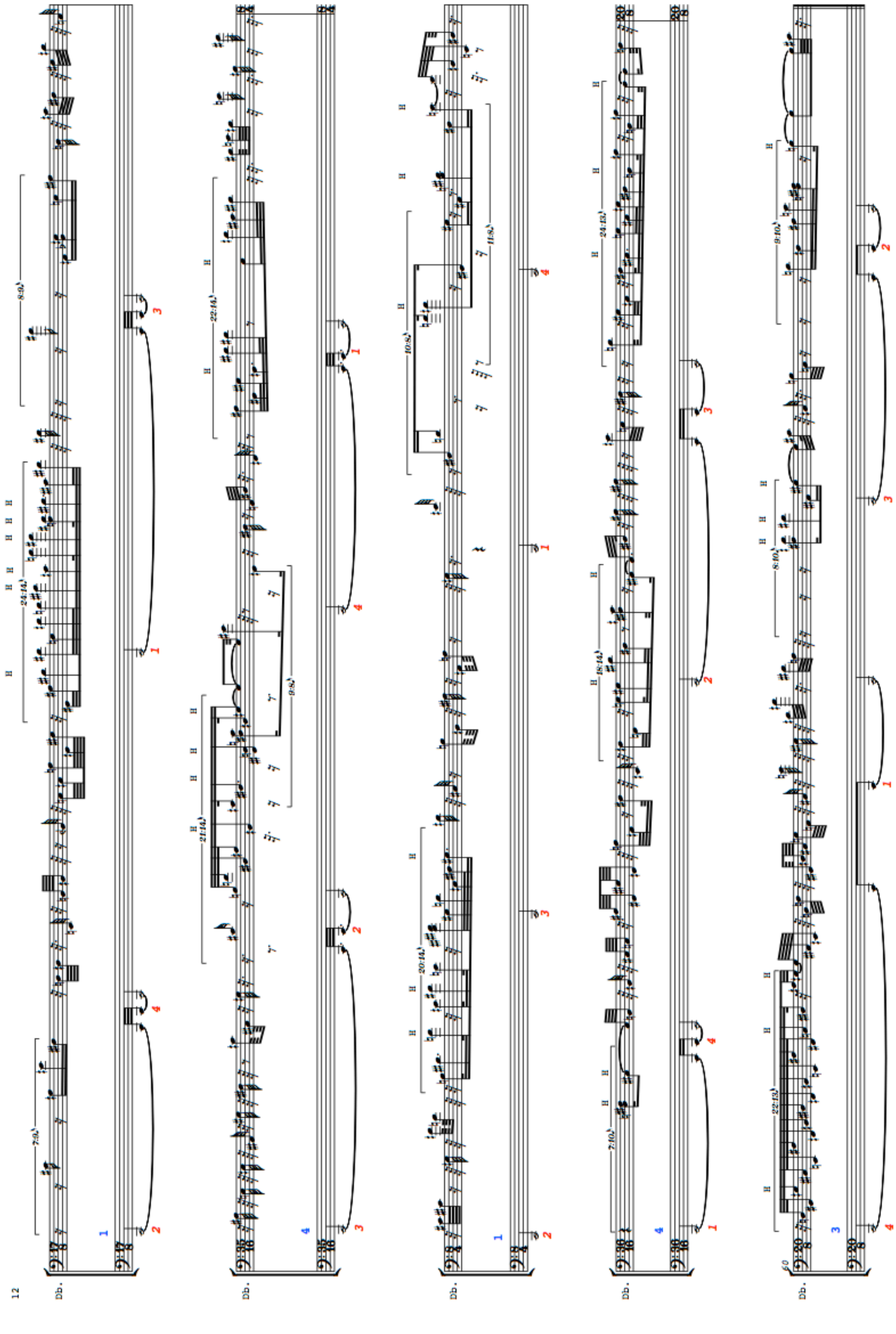
Section	Bar	Gestures assigned	
	1	[2,3,1,4]	(1-24) = 9
	2	[3,2,4,1]	Ent. = 16
0	3	[4,1,3,2]	Comb. (1-9) = 8 (20)
	4	[1,4,2,3]	Ent. = 5
	5	[3,1,4,2]	Comb. (1-9) = 4 (14)
	6	[2,4,1,3]	Ent. = 11
	7	[1,3,4,2]	Comb. (1-9) = 3 (4)
2	8	[4,2,1,3]	Ent. = 21
	9	[2,1,3,4]	Comb. (1-9) = 4 (7)
	10	[3,4,2,1]	Ent. = 18
	11	[1,2,3,4]	Comb. (1-9) = 1 (1)
	12	[4,3,2,1]	Ent. = 24
1	13	[3,4,1,2]	Comb. (1-9) = 9 (17)
	14	[2,1,4,3]	Ent. = 8
	15	[1,3,2,4]	Comb. (1-9) = 2 (3)
		[4,2,3,1]	Ent. = 22 (not used)

Table 5.7

Section	Bar	Retrograde of [0,2,1]
	46	[4,2,3,1]
	47	[3,4,1,2]
e	48	[2,1,4,3]
	49	[1,2,3,4]
	50	[4,3,2,1]
	51	[1,2,4,3]
	52	[4,3,1,2]
9	53	[3,1,2,4]
	54	[2,4,3,1]
	55	[3,1,4,2]
	56	[2,4,1,3]
	57	[3,2,4,1]
t	58	[2,3,1,4]
	59	[1,4,2,3]
	60	[4,1,3,2]

Table 5.8

Ex.5.9



Ex.5.10

[4,5,3] Sustained – [7,6,8] Un-sustained

There are nine 4-Pgs not used for sustained impulse pitch ranges in [0,2,1] and are listed in *Table 5.9.* As is shown, there are four sets of entangled partners (2-23, 6-19, 10-15 and 12-13) and the remaining 4-Pg ([4,2,3,1]) from *Table 5.7* that wasn't used. As the 4-Pg values assigned in [4,5,3] omits a pitch range from each bar only 3.75 4-Pgs are needed to allocate the omitted pitch ranges across the 15 bars that constitute this sub-group of sections.

Gestures not assigned	
2	[1,2,4,3]
23	[4,3,1,2]
6	[1,4,3,2]
19	[4,1,2,3]
10	[2,3,4,1]
15	[3,2,1,4]
12	[2,4,3,1]
13	[3,1,2,4]
22	[4,2,3,1]

Table 5.9

From this only four 4-Pgs were needed. To initially reduce the possible outcomes available, only 4-Pgs with a corresponding entangled partner in the list were used, thus omitting [4,2,3,1] from the possible assignments. The four-step process used to assign groups of four 4-Pgs delineated earlier slightly altered, as explained below.

Initially, a random process assigned [4,1,2,3] in Step 1, with its entangled partner assigned to step four. The leaves three sets of entangled partners. As 4-Pgs beginning with 1 and 4 are already assigned, 4-Pgs [1,2,4,3] and [4,3,1,2] were not allowed to be used for steps 2 and 3, leaving gestures 10/15 and 12/13. Gestures 12 and 13 are not complements of gestures 6 or 19 so were also not used, leaving gestures 10 and 15. Gesture 15 is the retrograde (Ret.) of 19 and is assigned to Step 2, with Step 2's entangled partner assigned to Step 3. One should note that Step 4 is not just the entangled partner of Step 1 but is also the retrograde of Step 3.

Step 1 – [4,1,2,3]

Step 2 – [3,2,1,4] = Comb./Ret. of Step 1

Step 3 – [2,3,4,1] = Ent. of Step 2

Step 4 – [1,4,3,2] = Ret. of Step 3/Ent. of Step 1

The omitted ranges are:

Section 4: 4,1,2,3,3

5: 2,1,4,2,3

6: 4,1,1,4,3

The three remaining pitch ranges are each assigned to one of the three partitions. In order to distribute these 3-Pgs were used, with the lowest numbered range assigned to '1' and the highest numbered '3' (highest to lowest temporal positions).

	[1,2,3]	[1,3,2]	[2,1,3]	[2,3,1]	[3,1,2]	[3,2,1]
1	[2,3,1]	[2,1,3]	[1,3,2]	[1,2,3]	[1,2,3]	[1,3,2]
2	[3,1,2]	[3,2,1]	[3,2,1]	[3,1,2]	[2,3,1]	[2,1,3]

Table 5.10

3-Pgs are assigned to bars using a similar system to the four-step process used to allocate 4-Pgs but in this instance there are 5 stages. *Table 5.10* lists each 3-Pg and its two combinatorial partners. Both combinatorial and entangled partners are used for this system, with the outcomes for sections 3, 4 and 5 shown below.

	1	(1-6) = 3	[2,1,3]		1	1	[1,2,3]		1	5	[3,1,2]
	2	Ent. = 4	[2,3,1]		2	Ent. = 6	[3,2,1]		2	Ent. = 2	[1,3,2]
3	3	Comb. (1,2) = 2 (5)	[3,1,2]	**4**	3	Comb. (1,2) = 2 (4)	[2.3.1]	**5**	3	Comb. (1,2) = 2 (6)	[3,2,1]
	4	Ent. = 2	[1,3,2]		4	Ent. = 3	[2,1,3]		4	Ent. = 1	[1,2,3]
	5	Comb. (1,2) = 2 (6)	[3,2,1]		5	Comb. (1,2) = 1 (2)	[1,3,2]		5	Comb. (1,2) = 1 (4)	[2,3,1]
		Remaining	[1,2,3]			Remaining	[3,1.2]				

Table 5.11

Five of the 3-Pgs are used in each section, with the remaining 3-Pg assigned as the first point gesture in the next section in *Table 5.11*. Step 1 in section 3 was assigned using a random number generator containing the values 1-6. Steps 3 and 5 are also determined through random selection but only use the values 1 and 2.

Table 5.12 lists the combined outcomes of the pitch ranges omitted (Omitted column) and the order of the remaining ranges within each bar when the 3-Pg assigned is applied.

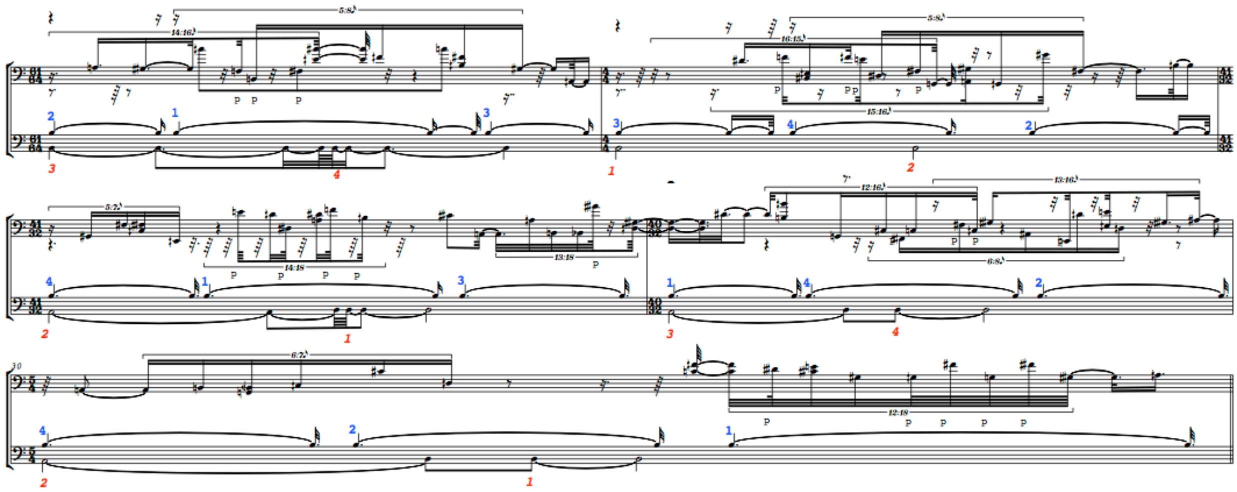
	Omitted	Remaining	3-Pg	Range order
	4	1,2,3	[2,1,3]	2,1,3
	1	2,3,4	[2,3,1]	3,4,2
3	2	1,3,4	[3,1,2]	4,1,3
	3	1,2,4	[1,3,2]	1,4,2
	3	1,2,4	[3,2,1]	4,2,1
	2	1,3,4	[1,2,3]	1,3,4
	1	2,3,4	[3,2,1]	4,3,2
4	4	1,2,3	[2.3.1]	2,3,1
	2	1,3,4	[2,1,3]	3,1,4
	3	1,2,4	[1,3,2]	1,4,2
	4	1,2,3	[3,1,2]	3,1,4
	1	2,3,4	[1,3,2]	2,4,3
5	1	2,3,4	[3,2,1]	4,3,2
	4	1,2,3	[1,2,3]	1,2,3
	3	1,2,4	[2,3,1]	2,4,1
	2			

Table 5.12

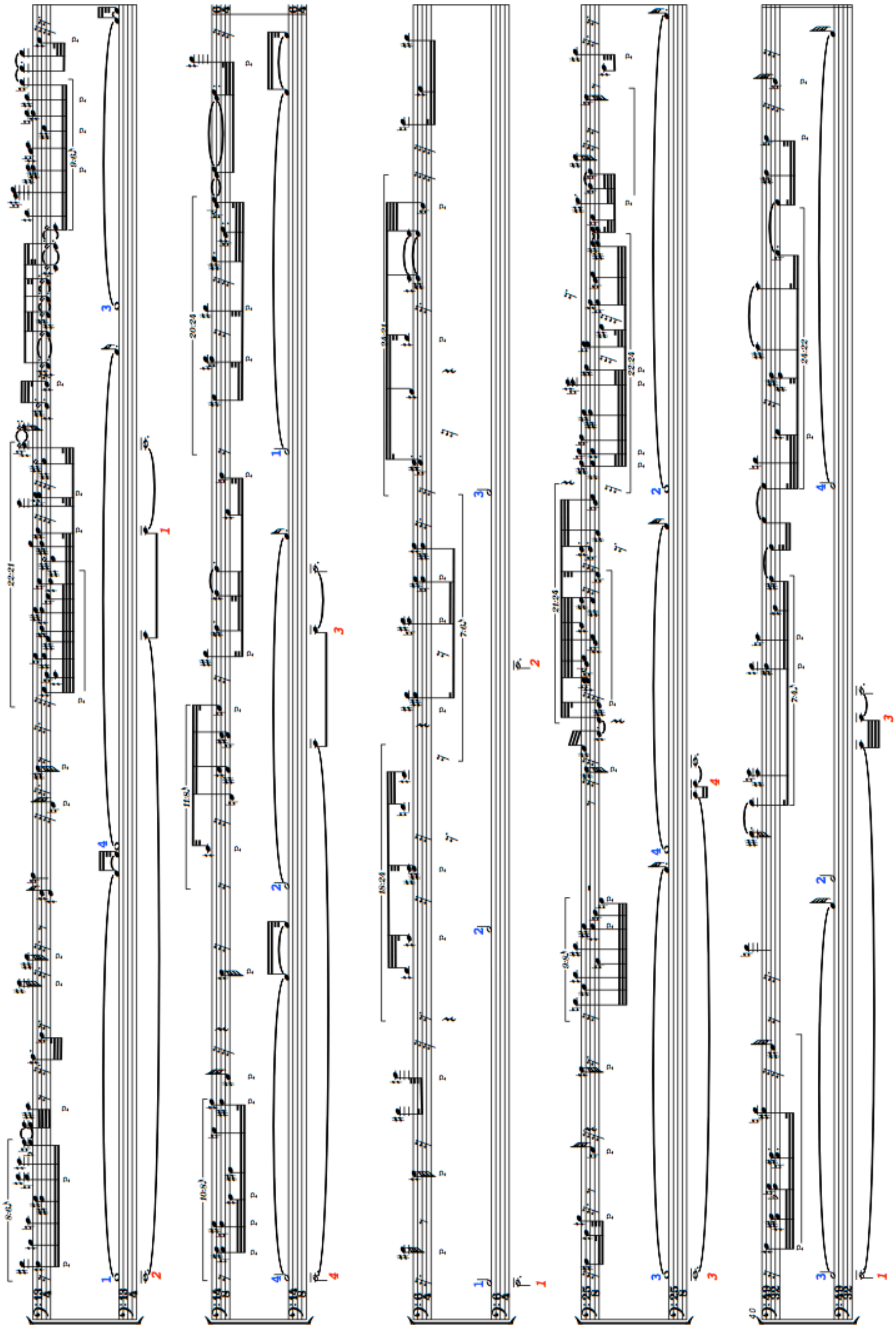
In *Table 5.5* it was shown that the sustained impulses in sections 3,4 and 5, and the un-sustained impulses in sections 6,7 and 8 are projected across three ranges. In order to derive assignments for sections 6, 7 and 8, the retrograde of the assignments in 3, 4 and 5 is used (starting with the 2 not used in *Table 5.12*) and are listed in *Table 5.13*. One should also note that the retrograde of the 3-Pg assignments in *Table 5.12* are used to order the remaining ranges within the bars. Skeleton scores of sections 3 and 6 are used as examples of this process in *Ex.5.11* and *Ex.5.12* respectively.

	Omitted	Remaining	3-Pg	Range order
	2	1,3,4	[1,3,2]	**143**
	3	1,2,4	[3,2,1]	**421**
6	4	1,2,3	[1,2,3]	**123**
	1	2,3,4	[2,3,1]	**342**
	1	2,3,4	[2,1,3]	**324**
	4	1,2,3	[2,3,1]	**231**
	3	1,2,4	[3,1,2]	**412**
7	2	1,3,4	[1,3,2]	**143**
	4	1,2,3	[1,2,3]	**123**
	1	2,3,4	[3,2,1]	**432**
	2	1,3,4	[1,2,3]	**134**
	3	1,2,4	[2,3,1]	**241**
8	3	1,2,4	[2,1,3]	**214**
	2	1,3,4	[1,3,2]	**143**
	1	2,3,4	[3,1,2]	**423**
	4			

Table 5.13



Ex.5.11



Ex.5.12

[7,6,8] Sustained – [4,5,3] Un-sustained

The sustained impulses in sections 6, 7 and 8 are assigned to two ranges in each bar. Each bar is split into two equal partitions with a range assigned to each. By splitting 4-Pgs into two, the ranges for two bars are assigned from one 4-Pg. A total of 7.5 4-Pgs are therefore needed to assign all sustained pitch ranges.

In an earlier version of this work, section 0 used four 4-Pgs, section 1 nine 4-Pgs and section 2 13 4-Pgs to assign ranges. In section 2 the 13th 4-Pg was [3,4,1,2], with its entangled partner [2,1,4,3] not needed to assign all of the impulses. Instead it was used as the fundamental 4-Pg from which all of the assignments for sustained impulses in sections [7,6,8] are derived. When the assignment system for [0,2,1] and [e,9,t] was corrected to assign a range per partition instead of per impulse, the fundamental 4-Pg for this section remained as it was.

For each 4-Pg there are nine combinatorial partners, with the partners of [2,1,4,3] listed in *Table 5.14*. Including [2,1,4,3], there are a total of ten 4-Pgs, with only eight needed to assign ranges. The two highlighted 4-Pgs in *Table 5.14* were used in section [4,5,3] to assign ranges so were omitted for this section. Starting with [2,1,4,3] as the initial assignment, a random number generator using the values 1-7 was used to assign the 4-Pgs, the outcome of which is listed in the far-right column of *Table 5.14*.

	[2,1,4,3]					[2,1,4,3]
1	[1,2,3,4]		1	[1,2,3,4]	1	[1,2,3,4]
2	[1,3,2,4]		2	[1,3,2,4]	2	[1,3,2,4]
3	[1,4,3,2]		3	[3,4,1,2]	3	[3,4,1,2]
4	[3,2,1,4]	1-7	4	[3,4,2,1]	6	[4,3,1,2]
5	[3,4,1,2]		5	[4,2,3,1]	4	[3,4,2,1]
6	[3,4,2,1]		6	[4,3,1,2]	7	[4,3,2,1]
7	[4,2,3,1]		7	[4,3,2,1]	5	[4,2,3,1]
8	[4,3,1,2]					
9	[4,3,2,1]					

Table 5.14

	[2,1/4,3]	2,1			2,4		[3,4/2,1]	3,4	
		4,3		[3,4/1,2]	4,3			2,1	
6	[1,2/3,4]	1,2	**7**		2,1	**8**	[4,3/2,1]	4,3	
		3,4		[4,3/1,2]	3,4			1,2	
	[1,3/2,4]	1,3			1,2		[4,2/3,1]	4,2	
								3,1	Not used

Table 5.15

Table 5.15 maps the outcomes in *Table 5.14* across sections 6, 7 and 8. The ranges for section 6 are shown in the lower voice of the bottom staves in *Ex.5.12*. The retrograde of the outcomes above are used to assign un-sustained impulses in section [4,5,3]. These are listed in *Table 5.16* and are also shown in the lower voice of the bottom staves in *Ex.5.11*.

	2,4			1,3	[1,3/2,4]
	4,3	34\12		2,4	
7	2,1		**4**	1,2	[1,2/3,4]
	3,4	43\12		3,4	
	1,2			1,2	[1,2/4,3]
	2,1	21\43		4,3	
	4,3			4,2	[4,2/3,1]
6	1,2	12\34	**5**	3,1	
	3,4			4,3	[4,3/2,1]
	1,3	13\24		2,1	
	3,4	34\21		3,4	[3,4/1,2]
	2,1			1,2	
8	4,3	43\21	**3**	2,1	[2,1/3,4]
	1,2			3,4	
	4,2	42\31		2,1	[2,1/4,3]
	3,1	Not used		4,3	Not used

Table 5.16

[e,9,t] Sustained – [0,2,1] Un-sustained

Sustained impulses in section [e,9,t] are assigned to one pitch range, so across 15 bars 3.75 4-Pgs are required. The same 4-Pgs used to order sustained impulse ranges in section [4,5,3] are used again but ordered slightly differently. As was the case in the techniques system, the assignments for sustained impulses form a continuous loop enveloping the work. The first 4-Pg value for range assignments in section 0 was 2, from the 4-Pg [2,3,1,4] (see *Table 5.7*), so the last 4-Pg value from the assignments in [e,9,t] is also 2, with the 4-Pg assignments listed below.

1	[4,1,2,3]	Ent. of bottom
2	[2,3,4,1]	Does not begin with 3
3	[3,2,1,4]	Ent. Above
4	[1,4,3,2]	Ends with 2

The four-step process for ordering the above assigned the 4-Pg ending with 2 first and appears as the last gesture above. Its entangled partner [4,1,2,3] is assigned to 1. [2,3,4,1] is assigned to 2 because it does not repeat the final value of [4,1,2,3], with its entangled partner assigned to 3. *Table 5.17* lists the above assignments as well as the un-sustained assignments for [0,2,1]. The assignments for [0,2,1] are the retrograde of those for [e,9,t], beginning on the omitted '2' from [1,4,3,2]. Skeleton score examples of the assignments for section 0 and section t can be found in *Ex.5.9* and *Ex.5.10* respectively.

	Bar	Range		Bar	Range
	46	4		1	2
	47	1		2	3
e	48	2	0	3	4
	49	3		4	1
	50	2		5	4
	51	3		6	1
	52	4		7	2
9	53	1	2	8	3
	54	3		9	1
	55	2		10	4
	56	1		11	3
	57	4		12	2
t	58	1	1	13	3
	59	4		14	2
	60	3		15	1
		2			4

Table 5.17

Sustained/Un-sustained points: Distributions

Points are realised as either sustained or un-sustained and single or double-stopped, with the ratio between the two mediated globally by gradually increasing the number of un-sustained points whilst proportionally reducing the number of sustained points and increasing and decreasing the percentage of double-stopped (DS) impulses (*Table 5.18*). This process of statistically demarcating the prevalence of different types of point is also reflected in their allotted temporal positions within the bar. One can see from *Table 5.18* and in the score examples shown in the previous sections that there is a broad move away from impulses within tuplets to impulses outside of tuplets. In the score, impulses within tuplets are demarcated as a group of pitch classes sharing a beam (for tuplets such as 24:12 (see bar 46, 1st beamed group)) or more commonly within a tuplet bracket (again, sharing a continuous beam).

Section	% sus	% in tups	% un-sus	% in tups	% DS
0	100	100	0	100	0
1	91 2/3	100	8 1/3	100	10
2	83 1/3	91 2/3	16 2/3	100	20
3	75	91 2/3	25	100	30
4	66 2/3	83 1/3	33 1/3	75	40
5	58 1/3	83 1/3	41 2/3	75	50
6	50	75	50	75	50
7	41 2/3	75	58 1/3	75	40
8	33 1/3	66 2/3	66 2/3	50	30
9	25	66 2/3	75	50	20
t	16 2/3	58 1/3	83 1/3	50	10
e	8 1/3	58 1/3	91 2/3	50	0

Table 5.18

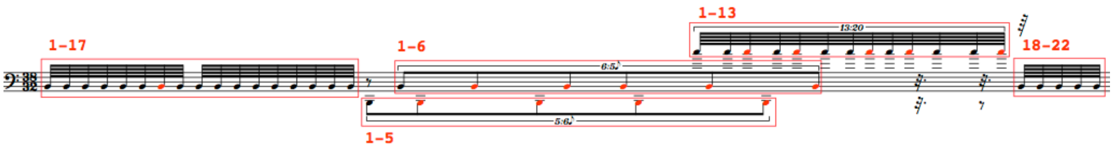
The system for assigning impulse point positions is entirely based on random number generators with bar 6 being used as an example because it relatively simplistically shows the strategies for assignments inside and outside of tuplets as well as the macro-distribution of impulses. With there being sixty different time signatures as well as sixty variants of pitch-class content (1-60), each bar required bespoke number generators to assign the impulse points. However, the mechanism used needed to be uniform throughout the work so the approach outlined below is repeated in all other bars.

Bar 6 contains 16 pitch-classes, with the percentage of these sustained being 83.34%. 16 x 0.8334 gives 13.3344 (13) sustained impulses, with the remaining 3 assigned as un-sustained. The three un-sustained impulses are assigned one to each tuplet. 20% of the 16 pitch classes are realised as double stops, giving 3.2 (1 DS). These are all listed in *Table 5.19* below.

Bar 6	
No. of Pcs	16
% Sus	83 1/3
No. Sus/Un-sus	13/3
% Sus in tups	91 2/3 = 15/1
% Un-sus in tups	100
%/No. DS	20 = 3.2 = 1

Table 5.19

As two of the pitch classes are realised as a double stopped dyads, this reduces the impulse content by one to fourteen impulses inside tuplets. These are distributed between the tuplets assigning 4, 5 and 5 impulses to tuplets 1, 2 and 3 (left to right in the score) respectively. A skeleton score of these assignments is shown in *Ex.5.13*, with *Ex.5.14* showing the results in the finished score.



Ex.5.13

Ex.5.14

Firstly, the total impulse content for each tuplet (1-5, 1-6, 1-13) is derived and these form the set for each number generator. To avoid a sense of strong or weak beats the first of each tuplet is never assigned, leaving tuplet one and two with four and five impulse points respectively. The impulse distributions across the three tuplets have therefore been ordered, as the tuplet with four impulses has to be assigned to the first because it contains only four impulse points after the first is omitted, thus assigning five impulses to the remaining two tuplets. *Table 5.20* lists the outcomes for each tuplet (and highlighted red in *Ex.5.13*). The impulse outside of the tuplets was assigned in a similar way, but instead totalling the number of hemidemisemiquavers outside of the tuplets (22, so values 1-22), with 7 being the outcome of the number generator.

Tuplet		No. Imp.	Imp. Points
1	5:6	4	All remaining
2	6:5	5	All remaining
3	13:20	5	3,5,8,10,13

Table 5.20

Objects: Object Distributions marks a key milestone in establishing a global aesthetic to which my works subscribe. From this work onwards the focus of my compositional output is on systems for macro- and micro-level partitioning and the development of a rather extreme form of point-based compositional practice. There are several examples outlined above that show the malleability of a system based on very limited sets of point gesture variants (3- and 4-Pgs, for example), that are able to assign sonic outcomes at both the largest, structural levels of the work and at the smallest, although the assimilation of point gesture variants other than the basic set of three or four points (in the context of micro gestures of trichords and tetrachords) is not achieved until *Objects 2*.

Although the surface-level micro gestures referenced above in this work have their vertical-temporal positions varied according to pre-defined pitch ranges, they are still in this work used in a rather un-refined fashion, with really only one type of gesture used: single points. The emancipation of the point in this work, manifest in the hyper-specificity of impulse content and playing technique parameters, are at the conceptual forefront in this work, however this is not necessarily borne out in the pitched domain of the work, with pre-compositional notes showing a somewhat haphazard approach that prioritised variance over invariance. With the compositional process heavily focused on matters pertaining to developing structural strategies employing point gestures, the result was that the pitched domain, although detailed, was not interrogated enough from a compositional standpoint. This was perhaps indicative of my approach in general at this time, whereby the desire to formulate overtly complex and technically challenging works took priority over defining the pitched domain of the works.

However, the under-defined nature of the pitched domain can also be viewed in the context of what I termed 'anti-sound' at the beginning of this chapter, which includes 'the degrading or obscuring of pitch focus' The result of this is a higher degree of abstraction in performance, in that both the performer and listener will find the process of comprehending the work through pitched domain-specific markers problematic, which is exacerbated by constantly changing the source pitch matrixes across and within sections. Detailing and listing these differences within this chapter would have been extensive but superfluous to the real concerns of this piece. The pitched parameter is used in a far more consistent and perceptive way in the later works, the result of a gradual process of 'distillation' whereby the following works are marked by their increasingly reductive and sparse nature, epitomized in the two sets of studies *Objects 5* and *Objects 6*. The following works are in part a reaction to the considerable amount of time it took to conceptualize and compose this work (roughly two years). After this work I looked to find ways by which to limit and refine both the material content and the total number of parametric source sets required for the processes to be effectively and efficiently realised in the compositions.

6. On the mimetic in contemporary music

As Stefan Beyst has shown, there are several ways in which music can be termed mimetic. From the obvious in what would be called 'programmatic music' to the act of realising a score in performance, the 'imitating of objects or beings through the duplication of one of their sensory appearances'[82] is how Beyst defines mimesis. Beyst delineates several sub-categories of mimesis, notably the notions of 'uncompleted' and 'completed' mimesis. In his *Sonorous Beings in Musical Space*, Beyst states that:

> Absolute music is not only mimesis, it is also the very paradigm of completed mimesis: through having the musician produce the outer appearance, the composer conjures up the 'soul' of non-existent beings that come to inhabit that appearance. The whole world of the sonorous beings in their musical space only exists through the activity of the musicians; they create the beings that they are imitating through duplicating their auditory appearance, just like painters conjure up living beings through duplicating their visual appearance on a canvas.[83]

[82] Beyst, S. (2019). Auditory Mimesis and Music. Retrieved 4 March, 2019, from http://d-sites.net/english/mimesismusic03.html

[83] Beyst, S. (2019). Sonorous Beings in Musical Space. Retrieved 4 March, 2019, from http://d-sites.net/english/mimesismusic02.html

It seems there is no avoiding the fact that there is a degree of mimesis inherent in the performance of music because, for it to be heard, a score is typically interpreted by a performer or group of performers and expressed through actions on their respective instruments. However, this form of mimesis is not a consideration of this chapter or in my practice in general, as the elements of the work have an inherent representative value assigned to them in that they appear in relation to other elements, such as the pitches that constitute a trichord creating that sonic image, or 'sonorous being'[84], of that trichord. Representing only the chord in question without duplicating an image or sound from the real world (i.e. birdsong), Beyst delineates as 'completed mimesis':

> With uncompleted mimesis, you cannot refrain from replacing the perception of the mirror image with that of the reality to which it refers… With completed mimesis, you continue to look into the mirror. The virtual image no longer functions as a sign for the real world, and is thereby turned into a real imitation - into an image or world - in the full sense of the word.[85]

The musical mimesis I will be discussing in the remaining text will be that of 'uncompleted mimesis', or more specifically the means by which composers use mimetic devices in order to provoke specific responses in the consumers of the art objects in question. What is represented in a piece of music and art in general, and how the representation occurs, has been a preoccupation of mine throughout my research. I came to the conclusion that the plea to emotion or aspects of play, to name

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[84] Ibid.

[85] Beyst, S. (2019). Mimesis: reconsideration of an apparently obsolete concept. Retrieved 4 March, 2019, from http://d-sites.net/english/mimesis.html#completed

two representations popular in art music today, were a rather crass, lowest common denominator form of composition which does not advance compositional practice.

With the boundaries between high art and the entertainment industry eroded in the age of postmodernism, music and its signifying capacity, of which ‘tonality’ (or more broadly speaking the combination of specific intervallic or harmonic content) plays an important role, can be exploited by the composer to maximize familiarity in its audience and increase market assimilation. Gordon Downie has written extensively on the issue of the artist’s relation to the market and the means by which he or she is able to manipulate the consumer in order to secure market prominence or dominance. In relation to tonality he writes:

> As a hyper-rich sign-vehicle—a product of a long historical process of semantic accretion and accrual—its connotative power makes it the ideal resource for the detailed representation and examination of human physiological and psychological experience, and thus the ideal resource for any composer seeking to replicate and/or reinforce the physiological and psychological complexions and textures of his or her target in order to create relationships of trust, confidence, and identity.[86]

[86] Downie, G. (2008). ‘Cultural Production as Self-Surveillance: Making the Right Impression’, *Perspectives of New Music*, 42(2), p.201.

This 'hyper-rich sign-vehicle' affords the composer with sonic markers that have the ability to refer to any number of musical and non-musical sources, for example sounds from nature, transportation and city infrastructure, or current aesthetic traits in other fields of music, such as pop. Works which exhibit elements of the above, as well as aspects of play and overtly emotive content, are able to gain popularity amongst the audience and public in general as their ease of consumption is all but guaranteed given the accessible, simplistic and un-critical aesthetic predominantly employed.

This is acutely true at big events such as the BBC Proms, which in recent years has integrated an increasing number of concerts aimed at as many intersections of audience-member as possible, ticking the box of each metaphorical sub-set to increase performance revenue. The Eric Whitacre Prom in 2015, *Prom 32: Eric Whitacre and the Royal Philharmonic Orchestra*[87], is a prime example of this populist mentality. The synopsis of the concert reads:

> Eric Whitacre's new work *Deep Field* is inspired by images taken from the Hubble Space Telescope – and offers the audience a chance to participate in a novel way. In his popular *Cloudburst*, too, you can help create the sound of rain falling. Plus, American classics by Copland and Gershwin.

[87] Bbccouk. (2015). Proms 2015 Prom 32: Eric Whitacre and the Royal Philharmonic Orchestra. Retrieved 4 March, 2019, from https://www.bbc.co.uk/events/evxwhn

> Download the free Deep Field smartphone app from the App Store and Google Play before the concert and be part of the performance.[88]

'Inspired by images' and 'the sound of rain falling' both invoke the mimetic in rather base and obvious terms, the cliché of the awe-inspiring nature of the cosmos represented in music and the obvious and aesthetically tired recreation of rain falling. Coupled with audience participation through the use of a downloaded App, these works fit neatly into the realm of entertainment and uncritical consumption. As Gordon Downie has stated, '[t]he use of emotive, whimsical, sentimental, or jocund language, projected using direct, simple, undemanding and frequently informal vocabulary and syntax, is particularly effective in inducing trust and confidence in the target'[89], thus increasing the ease by which the art objects presented can be consumed.

Another work in the same concert, *Blow It Up, Start Again* by Jonathon Newman, contains elements of the musical genre Dubstep in its appropriation of the so-called 'wobbler' effect performed on muted trombones.[90] A fusion of disparate musical styles within the context of a single work has never sat easily with me, as the sonic outcomes rarely form a cohesive artistic ideal or vision, and in the Newman example comes across as a means by which to increase the reach and potential performances by appealing to an extra intersection of society. It does not just appeal to the typical

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[88] Ibid.

[89] Downie, G. (2008). 'Cultural Production as Self-Surveillance: Making the Right Impression', *Perspectives of New Music*, 42(2), p.204.

[90] Youtubecom. (2019). Blow It Up, Start Again - Jonathan Newman. Retrieved 4 March, 2019, from https://www.youtube.com/watch?v=tGNdLhzTXr8
(The 'wobbler' effect is perhaps the preeminent gestural/sonic effect associated with dubstep)

Eric Whitacre audience, but also potentially people who listen to Dubstep or 'urban' music more so than 'classical' music, although the diluted version of this particular pop aesthetic within this work would (one would hope) put this demographic off repeated listenings of the work.

Of course, the mimetic is nothing new in music, with Beethoven's *Pastoral Symphony* being an obvious example, its five movements bearing descriptive titles (e.g. the storm-like fourth movement: *Gewitter, Sturm*). Although there are musical fragments that are obviously representative of non-musical events in his 6th Symphony, Beethoven apparently 'warned against taking the descriptions [of the movements] literally… call[ing] them 'expressions of feeling rather than depiction.''[91] And there are more contemporary attempts at programmatic music, such as Claude Debussy's *La Mer* or George Crumb's *Black Angels*, that are fairly obvious in what they are depicting. This does not necessarily mean they are not good pieces of music, and I would go so far as to say that these are two exemplary examples of the power of music's capacity to signify that which is not music both sonically and emotionally. However, in the context of what I wish to achieve in my own aesthetic practice, this level of real-life representation, 'uncompleted mimesis' in the terms set out by Beyst[92], is not appropriate in the works I create, given that the representation of material in works with the *Objects* prefix are non-descriptive of real-world objects; at

[91] Palisca, V. (1996). *A History of Western Music*. (5th ed.). New York: W W Norton & Company, p.550.

[92] Beyst, S. (2019). Mimesis: reconsideration of an apparently obsolete concept. Retrieved 4 March, 2019, from http://d-sites.net/english/mimesis.html#completed

the surface level, the gestures almost always depict trichords and tetrachords in all works except *Objects 6.1-6.3* (which are for un-pitched percussion).

In line with the goals of the entertainment industry, references and allusions to aspects of play are useful appropriate because play is associated with leisure time activities such as sports or games, as well as the potential addition of nostalgia when incorporating children's games. Distraction and relaxation are key components of leisure time, therefore music of this nature is foremost intended to entertain and not challenge its listening public. This is perhaps even truer in state-backed events such as the Cultural Olympiad of the Summer Olympics and Paralympics Games. The twenty works commissioned for the London 2012 event were 'inspired by the dynamism of Olympic and Paralympic sports, the passion of human endeavor so central to the Games, and the once-in-a-lifetime opportunity of creating a musical work contributing to a global sensation.'[93] As one would expect, several of the twenty new works commissioned contain elements of play, in particular sport, and also references to a hypothetical collective spirit, travels or celebration:

> 'Bells proclaim moments of public gathering, celebration and important news' (Skempton), 'focuses on a mythological character who leaves home, travels overseas to face trials and so

[93] Archiveorg. (2011). New Music 20x12. Retrieved 4 March, 2019, from https://web.archive.org/web/20110430053658/http://www.london2012.com/get-involved/cultural-olympiad/music/new-music-20x12.php

may return a hero' (Wolters), 'reflect the positive spirit of Melanie and the many other people' (Beamish), 'from the point of view of a second-generation immigrant' (Mukherjee), 'share their musicianship and creative inventiveness without their instruments, through clapping, body percussion and beatboxing' (Meredith), 'spirited meditation on humankind's enduring fascination with fire' (Bruce), 'layers of obscurity which the individual must penetrate to see the vision of Eternity' (Causton), 'a thrilling near real time musical recreation of this legendary race and celebration of its extraordinary winner' (Howard), 'a backdrop of events in Northern Ireland in 1972, which was one of the bloodiest years of the troubles' (Mitchell), 'exploring the base and animalistic side of the Faun' (Higgins), 'The Olympic idea of pushing the body to physical (and mental, and spiritual) extremes' (Cassidy), 'explores the distinct sounds and rhythms that table tennis players create' (Cutler), 'brings to life the relationship between two athletes, once adversaries in sport who became friends despite the ideological opposition surrounding them' (Joseph), 'music as a powerful vehicle for change, and enables prisoners to contribute positively to New Music 20x12' (Turnage), 'inspired by the competition of life' (Liew/Leung), 'tells the tale of success through team work and sporting pride' (Goss)[94]

Being promotional material for the general public, the language used to describe these works is informal with no technical language to give the reader further insight into the compositional process. In order to boost public interaction with the Cultural Olympiad, the promotional material was written in such a way that the appeals to the general public so any references to technical-aesthetic information or the mechanics of the work's construction are omitted, superfluous as they are to the goals of the event in question: to increase capital gains, either in a financial or cultural sense

[94] Nmcreccouk. (2019). New Music 20X12. Retrieved 4 March, 2019, from https://www.nmcrec.co.uk/new-music-20x12 (Listed by composer tabs)

(which are of course not necessarily mutually exclusive). Being a state-backed event, these works can be used by the government as a form of soft power both within the country and on the international stage. Thus public works will inevitably be in large part easy to consume and critical forms of composition, such as quantum composition, are mostly shunned in favour of a more universally digestible musical discourse more suitable for corporate marketing events.

After reassessing my own creative output, in particular the proto-quantum works in Chapter Three, I began to see the representation of non-musical elements as a hindrance to my aforementioned goals, as the desire for higher levels of abstraction is set back when delineating aesthetic goals and procedures in reference to 'real-world' sources. As explained earlier, the mimetic in the proto-quantum works is not necessarily explicit in the way programmatic music is, but is instead used as an initial source from which musical equivalents might be formulated. This is somewhat similar to the process Karlheinz Stockhausen used in the initial stages of the compositional process for *Gruppen* (1955-57), elaborated upon in his English Lectures (1972)[95], where the mountain range seen from his window informed the compositional process not in a literal sense as a surface-level musical equivalent in the work but as a means to delineate methods by which the elements of the work

[95] Youtubecom. (2013). Lecture 1 [PARTE 2/4] Stockhausen Karlheinz - English Lectures (1972). Retrieved 4 March, 2019, from https://www.youtube.com/watch?v=UMsPzuP8sXU

could be formalized.[96] In performance, one doesn't hear the music as descriptive of a mountain range, but instead as an interplay between the three orchestral bodies that at times coalesce but are more often than not performing against each other, for example in the superimposition of different tempi.

As my research and compositional output became less focused on aspects of physics, the works with the *Objects* prefix focus on the use of point gestures to delineate and realize the elements of the works. The works therefore become almost completely self-referential, or perhaps intra-referential, in that the methods by which the work is constructed are manifested at the surface level as well, forming a cohesive aesthetic and non-mimetic (in the 'uncompleted' sense[97]) approach to the art of music composition.

By eschewing surface-level, 'uncompleted' mimesis, the work is elevated from the realm of base entertainment to high art. Expressed through a high degree of abstraction, the works become less capable of assimilating market forces as there is only a very limited (if any) capacity for its elements to 'create relationships of trust, confidence, and identity'[98] in its audience. Because the work's signifying capacity has in effect been removed, one is forced (as a consumer) to take into account other

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[96] *Ibid.*, Stockhausen talks of vertically partitioning the sketches of the mountain range by drawing vertical lines by using the mountain peaks as markers and assigning each the duration of a semibreve. Horizontal partitions were then used to delineate time-point layers for impulse content.

[97] Beyst, S. (2019). Mimesis: reconsideration of an apparently obsolete concept. Retrieved 4 March, 2019, from http://d-sites.net/english/mimesis.html#completed

[98] Downie, G. (2008). Cultural Production as Self-Surveillance: Making the Right Impression, Perspectives of New Music, 42(2), p201

variables in order to gain a semblance of ‘order’ from the object(s) projected. The work therefore becomes harder to consume passively, requiring complete, focused and critical attention, which goes against the prevailing use of one’s ‘leisure’ time. As Gordon Downie has stated: ‘it is *representation* that most effectively detracts from the expression of structure and the materials articulating it. And it is the defeat of representation that characterizes most succinctly modernist sensibilities.’[99]

[99] Downie, G. (1995). Modernism in Architecture and Music. DOCOMOMO JOURNAL, November, pp54-56

7. *Objects 2: Four-Point Gestures*, for String Quartet (2012)

Objects 2: Four-Point Gestures, completed in late 2012, is in its total bar content one of the more extreme pieces I have written. As mentioned in the analysis of *Objects: Object Distributions*, the focus of my compositional research from that work onwards was in the formalisation and further refinement of systems of production and realisation that are derived using point gestures. Akin to a distillation or crystallisation process, this reduction of a work's fundamental compositional processes to point gestures had a significant impact on my aesthetic approach and the sonic outcomes in the works I was to create.

The reasoning behind developing a point gesture-based compositional method was that it enables one to delineate several outcomes from a relatively small number of initial assignments, whilst simultaneously decreasing the need to employ random processes. In this work the musical focus is on the different variants of micro-gesture that can be formed from four points. In *Objects* the pitch classes were realised as either single pitches or as part of a dyad, and this forms the basis from which the variants of micro-gesture in this work are formed. The hyper-segmentation of the previous works is developed further in this work with every bar now surrounded by silences. Each bar becomes a macro-section in its own right, reinforcing the undercurrent of distillation and fragmentation further.

Objects 2 is partitioned into 23 sections, 11 of which contain played material. These are ‘framed’ by 12 sections of varying lengths of silence, measured in seconds. Each of the 11 sections of played material is assigned a single gesture-type, and are variants derived from a set of 3 basic gesture-types: 4 points (4P), 2 points + 1 double-stopped[100] dyad (2P+1DS) and 2 double-stopped dyads (2DS). The 11 gestures are:

1	4P	1.1	4 points	4P
2	2P+1DS	1.2	4 points + 1 glissando	4P+1G
3	2DS	1.3	4 points + 2 glissandi	4P+2G
		1.4	4 points + 3 glissandi	4P+3G
		1.5	4 points + 4 glissandi	4P+4G
		2.1	2 points + 1 double-stopped	2P+1DS
		2.2	2 points + 1 double-stopped + 1 glissando	2P+1DS+1G
		2.3	2 points + 1 double-stopped + 2 glissandi	2P+1DS+2G
		3.1	2 double-stopped dyads	2DS
		3.2	2 double-stopped dyads + 1 glissando	2DS+1G
		3.3	2 double-stopped dyads + 2 glissandi	2DS+2G

Table 7.1

The gesture-types are assigned globally by first creating three sub-groups consisting of two groups of four and one group of three gestures. These are created by first listing the eleven gesture-types and picking one from each group (1.1, 2.1, 3.1) and then repeating the process twice, with 1.4 and 1.5 assigned after this process was complete (see ‘Initial’ column of *Table 7.2*). From top to bottom the gestures project a trajectory of four points (4P) to four points linked by glissandi (4P+4G), ‘broken’ to ‘unbroken’.

[100] Double stopped can be realized on one instrument or simultaneously on two instruments, with one note assigned to each instrument

Initial			Ordered	
1.1	4P		1.1	4P
2.1	2P+1DS	A6 - [1,4,3,2]	1.2	4P+1G
3.1	2DS		3.1	2DS
1.2	4P+1G		2.1	2P+1DS
2.2	2P+1DS+1G		2.3	2P+1DS+2G
3.2	2DS+1G	D1 - [4,1,2,3]	2.2	2P+1DS+1G
1.3	4P+2G		3.2	2DS+1G
2.3	2P+1DS+2G		1.3	4P+2G
3.3	2DS+2G		1.4	4P+3G
1.4	4P+3G	3 - [2,1,3]	3.3	2DS+2G
1.5	4P+4G		1.5	4P+4G

Table 7.2

To order the two sub-groups containing four gesture-types, two 4-Pgs were assigned by first using a random process (the outcome of which was [1,4,3,2], or A6) and then assigning the entangled partner of A6 ([4,1,2,3], or D1). The remaining sub-group, consisting of three gesture-types, was ordered using a 3-Pg chosen by a similar random process. The final order of gesture-types is shown in the 'Ordered' column of *Table 7.2*. This global ordering of gesture-types is projected onto the time signature outcomes shown in Chapter Two, thus assigning a gesture-type to each of the 11 bars (*Table 7.3*).

T-Sig	Step 3 outcome	Pg-type	Pcs	No. of Pgs
2\4	4	4P	12	3
4\4	6.1	4P+1G	36	9
3\4	5	2DS	24	6
7\4	8.1	2P+1DS	60	15
9\4	9.1	2P+1DS+2G	72	18
6\4	7	2P+1DS+1G	48	12
5\4	6.2	2DS+1G	36	9
8\4	8.2	4P+2G	60	15
12\4	e	4P+3G	96	24
10\4	9.2	2DS+2G	72	18
11\4	t	4P+4G	84	21

Table 7.3

As mentioned above, the 11 sections with played material are framed by 12 silences. The 12 silences are in multiples of 3, spanning 3 to 36 seconds, and are split into four sub-groups containing three silences (see 'Silences in seconds' column, *Table 7.4*). Listed as shown this gives three columns containing four silences, with each column being shorter in total duration than the column that preceded it (reading from left to right and shown in parentheses beneath the dotted line). Since each column contains four silences they can be ordered using three 4-Pgs, and the work broadly moves from lower to higher levels of saturation and activity (as well as shorter to longer bar lengths), with the silences in the broadest terms moving from longer to shorter durations in inverse relation to bar lengths. Unlike in previous works, silences in this work form a surrounding architecture or 'frame' in which the bars of played material exist.

Three 4-Pgs are needed to order the silences. The first of these, [4,1,2,3] (*Table 7.4*), is the remaining 4-Pg after tuplet positions had been assigned. From this a combinatorial partner ([2,3,4,1]) was assigned using a random process, with the final 4-Pg being the entangled partner of [2,3,4,1] ([3,2,1,4]). The first, second and third 4-Pgs are assigned to sub-columns 1, 2 and 3 respectively. The results of this are shown in the 'Outcomes' column of *Table 7.4.* With these in place and coupled with the assignments in *Table 7.3*, the overall skeleton of the work is complete.

Silences in seconds				Pgs	Outcomes		
1	36	33	30	D1 - [4,1,2,3]	4 - 9"	2 - 24"	3 - 12"
2	27	24	21	B4 - [2,3,4,1]	1 - 36"	3 - 15"	2 - 21"
3	18	15	12	C3 - [3,2,1,4]	2 - 27"	4 - 6"	1 - 30"
4	9	6	3		3 - 18"	1 - 33"	4 - 3"
	-90	-78	-66				
	1	**2**	**3**		**1**	**2**	**3**

Table 7.4

As in *Objects: Object Distributions*, each of the bars in this work is partitioned at both the macro- and micro-level. In the case of this work, each bar is partitioned into four macro-partitions of equal size, with each of these sub-divided into four micro-partitions. 2/4 is shown as an example in *Ex.7.1*.

Ex.7.1

How this work differs from *Objects* is in not only an increase to four of each partition-type but that partitions and sub-partitions are also the same respective sizes, forming an equal distribution across the bar. This is held invariant in all bars, so for example 3/4 would be partitioned into four dotted quavers globally, with the micro-partitions being dotted demisemiquavers. These partitions are then used for purposes similar to those in *Objects* (such as start-points for tuplets) so will only be discussed briefly below.

Tuplets: Numerators/denominators, global trajectories and starting positions

Listed next to *Table 7.5* are 10 values under 'Tuplet values' that are used as both numerators and denominators of tuplets. These are split into two groups that either increase or decrease the total number of possible impulse points within a given space. Like the saturation levels derived for each t-sig in *Objects*, a saturation level for each tuplet-type was delineated, with the 90 tuplet-types then being arranged linearly from highest to lowest percentage values. From this, all tuplet values that share the same saturation level (for example, 21:28, 18:24 and 15:20 all have a saturation level of 75%) were omitted from the final selection process, which left 24 tuplets for each tuplet group (increase/decrease).

Tuplet values	Tuplets									
14	14:28	15:28	16:28	18:28	20:28	21:28	24:28	25:28	27:28	28:27
15	14:27	15:27	16:27	18:27	20:27	21:27	24:27	25:27	27:25	28:25
16	14:25	15:25	16:25	18:25	20:25	21:25	24:25	25:24	27:24	28:24
18	14:24	15:24	16:24	18:24	20:24	21:24	24:21	25:21	27:21	28:21
20	14:21	15:21	16:21	18:21	20:21	21:20	24:20	25:20	27:20	28:20
21	14:20	15:20	16:20	18:20	20:18	21:18	24:18	25:18	27:18	28:18
24	14:18	15:18	16:18	18:16	20:16	21:16	24:16	25:16	27:16	28:16
25	14:16	15:16	16:15	18:15	20:15	21:15	24:15	25:15	27:15	28:15
27	14:15	15:14	16:14	18:14	20:14	21:14	24:14	25:14	27:14	28:14

Table 7.5

As Appendix 7.1 shows, only 13 tuplets that increase the impulse content are used (top six rows, designated Bar 1, 3, 7, 2, 6 and 10) and only 20 tuplets that decrease the impulse content are used from Bar 10 to the bottom of Appendix 7.1. This Appendix is listed from top to bottom in increasing pitch-class content order (`No. of pc' column), and the number of tuplets assigned to each bar increases in accordance with this. Bar '10' is the only bar to contain both types of tuplet variant so in this system it acts as a pivot-point around which it is constructed. This is also reflected in the saturation percentages (% column), in that as one reads down in Appendix 7.1 to Bar 10 the saturation percentages decrease and then begin to increase again from the third tuplet in 10. The four bars with the lowest impulse content and the four with the highest are assigned two and four tuplets respectively, with the remaining three assigned three tuplets.

2 tuplets: 2/4, 3/4, 5/4, 4/4

3 tuplets: 6/4, 10/4, 7/4

4 tuplets: 9/4, 8/4, 11/4, 12/4

For each group of bars containing two, three or four tuplets, a 4-Pg assigned to the bar determines in which macro-partition the tuplet will be assigned and also the specific micro-partition. This is achieved through a process similar to that found in the range system for *Objects*, so will only be briefly outlined below.

2 tuplets: The first two values of the 4-Pg assigned gives the macro-partitions, with the second two values assigning the micro-partitions.

3 tuplets: All 4s were removed from the 4-Pgs assigned, omitting the fourth macro- and micro-partitions in each bar, leaving the values 1, 2 or 3 to be assigned to the three remaining macro-partitions.

4 tuplets: All macro-partitions have tuplets assigned to them, so the 4-Pg assigns micro-partitions.

All tuplets, except in bars with three tuplets, have hemidemisemiquaver as their unit. In bars with three tuplets there are three unit values: semiquaver, demisemiquaver and hemidemisemiquaver. In some instances, the denominator content of the tuplet assigned was not able to fit with its partition allocation. When this was the case, the tuplet was shifted to the left by however many impulse points needed for it to fit into the bar.

Instrumentations

The hyper-segmentation mentioned earlier is at its most evident in the system created for instrumentations, and like the silence system reinforces the sense of fragmentation within the work. Segmenting an ensemble into its sub-ensembles is evident in all my works for two or more performers, with the purpose of presenting each variant equally across the work. This will of course depend upon the unit of measurement one chooses to use. If one chooses to measure the total number of pitches or impulses used by each ensemble across the work as opposed to the total number of bars the basic ensemble-types are assigned to, there will be a difference in how equally the units are distributed.[101]

Bar	T-Sig	G-Type	No. of Gs	Impulses	No. of Pc	Ensemble
1	2/4	4P	3	12	12	Solo
2	4/4	4P+1G	9	36	36	Solo
3	3/4	2DS	6	12	24	Duet
4	7/4	2P+1DS	15	45	60	Solo
5	9/4	2P+1DS+2G	18	54	72	Duet
6	6/4	2P+1DS+1G	12	36	48	Duet/Trio
7	5/4	2DS +1G	9	18	36	Trio
8	8/4	4P+2G	15	60	60	Quartet
9	12/4	4P+3G	24	96	96	Trio
10	10/4	2DS+2G	18	36	72	Quartet
11	11/4	4P+4G	21	84	84	Quartet

Table 7.6

In the ‘Ensemble’ column of *Table 7.6*, each ensemble is assigned three times across the work.[102] Also, one should notice that these ensembles are entangled (solo-quartet, duet-trio) so the antipodes of bars one to five (eleven to seven, respectively) are assigned the entangled partners. For example, bar one is assigned solo ensembles and bar eleven is assigned a quartet. As the work moves from bar one to eleven, the gesture-types assigned become problematic for ensembles with fewer instruments. This is particularly true when taking into account gestures with glissandi as the systematization methods for these are bespoke to each gesture-type. For example, the glissandi assignments for 4P+4G gestures are between gestures, which one could

[101] One should note that the only work submitted that shares pitch and impulse content exactly equally is *Entanglement*

[102] Bar 6 is the central bar and acts as a pivot-point in this system so contains both duets and trios to equalize these outcomes

reasonably assume would be impossible to realise on one instrument but is easily possible with a full quartet.

As well as the point gesture systems outlined above, similar systems were developed to assign all other parameters in the work. This is mainly achieved through the application of 4-Pgs, but there are instances where these were inadequate, so random processes and/or 3-Point Gestures (3-Pgs) were used. The remaining text will focus on two of these parameters: micro-gesture contours and glissandi.

Micro-gesture contours

These are the most easily identifiable of the 4-Pg assignments in the work, expressed most simplistically in the score in bars 1 and 2. Like the systems discussed earlier, the 4-Pgs are assigned using entangled and combinatorial partners. When initially formulating global systems for intra-object contours (the order of elements in the 4-Pg assigned) it was necessary to combine the assignments for different bars for there to be an equality regarding the occurrence of specific 4-Pgs. For example, in *Table 7.7* each box in the 'G-Type' column denoting 4P, 2DS and 2P+1DS gestures, was treated on its own terms, providing a global assignment system that was uniform within each gesture class.

Bar	T-Sig	From Set	G-Type	No. of Gs	PRs
1	2\4	4	4P	3	4
2	4\4	6a	4P+1G	9	4
8	8\4	8b	4P+2G	15	3
11	11\4	t	4P+4G	21	2
9	12\4	e	4P+3G	24	2
3	3\4	5	2DS	6	4
7	5\4	6b	2DS +1G	9	3
10	10\4	9b	2DS+2G	18	2
6	6\4	7	2P+1DS+1G	12	4
4	7\4	8a	2P+1DS	15	3
5	9\4	9a	2P+1DS+2G	18	2

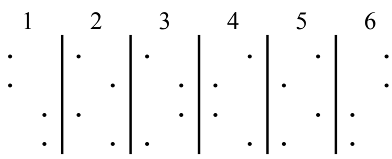
Table 7.7

4P: This was the simplest of the three classes to assign. There are 24 variants/permutations of four points, from [1,2,3,4] through to [4,3,2,1]. The 'No. of Gs' (Number of Gestures) column in *Table 7.7* lists how many gestures are assigned to each bar. Bar 9 has 24 gestures, so each permutation is assigned once. The remaining four bars are then combined in pairs to make the total number of gestures 24 (bars 1/11, 2/8). Each 4-Pg is therefore assigned three times within this gesture class (see Appendix 7.2). These were ordered by first using a random number generator (1-24) to determine the first 4-Pg. In the far-left column the outcome of this is 4 – [1,3,4,2]. Its entangled partner, 21 – [4,2,1,3], is then assigned to the last 4P+4G gesture. A combinatorial partner of this is then assigned to the second 4P gesture ([2,4,3,1]). The entangled partner of this gesture, [3,1,2,4], is then assigned to the penultimate gesture of 4P+4G. Respectively, these are shown in *Ex.7.*2 and *Ex.7.*3, and this is repeated until all gestures have been assigned.

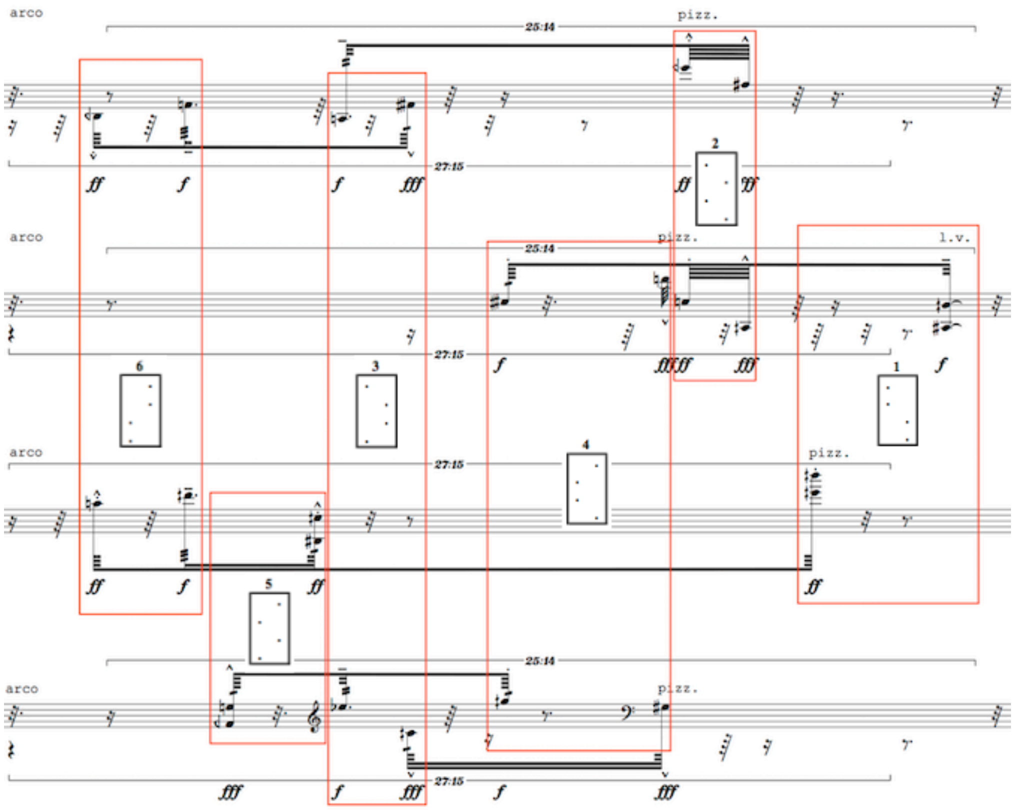
Ex.7.2

Ex.7.3

2DS: As there are only six different 2DS gestures (*Ex.7.4*), a different system was used that involved random processes and entanglement. Each 2DS gesture has an entangled partner (1-6, 2-5, 3-4) with entangled partners assigned to its root's antipode within the system. For example, bar 3 (*Ex.7.5*) has only 6 gestures so each 2DS gesture is used once. The outcome for the first gesture is 2DS-6, so the sixth gesture is assigned its entangled partner 2DS-1. The outcome for the first three gestures in bar 3 is 6-5-3, assigning to the final three gestures as 4-2-1. This system is used in all three bars (3, 7 and 10) containing this gesture class, with the complete assignments listed in Appendix 7.3.



Ex.7.4

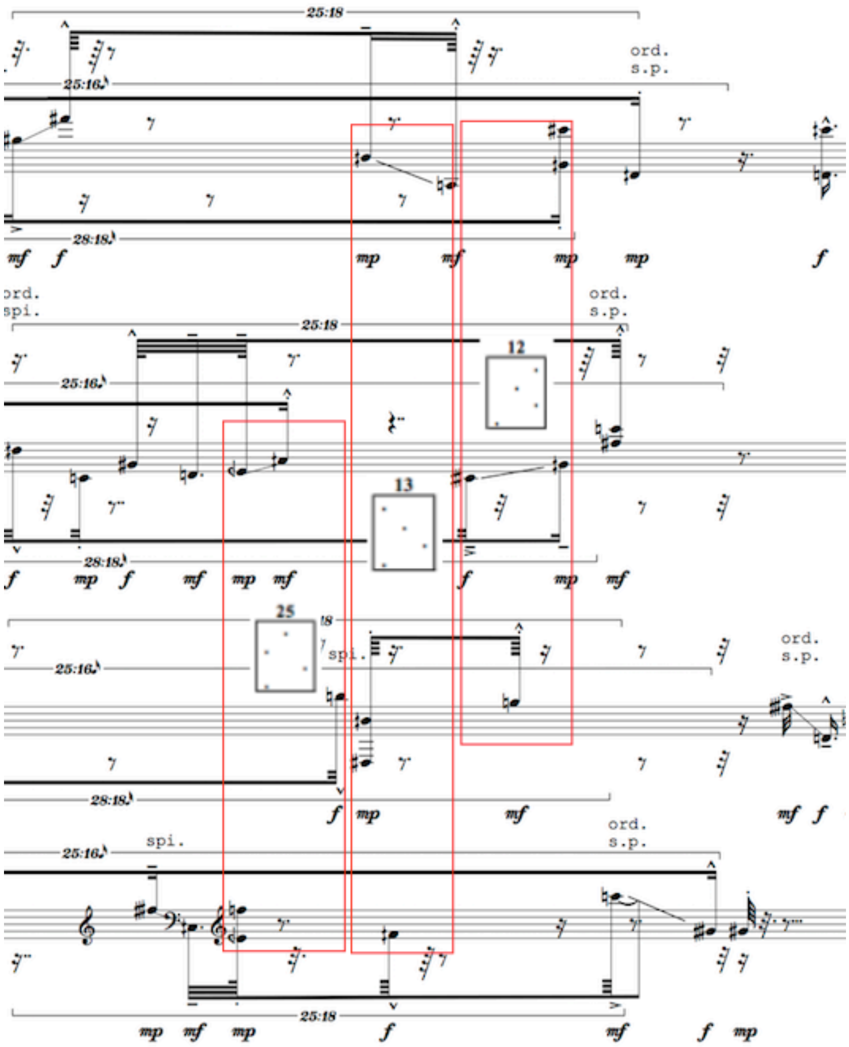


Ex.7.5

2P+1DS: As is shown in Appendix 7.4, there are 36 permutations in the 2P+1DS class and derived from the 2DS gestures shown in *Ex.7.4*. The 6 gestures in *Ex.7.4* are each permutated 6 times in each row of Appendix 7.4, ordered by keeping the first DS of each 2DS gesture as a DS and splitting the second DS to make two points. For each row in Appendix 7.4, the positions were permutated 1DS+2P, 1P+1DS+1P and 2P+1DS.

A combination of random processes and entanglement was used to assign gestures globally between bars 4, 5 and 6 (Appendix 7.5). There are a total of 45 gestures in these three bars, which is all 36 permutations plus a further 9 needed to be assigned.

Bar 5 has 18 gestures and these are the entangled partners of the gestures assigned in Bar 4 and the first three gestures of bar 6.[103] *Ex.7.6* shows gestures 7, 8 and 9 in bar 6.



Ex.7.6

[103] Reading from top left to bottom right, gesture 1 of bar 4 is entangled to gesture 18 of bar 5, 2 to 17, etc. The remaining 9 needed are assigned to gestures 4-10 of bar 6. The 8th gesture in bar 6 is the central gesture of all three bars combined so has no entangled partner assigned.

Glissandi

Gestures featuring glissandi occur in bars 2 and 5-11, and have glissandi originating from 1, 2, 3 or 4 points of the gesture. Bespoke systems were needed for each class of gesture listed in *Table 7.8* and constructed along similar lines to those in the previous section used for defining the basic contours of each gesture.

Bar	T-Sig	G-Type	No. of Gs	PRs	Ins.
2	4\4	4P+1G	9	4	1
8	8\4	4P+2G	15	3	4
9	12\4	4P+3G	24	2	4
11	11\4	4P+4G	21	2	3
7	5\4	2DS +1G	9	3	3
10	10\4	2DS+2G	18	2	4
6	6\4	2P+1DS+1G	12	4	2/3
5	9\4	2P+1DS+2G	18	2	2

Table 7.8

Bar 2 – 4P+1G: Each 4-Pg is assigned three un-sustained points and one sustained point, with the glissandi assigned to the latter. All un-sustained points are in hemidemisemiquaver units and assigned articulations that shorten the duration of the impulse by being percussive (^) or staccato (.). All sustained impulses are assigned tenuto articulations (–), with *Ex.7.7* showing gestures from the viola part.

Ex.7.7

Bar 8 – 4P+2G: The glissandi in this bar are always assigned from and to order numbers 1-3 and 2-4 (of each 4-Pg), with *Ex.7.8* showing the first three gestures.

Ex.7.8

Bar 9 – 4P+3G: Each 4-Pg contains one point without glissandi. As there are 24 gestures in this bar, six 4-Pgs were used to determine which point of the gesture will not have a glissando. For example, [1,4,3,2] is assigned to the first four gestures so the points that did not have a glissando are 1 for the first gesture, 4 for the second, 3 for the third and 2 for the fourth. These assign pitch classes from the rows in *Ex.7.9* (1 – top (P-11) to 4 – bottom (R-11)).

Bar 9	Not Gliss	
Gest. 1-4	A6 - [1,4,3,2]	
Gest. 5-8	C4 - [3,2,4,1]	
Gest. 9-12	B1 - [2,1,3,4]	
Gest. 13-16	C6 - [3,4,2,1]	Ent. B1
Gest. 17-20	B3 - [2,3,1,4]	Ent. C4
Gest. 21-24	D1 - [4,1,2,3]	Ent. A6

Table 7.9

G-No.	Tetra	Ins.	Not Gliss
1	[3,2,4,1]	[1,4,2,3]	1
2	[1,4,2,3]	[3,2,4,1]	4
3	[2,4,1,3]	[3,1,4,2]	3
4	[4,2,1,3]	[3,1,2,4]	2
5	[2,1,3,4]	[4,3,1,2]	3
6	[4,3,1,2]	[2,1,3,4]	2

Table 7.10

9	**P-11**	11	1	0.5	1.5
	RI-4.5	5	7	6.5	7.5
	I-4.5	4.5	2.5	3	2
	R-11	10.5	8.5	9	8

Ex.7.9

The 4-Pgs assigned to the first four gestures are [3,2,4,1], [1,4,2,3], [2,4,1,3] and [4,2,1,3] (*Table 7.10*). The retrogrades of these (listed in the 'Ins.' column of *Table 7.10*) are used to allocate the rows assigned to the instruments of the quartet (1 – Vln.1, 2 – Vln.2, 3 – Vla., 4 – Vc.). These outcomes are shown in *Ex.7.10*.

Ex.7.10

Bar 11 – 4P+4G: 4-Pgs were used to assign instruments to rows of the combinatorial matrix used, with the assignments for glissandi therefore directly related to these outcomes on each instrument (see *Ex.7.3*).

Bar 7 – 2DS+1G: For 2DS+1G gestures there are four types of glissandi that can be assigned and are related to the top (1) and bottom (2) pitches in each DS:

1. 1-1
2. 1-2
3. 2-1
4. 2-2.

There are nine gestures assigned to this bar. By entangling the above four glissandi types (1-4, 2-3) the glissandi assigned to the first four gestures will have their entangled partners assigned to its corresponding antipode in the last four gestures. The first element of another 4-Pg (2) was used to assign a glissando for the fifth gesture. The outcomes for this bar are shown in *Ex.7.11*.

Ex.7.11

Bar 10 – 2DS+2G: The 18 gestures in this bar are split into two groups of nine (1-9 and 10-18). The basic 2DS gestures without glissandi were assigned to gestures 1-9, with their entangled partners assigned to their antipodes in gestures 10-18. The values 1-6 were randomised, giving the outcome 1, 2, 3, 4, 6 and 5 (*Table 7.11*), and assigned to gestures 1-6, with 1, 4 and 5 assigned gestures 7-9 in the same way.

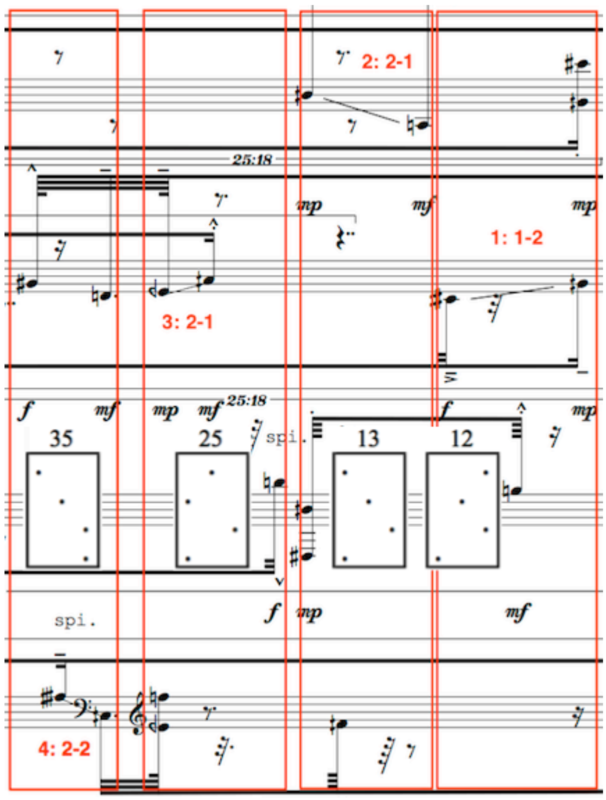
G. No.	2DS	Gliss.	G. No.	2DS	Gliss.	
1	1	3	13	2	1	Ent. 6
2	2	2	14	1	4	Ent. 5
3	3	1	15	3	1	Ent. 4
4	4	4	16	4	4	Ent. 3
5	6	1	17	5	3	Ent. 2
6	5	4	18	6	2	Ent. 1

Table 7.11

There are two variants of glissandi construct, 1-1/2-2 and 1-2/2-1, based on the four listed in relation to bar 7, above. In *Table 7.11* gestures 1-4 are assigned the 4-Pg [3,2,1,4], with values 1 and 3 assigning glissandi 1-1/2-2 and 2 and 4 assigning 1-2/2-1. At the right of the table one will see that these assignments are also entangled in the second half of bar 10. Gestures 1-4 and 15-18 are shown beside each other in *Ex.7.12*, below.

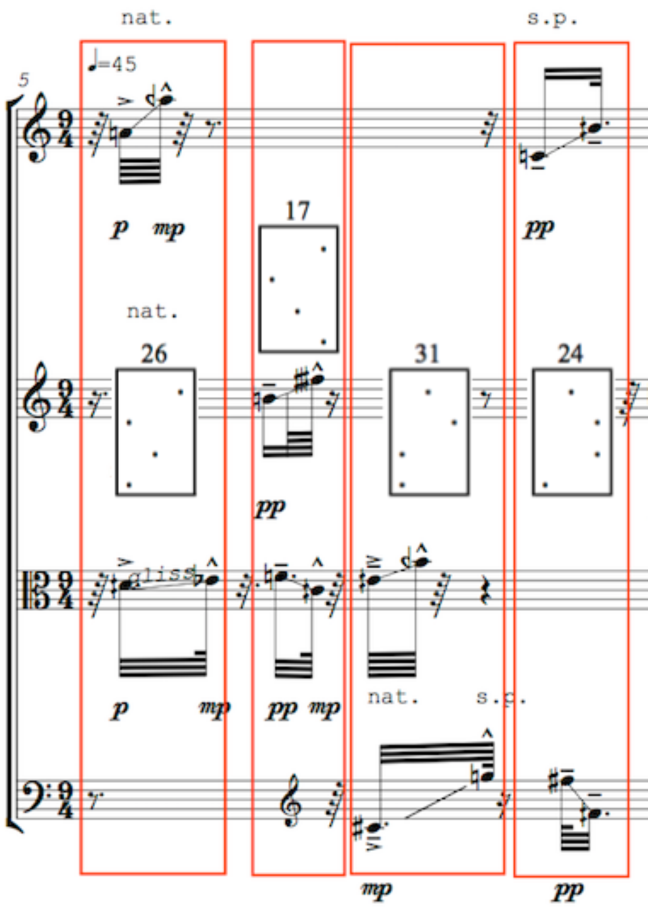
Ex.7.12

Bar 6 – 2P+1DS+1G: For 2P+1DS gestures, glissandi are only realised P-DS or DS-P. Using the four glissandi-types used in *Bar 7*, above, three 4-Pgs assigned the glissandi for each of the 12 gestures. As was mentioned above, gestures 1-6 are assigned duets, 7-12 trios. *Ex.7.13* shows gestures 6-9, the gesture numbered 13 being the central 2P+1DS gesture assigned to bars 4-6 in Appendix 7.5. Gestures 7 and 9 are therefore entangled (25-12).



Ex.7.13

Bar 5 – 2P+1DS+2G: As this bar has duet instrumentations throughout, each instrument has a glissando. Each micro-gesture is partitioned between the players evenly with each instrument having one P and one pitch within the DS. The glissandi are therefore derived from the outcomes of these assignments. The first four gestures listed in Appendix 7.5 are shown in *Ex.7.14*.



Ex.7.14

Objects 2: Four-Point Gestures is the last work to employ random processes for the assignment of parametric values. I have shown that point gestures can be used effectively on several levels of a work's construction, from the contours of the micro-gesture to the somewhat obfuscated constructive principles that govern the work's other macro- and micro-systems, thus providing a tool promoting aesthetic cohesion between the systems. One of the key principles in all my works is the process of partitioning, the *quantisation* of the work. This concept has permeated every level of the works, from the choice of pitch classes and dynamics to the saturation of a given bar or section, or the silences between those sections.

From this work onwards there is a marked reduction in impulse and pitch-class content. The works take a more extreme approach to point gesture use, becoming noticeably more fragmented in the process. Although silences as they are employed in this work are no longer used, there is a greater focus on the distance between gestures or the points of the gestures, creating sparser works. As previously mentioned, this distillation of processes is reflected sonically by a growing sparsity of activity stemming from the advances made in this work and *Objects.* Becoming more disparate, the desired abstraction intended in these works is increased further by reducing the musical content to a greater extent.

There is also a marked shift in the use of extended techniques in the remaining work, with *Objects 2* being the last work to systematize this parameter. The aesthetic distillation process led me to conclude that the use of extended techniques in the manner I have in this work and before was superfluous to the aesthetic trajectory of the remaining works. With the last works concentrating even more on point emancipation, incorporating extended techniques would blur the outcomes delineated by taking the focus away from the constructs of the point gestures expressed by what would in effect be decorative sonic elements.

8. Form and content; orchestration and instrumentation as a function; melody and accompaniment

The three sections below were initially intended as three stand-alone texts. However, through the process of writing them, it became apparent that they all shared a common thread, with the focus of each on the structures and methods used to promote equality between the constituent parts of sonic objects at both the macro- and micro levels of each work. With similar constructive devices used for objects at all levels (most notably in those works prefixed '*Objects*'), the works exhibit a fractal quality, in the sense that as one successively focuses in from the level of the work to the micro-gesture within a bar partition, one sees similar constructive principles and devices forming the material content and constructive principles at each level. Each of the three texts tackles issues relating to object formation in quantum music from different perspectives or viewpoints. *Form and content* takes a broad perspective, delineating a multi-level approach through the demarcation of object strata that shows how the form and content of quantum music are inextricably linked. *Orchestration and instrumentation as a function* delineates how the visual arts, politics and music have shaped the constructive and aesthetic principles of quantum music and how this is reflected or reinforced in the context of forming strategies for orchestration and instrumentation. *Melody and accompaniment* discusses the relationship between background and foreground material in my works since 2009, and the reasons why the notion of 'melody and accompaniment' is inherently hierarchical, requiring methods to tackle and negate this relationship.

Form and Content

Inherent to the notion of form in music is the dialectic between its contrasting parts. This is self evident in traditional forms such as the sonata, where contrasting material and pitch/key centres are recognisable as a method for defining the form (in simplest terms, exposition-development-recapitulation). This is also true when discussing larger scale forms such as the Classical Symphony, typically a four-movement work, with each movement's stylistic traits pre-formed, in that there is a generally prescribed form and style/content to which the four movements typically adhere.

An important element of the form in these instances is that it is realised on a fundamental level through the relationship between different key centres, establishing different degrees of gravitational pull depending on the distance from the centre (home key). For example, the developmental section in sonata form is typically fragmented and unstable harmonically until it transitions into the recapitulation that reaffirms the tonal centre. This 'gravitational pull' is weakened in highly chromaticized and atonal music so form is problematized as the use of received forms from the past become harder to validate in an aesthetic approach that seeks to avoid the use of key/pitch centres or power relations found in works whose pitch domain is more traditionally orientated and stable.

The composer is forced to find other means by which to mediate the global and local structures (form) and material (content) within the work. It is therefore paramount to define the form and content of a work by other means; a new unifying system is required to shape the form and content collectively as well as individually. This approach is similar to how Theodor Adorno describes the total organisation of musical elements in Schoenberg's music, in that 'it is not only that all dimensions are developed to an equal degree, but further that all of them evolve out of one another to such an extent that they all converge.'[104] A multi-level or multi-dimensional approach, whereby a governing set of principles or modes of production infer sonic outcomes at both the macro-level (form) and micro-level (content), can be achieved through seemingly simple methods and have been discussed at length throughout this thesis. For now, it will only be necessary to talk in broader terms to delineate strategies that one can use to achieve an equilibrium between the constituent parts of the work.

With form and content inhibiting a reciprocal relationship, strategies for how these manifest at the smallest levels (the point or a group of points) to the largest (the totality of the work, or its largest demarcated sections) are needed to achieve the required equilibrium mentioned above. Building gradients of object strata is the essential and somewhat inevitable outcome when constructing works in this way and enables this extensive process to be mediated efficiently. From the level of the work in its entirety to the contours of a micro-gesture within a partition of a bar, each level is a quasi-magnification or reflection of the previous, containing within it elements that point to the former, as well as these same or related elements defining the various levels that follow.

[104] Adorno, T. (2007). *Philosophy of Modern Music*. New York: Continuum, p38

Object strata

'Top-down decomposition' is used to delineate the various steps and sub-steps needed in order to create a piece of music. This stepwise refinement is a modular process that decouples the various levels and parameters of the work so that each step in the compositional process can be conceptualised, refined and ordered on its own terms, ironing out inefficiencies that can hinder the creative process. This is not to say that one can create various systems or object trajectories for each of the levels of the work completely isolated from all others, as all variables need to be able to work effectively in conjunction to realise the final work. The steps are therefore clarified in parallel, heterarchically mediating each stage of the work's construction. For example, consider the number of levels and variables that are typically delineated for an impulse system:

- Total impulse content: The number and types of gestures
- Their distributions: Number of bars, partitions and the instrumental forces
- Distance: The distance between impulses (short to long) and the variance in values (few to many)
- Duration: The length of the impulse (short to long) and the variance in values (few to many)

Incorporated into each of these will be further sub-steps and variables that need to be taken into consideration. This process breaks apart and systematises problems (the creation of a piece of music) into smaller and smaller tasks that can be managed more effectively. It brings uniformity and efficiency to the compositional process, and although this process is not as exhaustive in the works written before *Objects 4*, most of the levels in *Table 8.1* are present in all of my works from *Probability Interpretation* onwards. Top-down or modular decomposition results in an extreme fragmentation of the compositional process, with a focus on how the various levels can be ordered and mediated using similar systematic devices. This can be a lengthy process, often involving several rewrites until deciding on the most effective way forward[105], and it is through this process that the final form of the work becomes apparent, with the form of the work at the start of the compositional process being undefined and vague. For example, the initial kernel of an idea for *Entanglement* was to have the bass trombone and French horn move from one extreme to another, respectively high to low and low to high. Or for example in *Objects* and *Objects 2*, where there is a general trajectory of few to many pitch classes mediated through a modular process. These starting points are just that: initial ideas that are refined and defined through abstract processes to create the final form of the work. This process, at odds with traditional compositional practice, still requires a defined set of rules or axioms from which the form can arise. With the focus now on the work's constructive principals (its global and local structural frameworks (see levels 1-4 in *Table 8.1*)), and the weakened gravitational pull between pitches, the form in atonal, serial works is 'more fluid, the whole becoming a sum of individual, semi-autonomous parts, each element possessing an equivalence with every other.'[106]

[105] One should note that *Objects 4* took over 6 years to complete

[106] Downie, G. (1995). Modernism in Architecture and Music. *DOCOMOMO JOURNAL*, 14(November), 54-56.

Object levels within a work			Examples
1	Macro[1]	The work - start to finish	*Objects 4*
2	Macro[2]	Largest sections	Paragraphs (four)
3	Macro[3]	Semi-large sections	Paragraph - 6 word sections
4	Macro[4]	Demarcated partitions/sections within level 3	Word section – first-level time signatures
5	Micro[1]	Sub-bars of level 4	Second level time signatures - 4/8, 3/8, 4/8 (11/8)
6	Micro[2]	Sub-bar partitions	4/8 = quaver-crotchet-quaver; 3, 2 or 1 partitions
7	Micro[3]	Point gestures	Trichords and tetrachords
8	Micro[4]	The point, or sub-set of a gesture	Single note or a fragment of a gesture

Table 8.1

The demarcated levels in *Table 8.1*, above, which share similar methods of systematization and realisation in 'equivalence with every other'[107], have profound implications for music composition. These notions of fluidity and the partitioning of the whole into smaller sections or objects with the resulting elements being equivalent to all others (top-down decomposition) can permeate every parameter of the work, resulting in form and content being inextricably linked. The unifying system is therefore not just a singular system, but is in fact an amalgamation of systemization at all levels of the work. This is realised most effectively from *Objects 4* onwards, whereby this approach is derived entirely from permutations of 3- and 4-Point gestures, giving even greater unity to the works in question.

[107] Ibid.

Orchestration and instrumentation as a function

Above were delineated eight levels of object strata that are mediated using similar processes to increase inter- and intra-level unity between the various strata in a work. As form is 'an amalgamation of systemization at all levels of the work', it is therefore important for this to be evident in all parameters to achieve unity from a compositional and aesthetic standpoint. As well as the levels in *Table 8.1*, each of these will be modified further, for example when taking into account parameters such as dynamics, vertical displacements or instruments assigned. The principal focus of each parameter is to enable constant fluctuations in sonic content by varying the material presented in each bar or section, while simultaneously (and less obviously) inferring and promoting an underlying sense of unity or equilibrium between the constituent elements and the work as a whole. Each of these variables can therefore be seen to have multiple functions.

Like all quantised parameters, orchestration and instrumentation is used to define the object strata in the work, by for example assigning a specific instrumental sub-group to sections or bars. By the specific instruments assigned, the orchestration possibilities become more defined as each instrument has its own set of restrictions. Not only does the constant altering of the instrumentation and orchestration of sections or bars within a work highlight the sonic similarities and differences between instrumental groups and forces, it is able to punctuate, or in places obfuscate, the structural elements or forms that give the work its foundations. There are several reasons for the need to employ a fragmented yet uniform approach to the demarcation of sonic events using functional instrumentation and orchestration, stemming not just from music but politics and the visual arts as well.

Visual Arts

The visual arts have played an important role in forming a global aesthetic, for example Pablo Picasso's Cubist period and Piet Mondrian's De Stijl grid. From the former, works such as *Portrait of Daniel-Henry Kahnweiler* (1910) and *The Guitar Player* (1910), the works project multiple dimensions or perspectives using shading and geometric shapes. The Mondrian works from 1921 onwards, such as *Composition with Red, Black, Blue, and Yellow* (1928) or *Composition in White, Red and Blue* (1936) are striking as their small islands or *points* of primary colours punctuate the silence of the surrounding white. The focus on two lines, the vertical and the horizontal, as well as the use of primary colours only, achieves a greater level and of abstraction than the cubist works because they are non-figurative and non-mimetic. As Olga Rozanova explained, 'Cubism killed the love of the everyday appearance of the object, but not the love of the object as a whole. Nature continued to be the guide of aesthetic ideas. The Cubists lack a clearly defined idea of non-objective art.'[108] Cubism and De Stijl, and of course other forms of abstract art such as Kazimir Malevich's *Suprematist Composition: White on White* (1918) and Wassily Kandinsky's *On White II* (1923), do however share a common focus point in that they

[108] Danchev, A. (2011). 100 Artists' Manifestos. London: Penguin Books Ltd, p131.

are occupied with reassembling and expressing the basic elements of art objects in new ways.

Malevich and Kandinsky are influential in in my most recent works, and with Kandinsky this is more so with his books *Concerning The Spiritual In Art* and *Point and Line to Plane*, both of which I found revelatory but also affirmative. Here was an artist who fully interrogated the medium and the fundamentals of art in new ways that are catalogued exhaustively and logically throughout both works. In the case of Malevich, his influence became more prominent through a Twitter account called 'The Kazimir Effect', which from February 2017 started posting digital variants or permutations of his *Suprematist Composition: White on White*[109]. Describing itself as 'An Exercise in Visual Poetry', the permutational nature of the account's early manipulations of the Malevich artwork was highly influential on works from *Objects 5* onwards, extreme limitations being placed on the material but simultaneously permutated and reordered constantly throughout the works. *Objects 6.1-6.3* are good examples of this, with each of the three works focusing on only one form of 3-Pg: 3P, 1P+2Sim and 3Sim. This is most extreme in *Objects 6.3*, which is the same gesture, 3Sim, played 162 times but expressed differently on each iteration.

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[109] Twittercom. (2017). The Kazimir Effect. Retrieved 4 March, 2019, from https://twitter.com/kazimireffect/status/828548034422140930

Politics

Since the era of Margaret Thatcher and Ronald Reagan, governments of all leanings in the West have shared a common economic, and therefore political, doctrine: neoliberalism. As George Monbiot states:

> So pervasive has neoliberalism become that we seldom even recognise it as an ideology. We appear to accept the proposition that this utopian, millenarian faith describes a neutral force; a kind of biological law, like Darwin's theory of evolution. But the philosophy arose as a conscious attempt to reshape human life and shift the locus of power.[110]

Since the collapse of this inherently flawed economic system during 2007 and 2008, governments across the globe, in particular those in Europe and the United States, enacted an agenda of deep austerity onto the people that played little or no part in the economic crash. In Britain specifically the Conservative governments since 2010, both in coalition with the Liberal Democrats and also alone, have sought to increase the levels of privatisation of public bodies such as the National Health Service and probation services, imposed below-inflation caps on public sector wage rises, tripled university tuition fees and weakened the social security safety net to such an extent

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[110] Theguardiancom. (2016). Monbiot, G Neoliberalism – the ideology at the root of all our problems. Retrieved 4 March, 2019, from https://www.theguardian.com/books/2016/apr/15/neoliberalism-ideology-problem-george-monbiot

that food bank use is no longer shocking. In the West we have the most free, equal and open societies, but we have become increasingly financially unequal since the rise of neoliberalism, with most of the political and ruling classes so completely removed from everyday society that they no longer work in the electorate's best interest. The austerity agenda has eased somewhat in recent years, but the effects are still being felt:

> Since 2008 median real weekly wages in the UK have fallen by around 10 percent (with different measures and sources showing falls in the range of 4 to 11 percent). Real wages falls have been widespread and have occurred right across the wage distribution. Some groups have been particularly hard hit, most notably the young.
>
> At the same time wage inequality is at its highest level of the post WWII time period.[111]

Although well intentioned, some of the efforts by the left to effect change in recent memory can at best be seen as naïve or illogical, and have at worst been violent and racist. This is being played out on American university campuses, and to a degree in Britain, where the so-called progressive or activist Left demand free speech be curtailed because the words are deemed to be offensive, or the speaker's disagreement with their political ideology is equated with fascism or of being part of the patriarchy. There was a time when I would have been sympathetic towards these views, however

[111] Ifsorguk. (2015). Machin, S - Real Wage Trends. Retrieved 4 March, 2019, from https://www.ifs.org.uk/uploads/Presentations/Understandingtherecession_230915/SMachin.pdf (p33)

when these activists are challenged on their views, they rarely seem to have a cohesive argument or examples of how societal oppression or privilege has manifested.

This lack of clarity led me to question my own assumptions as to the power certain societal constructs have over me, a specific group of people, or society in general. For me, composition is a solitary act, and the ability of the individual to express freely is a fundamental tenet that should govern all creative output. By virtue of its position within, and relation to, society, the right to freedom of expression must not be curtailed. Dimitri Shostakovich, and other composers who wrote works for the 'bottom drawer', are an obvious example of the suppression of expression, something that is almost unheard of today.

The aesthetic approach I have undertaken has as a core tenet the construction of Utopian music. At the root of Utopian constructs is the interplay between the individual and the group, and these are also key dimensions in the fields of politics and the creative arts. The mediation of the individual and the group is inherent to the point-based approach delineated in this thesis, with the outcomes being formed by promoting egalitarian constructs at all levels of object strata.

Music

Musical developments in both Europe and America after the Second World War have had a profound effect on me artistically and politically. The inherent equality I perceived in twelve-tone and integral serialism, where all pitch classes (and by extension, all other mediated parameters) are treated equally, reflected the political radicalisation I embraced during the first year of my Masters in Composition at RWCMD. As mentioned in the previous section, these views have been challenged and refined in order to bring greater clarity to my compositional practice and views on politics.

The emancipation of the Point in post-WWII Europe, famously in pieces such as Karlheinz Stockhausen's *Kreuzspiel* (1951) and Boulez's *Structure 1a* (1952), and Milton Babbitt's development of techniques first used by Arnold Schoenberg (multidimensional set projections, combinatorial set matrixes using all four forms of set (P, I, R and RI), and codifying and refining the use of partitioning), gave composers the tools that could enact a similar agenda to those in the visual arts mentioned above. A more clinical and abstract approach to the formation of musical compositions can be found in these works, stripping away the excesses of Late Romanticism in the post-1945 era. Society was on its knees and the pursuit of new forms of expression coexisted with the rebuilding of society's infrastructure, from housing to culture.

These composers, as well as the Second Viennese School (most notably Anton von Webern) and their peers in the post-war *avant-garde*, who sought to reformulate and restructure music using similar, highly systematised methodologies, were the first composers whose output I would classify as broadly quantum in nature, as it subscribed to several of the point-based approaches outlined in this thesis, discussed further in Chapter Ten.

These three defining factors in the development of my aesthetic approach can be seen clearly when looking at strategies for instrumental assignments, and therefore orchestration, in my works. Delineating strategies for creating sub-ensembles from a meta-ensemble has played a key role in my approach, with the constant shifts in instrumentation in my works resulting in micro-level objects such as trichords and tetrachords being in a constant state of flux, reinforcing and exaggerating the fragmentation and 'free-floating' nature of the works. Each instrument is also partitioned into defined pitch ranges for each work, a gradient of which can be made between few and many ranges that will determine, for example, the vertical-temporal displacement of chords. Thus, the orchestration of a given section of a work is determined at first by the delineation and egalitarian assignment of sub-ensembles (for works larger than a solo), coupled with the outcomes for parameters such as pitch range displacement. The function of orchestration and instrumentation is therefore to reinforce strategies set forth in *Form and Content*, whereby equilibrium between the various elements of the work is one of the defining objectives of quantum music.

Melody and accompaniment

Quantum music espouses an egalitarian, heterarchical approach to the act of creating music. The universality of this process creates problems for the composer because hierarchy is inherent to the notion of melody and accompaniment: the accompaniment embellishes the dominant line, or melody, thus fulfilling a subordinate role within the piece. How can a composer express the sonic elements in a work without allowing any of those elements to attain a higher level of importance? Do 'melody' and 'accompaniment' need to be redefined to better express the axioms of quantum music? How is this realised in the works I have written since 2009?

How can a composer express the sonic elements in a work without allowing any of those elements to attain a higher level of importance? Do 'melody' and 'accompaniment' need to be redefined?

Although there are what could be termed melodic fragments in quantum music, in the sense that there are instances of a 'succession of notes, varying in pitch, which have an organized and recognizable shape',[112] their application in quantum music is, like orchestration and instrumentation, functional. The various material-types that can appear simultaneously within a given work at any point on the foreground-background gradient, for example one material-type expressed as a series of dyads at regular demarcated intervals and marked *fortissimo* coupled with detached, irregular

[112] Kennedy, M. (1994). *The Oxford Dictionary of Music*. (2nd ed.) Oxford: Oxford University Press.

single notes marked *pianissimo*. Given that one of the core aims of quantum music is to create an equilibrium between the parts of the work, the purpose of the two material-types in this example is not to reinforce or dominate the other, but is instead a means by which to project the multi-level and multi-dimensional approach initiated during the work's construction.

Although these fragments can contain recognisable attributes in intervallic and contour content, and there are strategies set in motion in quantum works that assign specific elements or objects either a background or foreground function within a given bar or section, a hierarchy between the multiple elements is never pronounced. In instances, typically in the proto-quantum works, where multiple types of material are superimposed and expressed simultaneously (*Probability Interpretation* and *Two-Slit Experiments*), certain elements within the bar or section will be more prominent depending on the other elements present and the bar or section in which they are presented.

The rejection of traditional modes of thinking when devising strategies for the projection of material-types, i.e. what constitutes 'melody' and 'accompaniment', forces the composer to develop new methods by which to enable these projections at both the micro- and macro-levels. There is no tangible 'melody' in the works presented here, with the focus in the pitch domain instead being on combinatoriality and the elements of the aggregates produced, essentially trichords and tetrachords. The boundaries and hierarchical relations between melody and accompaniment, or Schoenberg's *Haupstimme* and *Nebenstimme*, therefore dissolve and become obsolete in quantum music, providing the composer with new possibilities that are built on an equality between the work's elements.

The only hierarchy consciously enabled in the works I have submitted is that of competence, with the most competent mechanisms developed in the pre-compositional processes surviving in the work and the works that follow. This is why systems based on the application of point gestures have become so prevalent in my works because they are for me the most efficient way to formalise and unify the expressive outcomes in the works.

How is this realised in the works I have written since 2009?

I have employed several strategies in my works since 2009 that served the function of assigning foreground and background material. In *Probability Interpretation* (2009)[113] and *Two-Slit Experiments* (2010)[114], several variants of object strata either appear alone or in combination with others. Parameter gradients (i.e. loud to quiet or few to many) were created to mediate the content for each of the material-types assigned. When material-types are heard in conjunction, these works employ forms of what I termed 'tunnelling', where salient characteristics of one material-type of the bar (determined by time signature denominators) are used to shape the other material-types present. Each bar in which more than one material-type is present will have one

[113] See Chapter Three-one

[114] See Chapter Three-two

or two other bars of the same size (for example 7/8-14/16-28/32), with each of these bars having its own realisation in the work, so all material-types will be foregrounded equally. *Entanglement* (2010)[115] can be reduced to two threads of material, with the trajectories high to low (bass trombone) and low to high (French horn) unfolding concurrently and treated equally throughout, and this is the only work in which the instruments present play exactly the same number of impulses.

In the works prefixed '*Objects'*, the focus is on point gestures and partitioning, and how these can be employed to forge closer links between macro- and micro-level events. Unlike in *Probability Interpretation* and *Two-Slit Experiments*, *Objects* (2012) does not have specific material-types assigned to time signature denominator classes, with the material expressed consisting of either single notes or dyads taken from semitonal and quartertonal sets from combinatorial matrixes.[116] Point gestures were used extensively to define the contours of the pitches assigned, with the sections defined initially according to sectional saturation levels, ordered globally (0 = least saturated, e = most saturated) using a pitch-class set.

Objects 2 (2012) takes this a step further, its eleven sections focused on projecting a different form of 4-Pg[117], with each gesture partitioned equally between the instrumental forces assigned (solo, duet, trio and quartet). As these point gestures are not superimposed, systems for defining foreground and background material become

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[115] See Chapter Three.

[116] See Chapter Five.

[117] See Chapter Seven.

obsolete because each gesture is expressed collectively. The partitioning of gestures or groups of gestures equally (or as equally as possible) is used to reinforce the egalitarian nature of the music's construction, the point gestures presented in each section being the surface-level manifestation of the point gesture systems used in the work's underlying construction.

Objects 3.1 is for solo bass clarinet, with the trichords and tetrachords expressed consecutively, and always as single points. The remaining works all developed the expression of point gestures further, with each work formalising systems to express trichords and tetrachords. In *Objects 4* each 'Word section' has a different ensemble assigned with one or two vocalists. Each of these sections expresses a set of gestures as a unit, partitioning the content between the instrumental forces as equally as possible. This is also true of *Objects 5*, with both singers sharing the assigned gestures equally. *Objects 6.1-6.3* is for a single percussionist, with each of the three works focused on a single form of 3-Pg variant and are strictly point-based.

What would traditionally constitute melody and accompaniment is not evident in any of the works mentioned above, in some due to instrumental restrictions (*Objects*, *Objects 3.1*, *Objects 5* and *Objects 6.1-6.3*), and in all of the works for larger forces (*Objects 2, Objects 4* and *Objects 7*) performers work together (although often split and permutated into various sub-sets of ensembles) to realise the gestures as a unit, albeit differently depending on the instrumental configuration.

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In *Objects 7* each two-bar sub-section contains one of fifteen gesture sets, with the sets split between the root trio and a complementary ensemble that ranges from solo to sextet. Each of the two ensembles are assigned either trichords or tetrachords, and through mechanisms outlined in Chapter Sixteen the material is realised separately or interspersed and superimposed. Although each of the ensembles has an identifiable gestural content, they are never used to support or embellish another.

The relationship between accompaniment and melody, the many serving the few, is at odds with an egalitarian approach to creating art works. The dissolution of both melody and accompaniment in favour of a unified, point gesture-based system enables the artist to reconfigure the elements of the work and their inter- and intra-relations. Form and content, as well as instrumentation and orchestration, are other facets of this approach, with all three developed, refined and employed in the works in order to establish the modes of production and realisation that inhibits equality between the work's constituent parts.

9. *Objects 3.1: Solo piece [1]*, for bass clarinet (2015)

Objects 3.1: Solo piece [1] is the first in a series of 63 works for Wreckhead Ensemble, a sextet consisting of bass clarinet, French horn, vibraphone, piano, cello and double bass. The 63 works represent all possible instrumentations for every ensemble-type, resulting in 6 solos, 15 duets, 20 trios, 15 quartets, 6 quintets and 1 sextet. Each of these ensemble-types except the sextet has a complement that is derived from the sextet aggregate. For example, *Objects 3.1* is a solo for bass clarinet, so its complement will therefore be a quintet consisting of French horn, vibraphone, piano, cello and double bass. With the two ensembles closely related, the goal is to develop and modify the techniques used in the first work to 'iron-out' any systematic inconsistencies or notational issues that arise. There are also intended to be links between works of the same kind (in this case solos), so that each piece in turn will elaborate on and develop the over-arching constructive devices or compositional tools.

The first version of *Objects 3.1* was drastically altered after a masterclass with Marij van Gorkom at Brunel University. In its original incarnation, the work featured six playing techniques and double the number of pitch-classes. The work felt very bloated and I found the timbral quality of some of the extended techniques too akin to those of jazz for them to be aesthetically consistent. By reducing the number of impulses by a half and stripping away the layers of extended techniques, the work became more concise and focused, and was an influential work in the evolution and distillation of my aesthetic approach.

Restriction plays an important function in these later works, in for example the use of only one gesture per section in *Objects 2*. With extended techniques removed, only one pitch could be realised on the bass clarinet, restricting the gestures to three or four points. The removal of extended techniques enables the performer and listener to instead focus on other parameters such as duration or dynamic levels/difference. The system for extended techniques was adapted to instead order the accents in the work and is discussed in detail later.

Objects 3.1 is the first work of mine to not include random processes. Through the application of point gestures in the previous works, it became apparent that similar sonic outcomes to that of random processes could be achieved through a system that was more tightly inter-connected. Unless a random process has weighted outcomes (for example, impulses favouring a certain region in the bar or dynamic level) the ability for the listener to predict or make links between the various outcomes is heavily reduced because by their very nature they are random. This can be overcome using point gestures by creating sub-groups of linked gestures that form point gesture matrixes and deriving outcomes from these.

Building on the advances made in *Objects 1* and *Objects 2*, six 4x4-Pg matrixes were delineated that in total used each 4-Pg once. These were initially formed using a 4x4 magic square and is shown on the left in *Ex.9.1*. The matrix on the right is formed by subtracting 4 from each value from the magic square on the left until what remains is a value of 1, 2, 3 or 4.

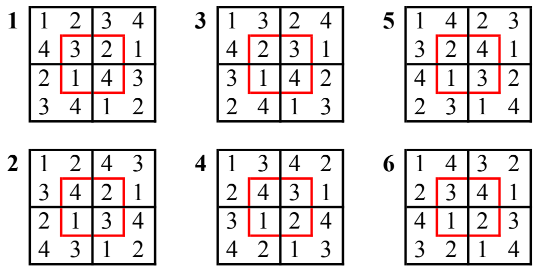
$$\boxed{\begin{matrix} 9 & 6 & 3 & 16 \\ 4 & 15 & 10 & 5 \\ 14 & 1 & 8 & 11 \\ 7 & 12 & 13 & 2 \end{matrix}} = \boxed{\begin{matrix} 1 & 2 & 3 & 4 \\ 4 & 3 & 2 & 1 \\ 2 & 1 & 4 & 3 \\ 3 & 4 & 1 & 2 \end{matrix}}$$

Ex.9.1

In each row, column and diagonal of a 4x4 magic square the values 1, 2, 3 and 4 are used without repetition. One can then infer inter-row relationships from the 4x4-Pg matrix on the right that can be used to order all variants of matrix used in the work without randomizing the internal outcomes. These relationships are:

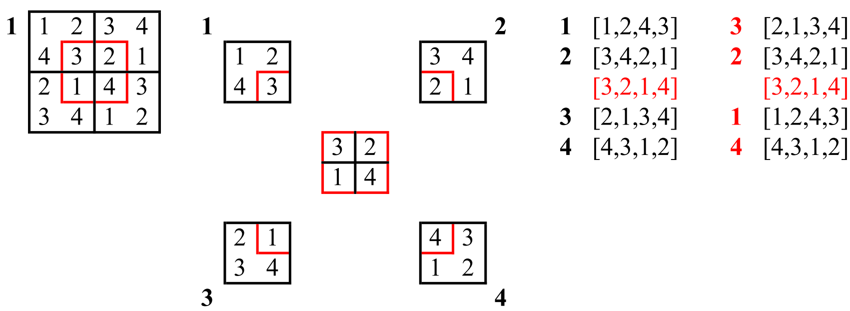
- The second row down is the retrograde of the top row
- The third row down is derived from the second row by swapping order positions 3 and 4 with 1 and 2.
- The fourth row is the retrograde of the third.

As shown in *Ex.9.2*, the six 'fundamental' 4x4-Pg matrixes were delineated by assigning to the top row 4-Pgs starting with the value 1 ([1,2,3,4]… [1,4,3,2]). Each of these is to be assigned to a specific solo work, with 1 ([1,2,3,4]) assigned to *Objects 3.1*, 2 ([1,2,4,3]) assigned to *3.2* (for French horn), and so on. These matrixes are then used as the principal source set from which to assign variables in each of the works.



Ex.9.2

Although on the surface this seems like a highly restrictive approach, a plethora of various sub-gestures as well as secondary matrixes can be delineated from each of the above. One way is to use each row of the source matrix as the top row of a secondary matrix, which for matrix 1 in *Ex.9.2* would yield secondary matrixes based on [4,3,2,1], [2,1,4,3] and [3,4,1,2]. As noted in Chapter Two, the matrixes form the foundation from which each macro-section delineates its assignment outcomes. Each matrix is in turn sub-divided into 2x2 sub-squares, each containing the numbers 1-4.



Ex.9.3

In other works of mine, structural pivots are used at several levels of the work to delineate assignments in a way that promotes equality. The central 2x2 square in each matrix in *Ex.9.2* is surrounded with a red border, and is used as a central 4-Pg and pivot-point around which the four outer 2x2 squares are placed. In *Ex.9.3* the central 2x2 square gives the 4-Pg [3,2,1,4], with the outcomes for this matrix shown on the right of the example. These assigned matrixes for bars 1 to 20 is elaborated on further in the *Pitch-class content* and *Impulse distributions* sections below.

The number 5 plays a key structuring role in this work, with several of the parameters (including metronome marks, pitch-class content, dynamics and durations) built on five values: 2, 4, 5, 6 and 8. As shown in Chapter Two, the numerators of the smallest t-Sig in each class are based on these five numbers (2/4, 4/8, 5/16, 6/32 and 8/64), as well as the five metronome marks and pitch-class content values. Discussion of these parameters will be the focus of the remaining text, presented in such a way as to highlight and focus in on the successively smaller scales at which it exists, from the largest to the smallest. The numbers 2, 4, 5, 6 and 8 are used as the initial structural device, providing each parameter with a foundation from which sub-systems are informed and developed.

Metronome marks and pitch-class content

There are four macro sections: bars 1-20, 21-40, 41-60 and 61-80. Each of these sections is split into five four-bar sub-sections, each with its own metronome mark. Mentioned in Chapter Two, these sub-sections are differentiated by the denominator class omitted in each, with each group's assigned tempo held constant throughout. One should note that the metronome marks divided by 18 gives the numbers 2, 4, 5, 6 and 8 (see ÷18 column, *Table 9.3*).

Q =	÷18	Pcs	÷3
36	2	24	8
72	4	18	6
90	5	15	5
108	6	12	4
144	8	6	2

Table 9.3

To each of the groupings shown in *Table 9.3* a total pitch class content is assigned, with the most assigned to the slowest sections and the least to the fastest. This is held invariant throughout the work with the content for each ranging from 6 to 24 pitch classes. These numbers divided by three also give the numbers 2, 4, 5, 6 and 8 (÷3 column, *Table 9.3*).

Pitch-class content

With 0=C this work is based on the set [0,1,4,5,2,3,e,t,7,6,9,8], with the four forms of the set combining to make a combinatorial matrix. How these matrixes are constructed relates back to the magic square shown in *Ex.9.1*, where the second and fourth rows are retrogrades of rows 1 and 3 respectively, with row 3 being derived from row 2 by swapping order positions 1 and 2 with 3 and 4, in effect relating it by inversion to row 2 (see *Ex.9.4*).

P	1	2	3	4
R	4	3	2	1
RI	2	1	4	3
I	3	4	1	2

Ex.9.4

From this, each row of the magic square is assigned a form of the set (P, R, RI or I) that reflects its relationship to the row above it. With the top row being P, R, RI or I, the second row (from top to bottom) will be the retrograde of the top, the third row is the 'inversion' of the second, and the fourth (bottom) row is the retrograde of the third.

The combinatorial matrixes shown in *Table 9.4* are the only sets used in each macro-section. One should note that the fundamental sets of each combinatorial matrix (the top row) share the same order as the set-types assigned to each row in *Ex.9.4*: P, R, RI, I. The transposition levels of the fundamental sets assigned are chosen because they all have ‘0’ as the first pitch-class.

1...20	**P-0**	0	1	4	5	2	3	e	t	7	6	9	8
	R-0	8	9	6	7	t	e	3	2	5	4	1	0
	RI-e	3	2	5	4	1	0	8	9	6	7	t	e
	I-e	e	t	7	6	9	8	0	1	4	5	2	3
21...40	**R-4**	0	1	t	e	2	3	7	6	9	8	5	4
	P-4	4	5	8	9	6	7	3	2	e	t	1	0
	I-3	3	2	e	t	1	0	4	5	8	9	6	7
	RI-3	7	6	9	8	5	4	0	1	t	e	2	3
41...60	**RI-8**	0	e	2	1	t	9	5	6	3	4	7	8
	I-8	8	7	4	3	6	5	9	t	1	2	e	0
	P-9	9	t	1	2	e	0	8	7	4	3	6	5
	R-9	5	6	3	4	7	8	0	e	2	1	t	9
61...80	**I-0**	0	e	8	7	t	9	1	2	5	6	3	4
	RI-0	4	3	6	5	2	1	9	t	7	8	e	0
	R-1	9	t	7	8	e	0	4	3	6	5	2	1
	P-1	1	2	5	6	3	4	0	e	8	7	t	9

Table 9.4

This is another example of reducing the pool from which variables, in this case pitches, can be chosen. In all of my works up to this point, each sub-section or bar was assigned a specific combinatorial matrix from a list of 48 (twelve transposition levels for each of the four row-types) or more. With the development of the point gesture method this was no longer needed because inherent to this method is the notion of permutation and continuous renewal. The vast quantities of source sets for parameters prevalent in the works before *Objects 3.1* is markedly reduced and this work marks an important milestone in this respect and influences the approach taken in the following works.

The pitch classes in each micro-section are realised differently depending on their metronome marks, either vertically as tetrachords and/or horizontally as trichords. For each metronome mark section, these are:

Q = 144: Tetrachords

Q = 108: Trichords

Q = 90: Tetrachords and trichords

Q = 72: Trichords

Q = 36: Tetrachords

The following outlines the systems for pitch-class assignments devised for each group in bars 1 to 20. All pitched material is ordered using the 4x4-Pg matrix assigned to the micro-section (*Ex.9.3*, above). *Ex.9.5* below shows the five 4x4-Pg matrixes that are formed from the five 2x2 squares in *Ex.9.3*, with the 2x2 4-Pgs shown on the left.

3	[2,1,3,4]	**Bars 1-4**				**Bars 5-8**				**Bars 9-12**				**Bars 13-16**				**Bars 16-20**			
2	[3,4,2,1]	2	1	3	4	3	4	2	1	3	2	1	4	1	2	4	3	4	3	1	2
C	[3,2,1,4]	4	3	1	2	1	2	4	3	4	1	2	3	3	4	2	1	2	1	3	4
4	[1,2,4,3]	1	2	4	3	4	3	1	2	2	3	4	1	2	1	3	4	3	4	2	1
1	[4,3,1,2]	3	4	2	1	2	1	3	4	1	4	3	2	4	3	1	2	1	2	4	3

Ex.9.5

Q = 144: 6 pitch-classes

Two pitches are assigned from three of the four 3x4 aggregates listed in *Table 9.4*. These were ordered using the central 4-Pg of the magic square, with the first value omitting the corresponding 3x4 aggregate. The remaining three values derive the aggregates from which the pitch-classes will be assigned.

Q = 144	4	3		2
	1	2		3
	3	4		1
	1	**2**	**3**	**4**
			X	

Ex.9.6

Ex.9.6 is a modified version of the 4x4-Pg matrix assigned to the micro-section. As the '3' from the central 4-Pg ([3,1,2,4]) omitted the third aggregate from the combinatorial matrix, it also omits the third column in *Ex.9.6*. This leaves three columns, with each having a corresponding aggregate from the combinatorial matrix. With each aggregate only having two pitch-classes assigned from it, only the top two values from the columns in *Ex.9.6* are used. The outcomes for this are shown in *Ex.9.7* and *Ex.9.8*, below.

0	1	4	5	2	3	e	t	7	6	9	8
8	9	6	7	t	e	3	2	5	4	1	0
3	2	5	4	1	0	8	9	6	7	t	e
e	t	7	6	9	8	0	1	4	5	2	3
	e,0			4,7			**Omitted**			1,t	

[3,1,2,4] – 1: 4,1 (e,0)

– 2: 3,2 (4,7)

– 4: 2,3 (1,t)

Ex.9.7

Ex.9.8

Q = 108: 12 pitch-classes

Q = 108				
	3	4	2	1
	2	1	3	4
	4	3	1	2
	1	**2**	**3**	**4**

Ex.9.9

Unlike in Q = 144 sections where the pitched material is derived from tetrachord columns, in Q = 108 the pitch-classes are derived using one trichord from each row of the combinatorial matrix. The 4-Pg matrix assigned to the section is once again modified so that the top row has been removed (*Ex.9.9*), with the central 4-Pg, [4,2,1,3], used to order the 3x4 aggregates, with the results shown in *Ex.9.10*.

	4			2			1			3	
6	9	8	5	2	3	0	1	4	e	t	7
4	1	0	7	t	e	8	9	6	3	2	5
7	t	e	4	1	0	3	2	5	8	9	6
5	2	3	6	9	8	e	t	7	0	1	4

Ex.9.10

The bottom left 4-Pg from *Ex.9.9*, [2,1,4,3], is used to assign the trichord from each aggregate, highlighted in red in *Ex.9.10*. The bottom right 4-Pg, [3,4,1,2], is used to assign the internal order of the trichord by using the values in columns 1-4 of *Ex.9.9* (always top to bottom), the lowest value assigning the first pitch-class of the initial trichord and the highest value assigned the last, with the outcomes for this shown in *Table 9.5* and *Ex.9.11*.

Trichord	**From *Ex.9.9***		**P-c order**
[4,1,0]	**3**	2,3,1	1,0,4
[5,2,3]	**4**	1,4,2	5,3,2
[e,t,7]	**1**	3,2,4	t,e,7
[8,9,6]	**2**	4,1,3	6,8,9

Table 9.5

Ex.9.11

Q = 90: 15 pitch-classes

Q = 90				
	1	2	4	3
	4	3	1	2
	2	1	3	4
	1	**2**	**3**	**4**

Ex.9.12

The pitch classes for Q = 90 sections are derived from both trichords and tetrachords, acting as a pivot-point in this system. The 15 pitch-classes are split relatively evenly, with eight assigned through trichords and seven through tetrachords. The pitch-classes are chosen from all four 3x4 aggregates, with their global order derived from the central 4-Pg [2,4,3,1].

2		4		3		1		
5 2 3	6,4,7,5	4 3 6 9 8	1,2,[4,3]	e t 7	[1,2],4,3	0 1 4	9,2,t	2
7 t e		2 1 4 1 0	6,9,8	3 2 5	0,1	8 9 6		3 4
4 1 0		7 t e	4	8 9 6	9,6	3 2 5		
6 9 8		5 2 3		0 1 4		e t 7		

Ex.9.13

Ex.9.13 and *Ex.9.14* show the outcomes for bars 5-8. For aggregate '2' the 4-Pg in the bottom left box in *Ex.9.12* ([4,3,2,1]) is used to order the pitch-classes. To determine the trichords for aggregates 4 and 3, the 4-Pg in the top left of *Ex.9.12* ([1,2,4,3]) is used to assign the trichord rows, with 1 and 2 assigned in aggregate 4, and 4 and 3 assigned in aggregate 3. The final aggregate, 1, has its pitches assigned using the 4-Pg in the bottom right box of *Ex.9.13*, minus the top left value.

Ex.9.14

Q = 72: 18 pitch-classes

As was the case in the Q = 108 micro-section, the pitch classes in Q = 72 are realised as trichords. In Q = 72 micro-sections, six trichords are assigned from three 3x4 aggregates, with the outcomes again being derived using the central 4-Pg from a 4-Pg matrix, shown in *Ex.9.15*.

2	1	3	4
3	4	2	1
1	2	4	3
1	**2**	**3**	**4**

Ex.9.15

With the central 4-Pg being [1,3,4,2], the first aggregate ('1') is omitted, with the order of the remaining three assigned using the remaining three values of the central 4-Pg. To assign the specific trichords highlighted in red, the bottom two 4-Pg boxes in *Ex.9.15* (omitting the top left value in each) were used to assign the trichord rows in each aggregate (see far right in *Ex.9.16*).

1	**3**		**4**		**2**	
0 1 4	e t 7	**4,1**	6 9 8	**4,3**	5 2 3	**2,1**
8 9 6	3 2 5	[0,1,4]	4 1 0	[5,2,3]	7 t e	[7,t,e]
3 2 5	8 9 6	[e,t,7]	7 t e	[7,t,e]	4 1 0	[5,2,3]
e t 7	0 1 4		5 2 3		6 9 8	
Omitted						

	4		1	4,1,2,1,4,3
1	2	4	3	

Ex.9.16

Ex.9.17

Q = 36: 24 pitch-classes

Like Q = 144 sections, the pitches for this section are derived from the vertical tetrachords in the combinatorial matrix. Also, the first value from the central 4-Pg is used to omit one 3x4 aggregate, with the remaining three assigning the order of the remaining aggregates.

				[1,2,3,4]						[2,3,4,1]	
4	1	2	3	4,2,1	6,7,5	1	2	3	4	2,4,1	2,0,t
2	3	4	1	1,3,4	2,4,9	3	4	1	2	3,1,4	6,6,4
1	4	3	2	2,4,3	t,8,8	2	1	4	3	4,2,3	5,1,7
				3,1,2	9,e,3					1,3,2	9,t,1

Ex.9.18

As there are 24 pitch-classes, a second 4-Pg matrix was derived using the central 4-Pg of the original ([1,2,3,4]). In order for the secondary matrix to not be the same as the source matrix for bars 1-20 (see top left in *Ex.9.3*), [1,2,3,4] was assigned to the second row and is shown in *Ex.9.18*. Both central 4-Pgs determine the order of the four columns of its corresponding modified 4-Pg matrix, with the corresponding outcomes shown in *Ex.9.19* and *Ex.9.20*.

	1			**2**			**3**			**4**	
0	1	4	5	2	3	e	t	7	6	9	8
8	9	6	7	t	e	3	2	5	4	1	0
3	2	5	4	1	0	8	9	6	7	t	e
e	t	7	6	9	8	0	1	4	5	2	3

Omitted

Ex.9.19

Ex.9.20

Impulse distributions and intra-bar partitions

How the assigned pitch classes are distributed within a composition has been a focus of my work for several years and even though the modes of production for each work are different to some degree, there is one trait that is present in all of them, equality, with the egalitarian nature of each work's construction permeating all parameters of the work. The following discusses two such parameters: impulse distributions and intra-bar partitions.

Impulse distributions

The total impulse content for each four-bar micro-section is initially segmented into five discrete units that distribute the content value as evenly as possible. *Table 9.6* lists the five different impulse content values and their subsequent distributions when segmented into five units. These distributions are also shown in the 'Dist.' column of Appendix 9.1.

Pc	Dist.
6	1,1,2,1,1
12	2,3,2,3,2
15	3,3,3,3,3
18	4,3,4,3,4
24	4,6,4,6,4

Table 9.6

Appendix 9.1 shows all the possible pitch-class distributions for each metronome mark group/micro-section that is achieved through a process of permutation, omitting a row from each column (marked 'X') and distributing its contents to the adjacent rows (above and below). The columns highlighted in red were used in the formation of t-Sig sets and were discussed in depth in Chapter Two. The top row of the matrix assigned to the sub-section ordered the denominator-class assignments, and are used again in this system to assign impulse/pitch-class content for each bar. The values in the 'Dist.' column of *Table 9.7* are the number of impulses assigned to each denominator class of t-Sig and are held invariant throughout (left columns in *Table 9.7*). With these fixed, the impulse distribution system at this level is directly related to the t-Sig assignments discussed in Chapter Two.

Q = 144	Dist.	4-Pg	Q = 108	Dist.	4-Pg	Q = 90	Dist.	4-Pg
\4	1	1	\4	2	1	\4	3	1
\8	1	2	\8	3	2	\8	(+2) 5	2
\16	2	3	\16	(+2) 4	3	\16	**X**	
\32	(+1) 2	4	\32	**X**		\32	(+1) 4	3
\64	**X**		\64	(+1) 3	4	\64	3	4

Q = 72	Dist.	4-Pg	Q = 36	Dist.	4-Pg
\4	(+2) 6	1	\4	**X**	
\8	**X**		\8	(+2) 8	**1**
\16	(+1) 5	2	\16	4	2
\32	3	3	\32	6	3
\64	4	4	\64	(+2) 6	4

Table 9.7

The four remaining distributions in Appendix 9.1 are used to determine the distribution of the assigned impulse content within each bar. Each of the four distributions is assigned once per sub-section, ordered by the central 2x2 of the assigned 4-Pg matrix. As these methods are the same for all four macro-sections, only bars 1-20 will be used to demonstrate how this is achieved, and is based on the matrixes shown in *Ex.9.5*. The assigned distributions delineate the intra-bar partitions in which the impulses can and cannot be assigned, with the content distributed evenly between the allotted partitions. The outcomes for the five sub-sections of bars 1-20 are discussed below.

Intra-bar partitions

Each bar is partitioned at two levels. The first is structurally, with the bars of each metronome mark group assigned 2, 4, 5, 6 or 8 macro partitions. In most cases this is realised as a tuplet spanning the entirety of the bar, with its numerator value creating the allocated partitions and are listed in the 'Ptns.' column of *Table 9.8*.

Quaver =	**P-c**	**Ptns.**
36	24	8
72	18	6
90	15	5
108	12	4
144	6	2

Table 9.8

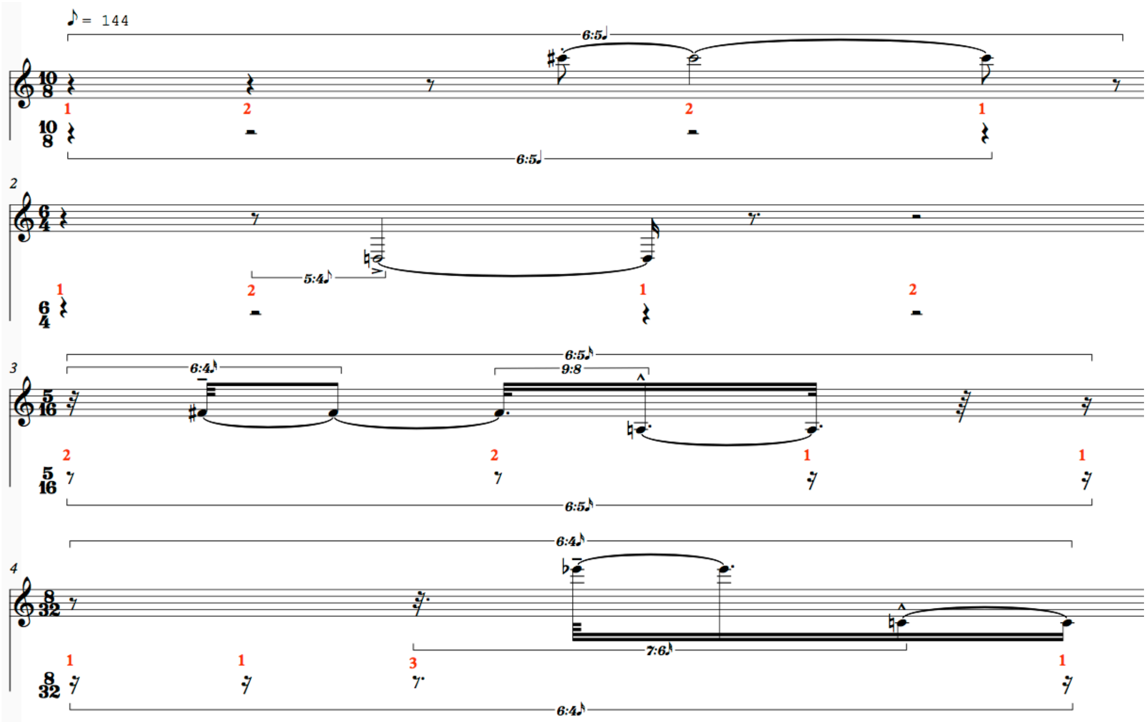
The second-level partitions are derived from the pitch-class distribution system outlined in Appendix 9.1. Each of these distribution schemes can be projected onto a time-space, demarcating the areas in which the impulse can or cannot be realised.

Bars 1…4: Q=144 – [3,1,2,4]

	Bar		Dist.	**1**	**2**	**3**	**4**	**5**	**6**
	1	**3**	1,2,2,1	1	2		2		1
Q = 144	2	**1**	1,2,1,2	1	2		1	2	
[3,1,2,4]	3	**2**	2,2,1,1	2		2		1	1
	4	**4**	1,1,3,1	1	1	3			1

Table 9.9

Table 9.9 lists the impulse distributions for bars 1-4. It shows how the six pitch-classes are distributed according to the outcomes in columns 1-4 of Appendix 9.1. To reduce the number of possible areas in which an impulse can occur, the smallest regions in each are never used. The impulses/pitch-classes are then evenly distributed between the remaining areas. For the most part, the superimposition of these two partitioning systems allows for both to be realised effectively, but there were cases in which they were not compatible. In these instances, the second-level partitions take precedence and the first-level partitions are removed. What applies in Bars 1-4 is also true of bars 5-8, 9-12, 13-16 and 17-20, all of which are shown in the tables and examples below.

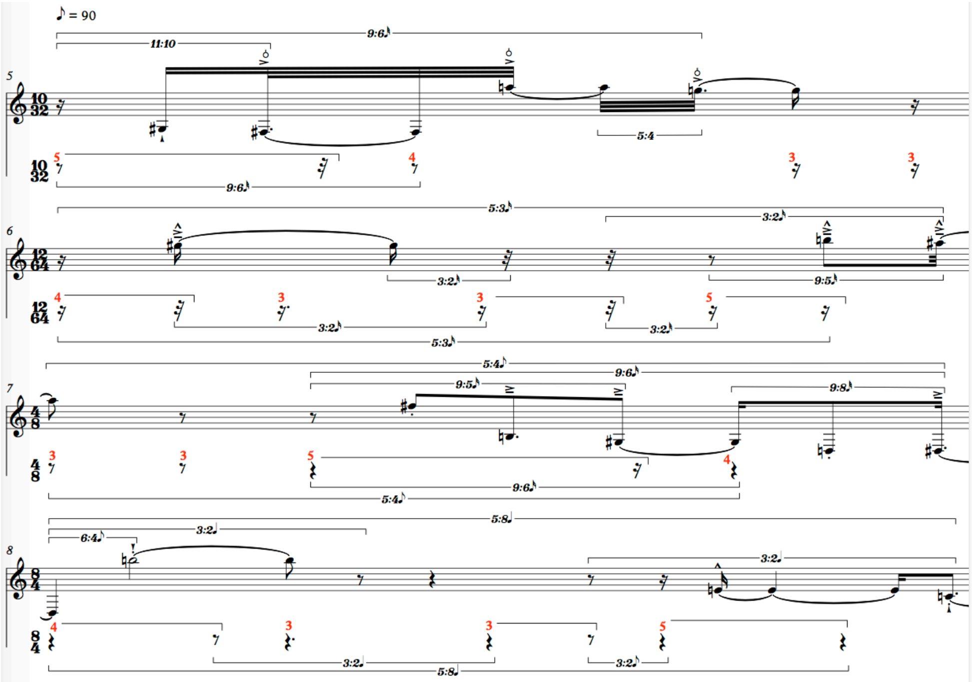


Ex.9.21

Bars 5…8: Q=90 – [2,4,3,1]

	Bar	Dist.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	5	**2**	5,4,3,3	5					4				3			3		
Q = 90	6	**4**	4,3,3,5	4				3			3			5				
[2,4,3,1]	7	**3**	3,3,5,4	3			3			5					4			
	8	**1**	4,3,3,5	4				3			3			5				

Table 9.10

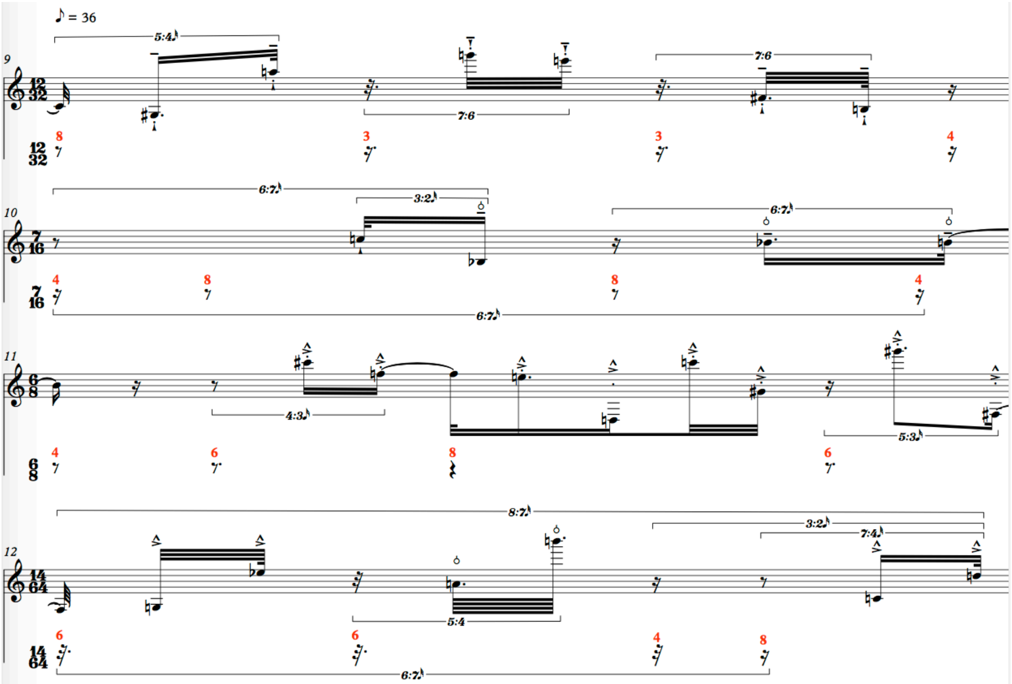


Ex.9.22

Bars 9…12: Q=36 – [1,2,3,4]

<table>
<tr><th></th><th>Bar</th><th colspan="2">Dist.</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th><th>17</th><th>18</th><th>19</th><th>20</th><th>21</th><th>22</th><th>23</th><th>24</th></tr>
<tr><td rowspan="4">Q = 36
[1,2,3,4]</td><td>9</td><td>1</td><td>8,6,6,4</td><td colspan="8">8</td><td colspan="6">6</td><td colspan="6">6</td><td colspan="4">4</td></tr>
<tr><td>10</td><td>2</td><td>4,8,8,4</td><td colspan="4">4</td><td colspan="8">8</td><td colspan="8">8</td><td colspan="4">4</td></tr>
<tr><td>11</td><td>3</td><td>4,6,8,6</td><td colspan="4">4</td><td colspan="6">6</td><td colspan="8">8</td><td colspan="6">6</td></tr>
<tr><td>12</td><td>4</td><td>6,6,4,8</td><td colspan="6">6</td><td colspan="6">6</td><td colspan="4">4</td><td colspan="8">8</td></tr>
</table>

Table 9.11

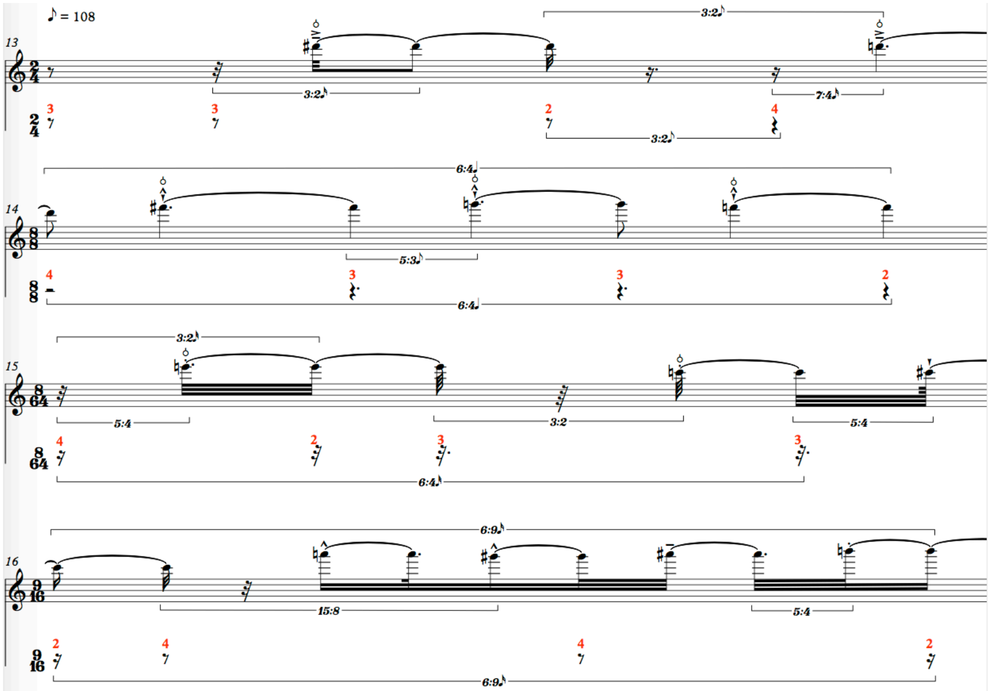


Ex.9.23

Bars 13…16: Q=108 – [4,2,1,3]

<table>
<tr><th></th><th>Bar</th><th colspan="2">Dist.</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th></tr>
<tr><td></td><td>13</td><td>4</td><td>3,3,2,4</td><td colspan="3">3</td><td colspan="3">3</td><td colspan="2">2</td><td colspan="4">4</td></tr>
<tr><td>Q = 108</td><td>14</td><td>2</td><td>4,3,3,2</td><td colspan="4">4</td><td colspan="3">3</td><td colspan="3">3</td><td colspan="2">2</td></tr>
<tr><td>[4,2,1,3]</td><td>15</td><td>1</td><td>4,2,3,3</td><td colspan="4">4</td><td colspan="2">2</td><td colspan="3">3</td><td colspan="3">3</td></tr>
<tr><td></td><td>16</td><td>3</td><td>2,4,4,2</td><td colspan="2">2</td><td colspan="4">4</td><td colspan="4">4</td><td colspan="2">2</td></tr>
</table>

Table 9.12



Ex.9.24

Bars 17…20: Q=72 – [1,3,4,2]

<table>
<tr><th></th><th>Bar</th><th colspan="2">Dist.</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th><th>16</th><th>17</th><th>18</th></tr>
<tr><td></td><td>17</td><td>1</td><td>5,4,3,6</td><td colspan="5">5</td><td colspan="4">4</td><td colspan="3">3</td><td colspan="6">6</td></tr>
<tr><td>Q = 72</td><td>18</td><td>3</td><td>4,3,6,5</td><td colspan="4">4</td><td colspan="3">3</td><td colspan="6">6</td><td colspan="5">5</td></tr>
<tr><td>[1,3,4,2]</td><td>19</td><td>4</td><td>6,3,4,5</td><td colspan="6">6</td><td colspan="3">3</td><td colspan="4">4</td><td colspan="5">5</td></tr>
<tr><td></td><td>20</td><td>2</td><td>4,5,5,4</td><td colspan="4">4</td><td colspan="5">5</td><td colspan="5">5</td><td colspan="4">4</td></tr>
</table>

Table 9.13

Ex.9.25

Durations and dynamics

There are a total of 9 durational values, 1-9, that are grouped into five sets of three values. As shown in the far left column in *Table 9.14*, the five sets are derived from the numbers 2,4,5,6 and 8.

Durations		Q =	P-cs	3-Pgs
2	1,**2**,3	36	24	8
4	3,**4**,5	72	18	6
5	4,**5**,6	90	15	5
6	5,**6**,7	108	12	4
8	7,**8**,9	144	6	2

Table 9.14

To assign these values, a system using 3x3-Pg matrixes was employed. Listed in *Table 9.14*, to determine the number of 3-Pgs needed for each micro-section the total pitch-class content is divided by 3. From each metronome mark group, different 3-Pgs within the 9x3-Pg matrix assigned were used to give durational values to each impulse, with the assignments for the first bars 1-20 shown in Appendix 9.2. As one can see, the entangled partner of each 9x3-Pg matrix is also assigned (1-6, 2-5, 3-4), with the highlighted 3-Pgs used for durational values.

With four macro-sections, each metronome mark group is assigned a different 9x3-Pg matrix for each section. Only four of the six fundamental matrixes[118] are needed so a two-step system was devised whereby five tetrachords were derived from P-0, which were then assigned to a metronome mark group using the central row from the 5x5-Pg matrix shown in *Ex.2.3* in Chapter Two, with the outcomes shown in *Table 9.15*. With the outcomes for bars 1-20 highlighted in red in *Table 9.15*, these correlate to the assigned 9x3-Pg matrixes in Appendix 9.2.

P-0: [0,1,4,5,2,3,e,t,7,6,9,8]		**Q =**
1. [0,1,4,5] – 1,2,5,6	2. [4,5,2,3] – 5,6,3,4	36
2. [4,5,2,3] – 5,6,3,4	5. [7,6,9,8] – 2,1,4,3	72
3. [2,3,e,t] – 3,4,6,5	3. [2,3,e,t] – 3,4,6,5	90
4. [e,t,7,6] – 6,5,2,1	1. [0,1,4,5] – 1,2,5,6	108
5. [7,6,9,8] – 2,1,4,3	4. [e,t,7,6] – 6,5,2,1	144

Table 9.15

[118] The fundamental 3-Pg of a 3x3-Pg matrix being the 3-Pg on the top row.

Dynamics

There are a total of eight dynamic values used in this work, from *ppp* to *fff*. From this four sub-sets were delineated with each containing three dynamic values. These are designated 'first-level' dynamics and are shown in *Table 9.16*. Each of these four sub-sets is assigned to each metronome mark group once throughout the work. The order of these assignments is determined using 4-Pgs derived from the 5x5 magic square shown in Chapter Two. To derive 4-Pgs from these, all 5s were removed, leaving the values 1, 2, 3 and 4. The outcomes of this are shown in the 'Minus 5s' column of *Table 9.17*. These values were inverted (1-4, 2-3, 3-2, 4-1) to give the first-level dynamics for each metronome mark group.[119]

First-level Dynamics	
1	*mf - p - ppp*
2	*f - mp - pp*
3	*ff - mf - p*
4	*fff - f - mp*

Table 9.16

5x5					**Minus 5s**	**Inverse**	**Q =**	**Dur.**	**Dur.-Ent.**
5	3	1	4	2	3,1,4,2	2,4,1,3	144	7,8,9	1,2,3
1	4	2	5	3	1,4,2,3	4,1,3,2	108	5,6,7	3,4,5
2	5	3	1	4	2,3,1,4	3,2,4,1	90	4,5,6	4,5,6
3	1	4	2	5	3,1,4,2	2,4,1,3	72	3,4,5	5,6,7
4	2	5	3	1	4,2,3,1	1,3,2,4	36	1,2,3	7,8,9

Table 9.17

The first-level dynamics are mapped across the entirety of the micro-section by using a system that allocates the number of adjacent pitch-classes that share a dynamic value. This is derived from the set of durations assigned to each metronome mark group. Each of these durational sets is assigned an entangled partner, and it is the

[119] The Minus 5s column is inverted because these outcomes were used for pitch range assignments.

values of the entangled partner that are used to map the first-level dynamics onto the micro-section (see columns 'Durations' and 'Dur.-Ent.', *Table 9.17*).[120] These first-level dynamics act as a foundation from which second-level 'sub-dynamics' are derived. The following uses bars 1-4 (Q=144) as an example to show how the first-level dynamics are mapped onto the micro-section and how the second-level dynamics are derived and assigned using related constructive methods.

With set 2 of the first-level dynamics assigned to bars 1-4 (see the first value in the top row of 'Inverse' column in *Table 9.17*), the fundamental dynamics for this section are *f, mp* and *pp*. As only one 3-Pg is needed to assign the order of first-level dynamics, the central 3-Pg of the 9x3-Pg matrix assigned to the section is used, giving [1,3,2] (see Appendix 9.2). With '1' assigned to the loudest dynamic and '3' to the quietest, the outcome is *f* (1), *pp* (3), *mp* (2). As one will see in Appendix 9.2, the 3-Pg used to assign the above is coupled with its entangled partner [3,1,2], which gives the number of adjacent pitch classes for each dynamic value. The result is therefore *f* (x3), *pp* (x1), *mp* (x2). These assignments are shown as a proto-score in *Ex.9.26*.

[120] One should note that the sum of values for each row in the Dur-Ent. column is the total pitch-class content for each metronome mark's micro-section.

Ex.9.26

To each of the first-level dynamics is assigned 1, 2 or 3 'second-level' dynamics. These are derived from the two adjacent dynamics that surround each first-level dynamic. So, in *Ex.9.26*, the second-level dynamics for notes marked '*f*' will be *mf, f,* and *ff*. This same principle is then repeated for *pp* and *mp*, giving {*ppp,pp,p*} and {*p,mp,mf*} respectively.

3	**2**	**1**	**3**	No. sub-dyn.
2	1	3	2	First-level dyn.
6	3	2	1	Specific sub-dyn.

Ex.9.27

With the central 3-Pg ([1,3,2]) used to assign first-level dynamics, the two that appear above and below it in Appendix 9.2 are used to determine the number of sub-dynamics assigned to the section as well as the specific dynamics. As shown in *Ex.9.27*, the 3-Pg used to determine the number of sub-dynamics is [2,1,3], with [3,2,1] determining the specific dynamics assigned. Each first-level dynamic has its second-level dynamics ordered by the corresponding values of each column in *Ex.9.27*. The outcomes of this process are shown below.

1 dynamic: *p* (1)*, pp* (2)*, ppp* (3) – *pp* (2) assigned

2 dynamics: *ff* (1), *f* (2), *mf* (3) – 1/2 (1), 1/3 (2), 2/3 (3) – *f/mf* (3) assigned

3 dynamics: All three dynamics present. The order of second-level dynamics is determined by assigning a 3-Pg formed by rotating the values of the central 3-Pg three times, giving three 3-Pgs to choose from.

	1	**3**	**2**
R1	3	2	1
R2	2	1	3
R3	1	3	2

Table 9.18

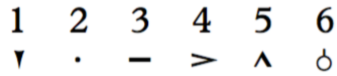
In *Table 9.18*, the rotation number (R1, 2 or 3) assigned for the first-level dynamic with three sub-dynamics '1', giving [3,2,1] from *Table 9.18*. This gives the outcomes for dynamics as *p, mp, mf*, with all of the above assignments shown in *Ex.9.28*, below.

Ex.9.28

Accents

Briefly mentioned at the start of this chapter, the system for accents was originally intended for assigning playing techniques. Instead of six techniques there are now six accents that can be combined with up to two others. The combination of multiple accents is often problematic as one could rightly argue that some combinations are by their very nature contradictory. For example: a staccatissimo accent combined with a tenuto accent are opposing, with the former being very light whilst shortening the note value and the latter being slightly stressed with the note value lasting for the full duration. How an accent affects an impulse is quantized considering three variables: duration, attack and dynamic shift.

The six accents used in this piece are shown in *Ex.9.29*. For ease of typesetting, the number above each accent will denote all future references to these accents.



Ex.9.29

All of these accents apart from 6 will be familiar to most musicians. Karlheinz Stockhausen devised accent 6, and is a modified version of the Bartok pizzicato used 'for woodwind and brass instruments, to command the hardest attack (or accent) possible.'[121] As mentioned above, each accent affects three parameters: duration, attack and dynamic shift. *Table 9.19* lists the parameter values for each accent. For duration ('Dur.' column), a gradient from 0 to 1 is used, where 0 is the initial impulse point of the note and 1 is a note lasting for its full duration. For attack ('Att.' column), a gradient from 0 to 1 is used again, with 0 being the softest attack and 1 being the hardest. Dynamic shift ('DynSh.' column) is the change in dynamic value as a result of the accent being applied, ranging from a decrease of two dynamic values (for example from *mf* to *p*) to an increase of two (*p* to *mf*).

[121] Read, G. (1979). *Music Notation*. (2nd ed.). New York: Taplinger, p.272.

Acc.	Dur.	Att.	DynSh.
1	0	0	-2
2	0.5	0.2	-1
3	1	0.4	0
4	0.75	0.6	1
5	0.25	0.8	1
6	0	1	2

Table 9.19

By quantising these three parameters one can codify how an impulse is to be realised when assigned a given accent. Once numerical values have been assigned to each parameter, when multiple accents are assigned a mean can be derived for each parameter, giving the resulting duration, attack and dynamic shift of the combined accents.

Accents are combined to form sub-sets of three accents, of which there are 20 (*Table 9.20*). This means that for each 20-bar macro-section a different 3-accent set can be assigned to each bar without repetition. As there are four macro-sections, each is used four times throughout the piece.

1	2	3	4
1,2,3	1,3,5	2,3,4	2,5,6
1,2,4	1,3,6	2,3,5	3,4,5
1,2,5	1,4,5	2,3,6	3,4,6
1,2,6	1,4,6	2,4,5	3,5,6
1,3,4	1,5,6	2,4,6	4,5,6

Table 9.20

These are assigned to each bar through a two-step process using both 5-Pgs and 4-Pgs. To each 20-bar section is assigned a 5x5-Pg matrix (see Appendix 9.3). Only four of these 5-Pgs are used, with the 5-Pg not used highlighted in red. To explain how these are used to assign 3-accent sets in *Table 9.20* bars 1-20 are used as an example.

	5-Pgs						Bars 1-4		Bars 5-8		Bars 9-12		Bars 13-16		Bars 17-20	
	1	5	3	1	4	2	**5**	1,3,4	**3**	1,2,5	**1**	1,2,3	**4**	1,2,3	**2**	1,2,4
	2	1	4	2	5	3	**1**	1,3,5	**4**	1,4,6	**2**	1,3,6	**5**	1,5,6	**3**	1,4,5
Bars 1...20		**2**	**5**	**3**	**1**	**4**										
	3	3	1	4	2	5	**3**	2,3,6	**1**	2,3,4	**4**	2,4,5	**2**	2,3,5	**5**	2,4,6
	4	4	2	5	3	1	**4**	3,5,6	**2**	3,4,5	**5**	4,5,6	**3**	3,4,6	**1**	2,5,6

Table 9.21

In the '5-Pgs' column of *Table 9.21*, the four 5-Pgs used are numbered 1-4, and relate to the sets listed in columns 1, 2, 3 and 4 of *Table 9.20*. The 5-Pgs therefore assign sets from the five rows in *Table 9.20* to the corresponding four-bar micro-sections in *Table 9.21*, giving four 3-accent sets per micro-section. With the rows in *Table 9.21* assigned the numbers 1-4 (see far-left of '5-Pgs' column), the central 4-Pg from the 4x4 magic square assigned to the micro-section is then used to order the assignments for each micro-section column, with the outcomes shown in *Table 9.22*. This two-step process assigns all 3-accent sets to their respective bars.

[3,1,2,4]		[2,4,3,1]		[1,2,3,4]		[4,2,1,3]		[1,3,4,2]	
3	2,3,6	**4**	1,4,6	**1**	1,2,3	**3**	3,4,6	**2**	1,2,4
5	1,3,4	**2**	3,4,5	**2**	1,3,6	**5**	1,5,6	**5**	2,4,6
1	1,3,5	**1**	2,3,4	**4**	2,4,5	**4**	1,2,3	**1**	2,5,6
4	3,5,6	**3**	1,2,5	**5**	4,5,6	**2**	2,3,5	**3**	1,4,5

Table 9.22

Each 3-accent set is realised in one of four ways within each macro-section:

1. All pitch-classes have three accents simultaneously
2. 2/3 have two accents simultaneously, 1/3 have one accent[122]
3. 1/3 have two accents simultaneously, 2/3 have one accent
4. All have one accent

These were assigned to each 3-accent set globally by deriving five 4-Pgs from each of the four fundamental 4x4-Pg matrixes (see Appendix 9.4). To determine which accents in points 2 and 3 above are combined and which are not, each 3-accent set is coupled with nine other 3-accent sets that share one or two of the same values. Using the set [1,2,3] as an example, *Table 9.23* lists the coupled sets that share one and two of the same values. It is also split into three sections, each containing three forms of coupled sets.

For each 20-bar section is assigned a 2x3-Pg matrix and its entangled partner (see Appendix 9.5). These were assigned using the first tetrachord of P-0, [0,1,4,5], giving the fundamental 3-Pgs 1, 2, 5 and 6. Five values from each 3x3-Pg matrix were used to assign the specific coupled sets from *Table 9.23*.[123]

---

[122] These values are dependent on the pitch-class content of a given bar. If the pitch-class content cannot be divided by 3, the closest fractional values to 2/3 and 1/3 are used. For example, in a bar with 8 pitch-classes, 5/8 and 3/8 would be used.

[123] *Table 9.23* is used here as one example, with each 3-accent set having slightly different sub-sets of coupled sets.

	1	2	3	1	2	3
1.2	1	2	**4**	1	**4**	**5**
1.2	1	2	**5**	1	**4**	**6**
1.3	1	2	**6**	1	**5**	**6**
2.1	1	3	**4**	2	**4**	**5**
2.2	1	3	**5**	2	**4**	**6**
2.3	1	3	**6**	2	**5**	**6**
3.1	2	3	**4**	3	**4**	**5**
3.2	2	3	**5**	3	**4**	**6**
3.3	2	3	**6**	3	**5**	**6**

Table 9.23

Bars 1…20							
1				**Ent.**			
1	**1**	**2**	**3**	6	**3**	**2**	**1**
4	2	3	1	3	2	1	3
5	3	1	2	2	1	3	2
3	**2**	**1**	**3**	**4**	**2**	**3**	**1**
2	1	3	2	5	3	1	2
6	3	2	1	1	1	2	3

Ex.7.19

The values highlighted in yellow in the top 3x3-Pg matrixes in both columns (1 and Ent.) of *Ex.9.19* assign a section from *Table 9.23*. The bottom 3x3-Pg matrix then assigns the specific coupled set. For bars 1 to 20 the outcomes for this are:

1: 1,3,3,3,2 / 2,3,3,3,1 = 1.2, 3.3, 3.3, 3.3, 2.1

Ent: 3,1,1,1,2 / 2,1,1,1,3 = 3.2, 1.1, 1.1, 1.1, 2.3

The full outcomes for bars 1-20 are shown in Appendix 9.6, and can also be seen in the score examples shown above.

Summary

The application of point gestures in the compositional process has in this work reached a point where random processes are no longer required. By eschewing these processes and focusing on the Point and its relation to others, the music has reached a higher level of abstraction. However, this has been achieved through a more rigorous and cohesive constructive process, with every parameter employing similar or semi-similar processes built from variously sized point gestures. *Objects 3.1* can be seen as a departure from the processes of *Objects* and *Objects 2*, most recognisably in the lack of extended techniques and reduced material content, but also in the methods employed for the partitioning of time spaces. I found the partitioning techniques in this work to be problematic and clumsy in places, so refined the inadequacies of the methods in the remaining works, assigning impulses to quaver or crotchet sized partitions only.

As explained earlier, each work in this series has a complementary partner that when combined form the full sextet aggregate. This quantizing of compositional output, whereby a large body of future works are predetermined from a fixed set of instrumental forces (the six instruments of the sextet), can provide higher levels of inter-work coherence. Within each class of instrumentation (solo to sextet) is intended to be a defined set of aesthetic, constructive and technical principles that are developed and refined across the class, as well as in their respective complements, in order to exhaustively interrogate the methods and point-based aesthetic employed.

10. The •

Art derived using points has its origins in the Neo-Impressionist works of Georges Seurat (1859-91) and Paul Signac (1863-1935). Two works, *A Sunday Afternoon on the Island of La Grande Jatte* (Seurat 1884-86) and *Comblat le Chateau. Le Pré* (Signac, 1886) are some of the earliest examples of what would become known as Pointillism, and was developed in parallel with chromoluminarism, or Divisionism, 'the practice of separating colour into individual dots or strokes of pigment.'[124] Reducing the artwork to its fundamental components, focusing here on colour juxtapositions expressed through points, was developed further in the 20th Century by Wassily Kandinsky (1866-1944), whose two seminal texts (*Concerning the Spiritual in Art* (1912) and *Point and Line to Plane* (1926)) refined this approach, delineating three basic elements, the point and line, as well as the plane.[125]

This approach of distilling the artwork into its fundamental components (point and line, geometric shapes, primary or limited use of colours) is a key thread in modernist art, for example in Kasimir Malevich's Suprematist work *Suprematist composition conveying a feeling of universal space* (1913) or Piet Mondrian's De Stijl works. It can also be seen in Roy Lichtenstein's use of Ben-Day dots in his comic book-

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[124] Britannicacom. (2019). Encyclopedia Britannica - Divisionism. Retrieved 4 March, 2019, from https://www.britannica.com/art/divisionism

[125] Kandinsky, W. (1980). *Point and Line to Plane*. New York: Dover Publications Inc.

inspired works such as *Look Mickey* (1961) and *Drowning Girl* (1963), as well as Damien Hurst's 'Spot' paintings (1986-2011). Although both of these examples are not strictly pointillist or even modernist, the point/dot/spot used as a fundamental building block in these examples can be traced back to the aesthetic approach initiated by Seurat and Signac in 1886[126].

It was the third (*Farben*) of Arnold Schoenberg's *Five Pieces for Orchestra,* Op.16 (1909), that was to initiate pointillist tendencies in music[127], but it was another member of the Second Viennese School, Anton von Webern, who took it further in his works from *Five Pieces for Orchestra*, Op.10 (1911-13) onwards. *Farben* was no doubt influential to the post-1945 generation of composers. The more-or-less static nature of the work, two-note motifs that appear in different instruments of the orchestra (thus providing a different timbral colour (*farben*) with each instrumental iteration), are aspects that Webern was to refine and would become highly influential with the post-1945 European avant-garde composers that were students of Olivier Messiaen.[128]

Stockhausen was to call this ''punktuelle Musik' ('point music')'[129], which is in contrast to the pointillism exhibited in the works of Seurat et al. For the European

[126] The fact that Hirst's spot paintings were initiated 100 years after Seurat's 1886 work is perhaps more than a coincidence

[127] As well as introducing the term *Klangfarbenmelodie* (colour/timbre melody) in 1911

[128] Boulez, Stockhausen, et al. These are examined specifically later

[129] Maconie, R. (1989). *Stockhausen on Music: Lectures and Interviews*. UK: Marion Boyars Publishers Ltd., p35

avant-garde centered around those composers that attended Messiaen's Analysis Seminars at the Paris Conservatoire, and also the Darmstadt Summer Courses in 1949 and 1951, 'point music' was to become a central fascination. At the Darmstadt course of 1949, Messiaen composed 'the piano study *Mode de valeurs et d'intensités*… whose systematic ordering of durations, dynamics, articulation and pitch values, taken together with Webern's employment of twelve-note technique, [were to be] considered decisive for the emergence of serial music around 1950.'[130]

This early phase of serial music, as Richard Toop states, 'is represented in most people's minds by three works: Messiaen's *Mode de valeurs et d'intensités* (1949), Stockhausen's *Kreuzspiel* (1951), and Boulez's first book of *Structures* (1951-52).'[131] As this two-year period (1949-51) 'seems a long time for a cause to produce effects', Toop provides two further works 'that form the 'missing link' from Messiaen's study to the above-mentioned works of Boulez and Stockhausen.'[132] These works are Karel Goeyvaerts's *Sonata for 2 Pianos* (1950-51) and Michel Fano's *Sonate pour deux pianos* (1952).

The works that followed these initial attempts at 'punctual' music follow a different trajectory for each composer, most notably in the cases of Boulez, Goeyvaerts and Stockhausen. Boulez felt as though he had reached the zenith of punctual composition

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[130] Delaere, M (2002). 'Oliver Messiaen's Analysis Seminar and the Development of Post-War Serial Music.' *Music Analysis*, 21(1), p.35.

[131] Toop, R. (1974). 'Messiaen/ Goeyvaerts, Fano/ Stockhausen, Boulez.' *Perspectives of New Music*, 13(1), p.141.

[132] Ibid.

in his *Structures 1a*, and like Stockhausen started incorporating the notion of ‘groups’ and ‘masses’ of notes into his compositions. This is not to say that these groups do not contain what one would describe as points, far from it. The ‘point’ still exists but it is that it appears mediated through a gradient from the solitary ‘point’, to the group, to a mass (of points, groups, or both).

This gradient is the basic structure of Stockhausen’s *Kontra-Punkte* (1952-53):

> The beginning of KONTRA-PUNKTE is point music, with a maximum of differentiation… As the work progresses, more and more small groups appear, that is, sequences of notes played by the same instrument, and eventually the piano comes to the fore playing a whole mass of notes.[133]

Points and groups were to remain the focus of Stockhausen’s work for the rest of the 1950s, in both his instrumental and electronic music.

Karel Goeyvaerts, in his works of this period, is also a key composer in the development of both ‘punctual’ and electronic music[134], and where Stockhausen in the quote above talks of a ‘maximum of differentiation’, Sabbe states that:

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[133] Maconie, R. (1989). *Stockhausen on Music: Lectures and Interviews*. UK: Marion Boyars Publishers Ltd., p.39.

[134] Sabbe, H. (1994). ‘Goeyvaerts and the Beginnings of “Punctual” Serialism and Electronic Music.’ *Revue Belge De Musicologie / Belgisch Tijdschrift Voor Muziekwetenschap, 48*, pp.55-94.

> '[P]unctuality' should be qualified by introducing the term 'differential': within these dimensions one sees a larger differentiation of values, a differentiation applied systematically as well - not only are pitch and duration determined for each sound but essentially they also differ on a sound-by-sound basis; such a wider conception can be supplemented with a further semantic nuance of 'punctual', i.e. regular, as 'occurring regularly, recurring regularly'[135]

Although, as Stockhausen has stated, '[p]oint music flourished for only a relatively short period'[136], I would argue that this is not necessarily the case. It is true that a certain 'pureness' in the treatment of what one could term points did begin to wane after the 1950s, but what remains in the works of those composers that adhere(d) to the tenets of high modernism, for example the works of Milton Babbitt, Iannis Xenakis or the so-called 'New Complexity' composers, is the notion of differentiation, either maximum or minimum, of which a gradient can be formulated to mediate the process.

The composer Gordon Downie has taken this process considerably further than those mentioned in the previous paragraph. For example, in his work *Forms 5: Event Intersection* (1998), Downie establishes 'two formal extremes comprising high impulse density and low impulse density… mediated to form a 7-element scale of

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[135] Ibid., p.69.

[136] Maconie, R. (1989). *Stockhausen on Music: Lectures and Interviews*. UK: Marion Boyars Publishers Ltd., p.38.

high to low impulse density… permutated to form distinct series which… prioritize adjacencies which exhibit maximum differentiation from one another.'[137] His *Piano piece 2* (1995) is one of the most extreme 'punctual' works to have been written (a performance of which can be found on the composer's website).[138] The 'temporal partitioning' expressed in the highly complex notational strategies Downie has established in the work 'function to further emphasize the autonomy of the point, or the single note… achieved through the hyper-re-specification of the parametric profile of each successive impulse, in terms which include duration, intensity, and register.'[139]

As is evident from the text above, the Point in art has been developed considerably from its origins in the 1880s, enabling artists to create a plethora of works exhibiting increasing levels of abstraction and complexity. As Stockhausen said, 'there is still a lot to be done'[140] (regarding point music), with the trajectories in my own output discussed in *Point Gestures as a Compositional Determinant*.

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[137] Kennethwoodsnet. (2008). Gordon Downie Interview- part one. Retrieved 4 March, 2019, from https://kennethwoods.net/blog1/2008/03/05/gordon-downie-interview-part-one-forms-7/

[138] http://www.gordondownie.net/main.html (see 'Video' tab)

[139] Downie, G & Pace, I. (2006/07). 'Gordon Downie and Ian Pace: A Dialogue.' *The Open Space magazine*, Fall 06/Winter 07(8/9), pp.203-204.

[140] Maconie, R. (1989). *Stockhausen on Music: Lectures and Interviews*. UK: Marion Boyars Publishers Ltd., p.38.

11. *Objects 4: Vocalised Objects – The New Ennui*, for two mezzo sopranos, bass clarinet, French horn, vibraphone and double bass (2010 – 2016)

Objects 4: Vocalised Objects – The New Ennui is the first in a series of vocal works setting Christian Bök's book of poetry *Eunoia* to music. *Objects 4* sets the section titled *The New Ennui*, which appears on pages 103 to 105 in the first edition copy. The first three paragraphs of this section are a summary of the devices or conceptual ideas employed in the various texts in the book, with the final paragraph thanking friends for their 'patient encouragement'[141] during the writing of the book. The devices employed in the texts are highly restrictive in nature, with Bök describing the poem *Eunoia*[142] as making 'a Sisyphean spectacle of its labour, wilfully crippling its language in order to show that, even under such improbable conditions of duress, language can still express an uncanny, if not sublime, thought.'[143] As will be shown, the musical material in this work reflects this on several levels, and a part of this process involved stripping away of some of the more inelegant and excessive elements found in the previous works. For example, there are sixty different time signatures in *Objects* and ninety possible variants of tuplets in *Objects 2*. In both of these instances, other systems were applied to reduce the pool of possible assignments

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141 Bök, C. (2001). *Eunoia*. (1st ed.). Edinburgh: Canongate Books Ltd., p.105.

142 ibid., pp12-81

143 ibid. , p103

further, however in this work and all others from *Objects 3.1* onwards the focus is on generating more from less.

This work had an extremely long gestation period, with several versions attempted and abandoned from 2010 to 2016. The earliest versions were abandoned for several reasons, from too much bending of the systems in place (creating caveats upon caveats to justify and/or correct irregularities or impossibilities in the parametric assignments), to the vocal parts not being integrated enough with the instrumental parts. The version prior to the finished work was created using the same principles as this final version but used significantly more words, resulting in a duration of over fifty minutes. Although *Objects 4* has gone through several re-writes, it has retained several of the original structural and compositional principles, albeit in a more refined and coherent fashion. It develops the application of point gestures found in *Objects 2* (where specific types of point gesture are assigned to different sections and/or instrumentations) by incorporating both 3- and 4-Point gestures as well as multiple point-gesture variants within each section.

The two most recent versions of this work were the most successful because they were constructed with a focus on the content of the words, as opposed to writing the music and adding the words within what had been written. More attention was paid to building each word section according to the specifics of the words used, which were all partitioned into separate letters or combinations of letters. In order to provide greater levels of cohesion, the vocal and instrumental parts are combined within the same gestures, sharing the content between the available instrumental and vocal forces. As will be expanded upon later, each ensemble is limited to only a small subset of the available gestures by delineating the limitations of each instrument as well as in combination. As a fundamental aspect of this work, the ability of an instrument or instrumental group to realise a given gesture needed to be taken into account to prevent any unnecessary practical impossibilities inherent to a gesture's content. Some gestures, such as a three-point gesture expressed as a triple-stopped chord, would be impossible on instruments that cannot ordinarily produce chords (such as wind and brass instruments), and could also be difficult for a solo stringed instrument to realise if spread over non-adjacent strings or without a specific type of bow.

Like the use of words elaborated upon in the following section, the gestural content within this work is highly fragmented but without overlapping or superimposing the gestures assigned. Although there are areas in the work that contain high levels of impulse saturation, the work on the whole is very sparse in nature. In several parts of the work the areas of played activity are separated by silences, but whereas in works such as *Objects* and *Objects 2* the silences were used as a framing device before and after sections, this is different in this work as the silences are the result of bars and partitions within the bars not being assigned impulses. This is elaborated on further towards the end of this chapter.

Words

Paragraph 1

th**E**
Univocal
i**N**spired
c**O**terIe
S**I**syphean
improb**A**ble

Paragraph 2

abId**E**s
c**U**linary
acce**N**t
v**O**wel
Include
subst**A**ntive

Paragraph 3

Fr**E**nch
trib**U**te
o**N**ly
translati**O**n
l**I**ke
m**A**ke

Paragraph 4

r**E**quired
enco**U**ragement
Ber**N**stein
J**O**hnston
K**I**m
c**A**r

Ex.11.1

Ex.11.1 shows the work partitioned into four macro-sections marked Paragraph 1, 2, 3 and 4, with each containing 6 words derived using a mesostic based on the word 'eunoia', giving 24 words in total. Each paragraph in the original text of *The New Ennui* consists of twelve lines, which for the purpose of allocating words are split into six groups of two lines. A letter from the word 'eunoia' is assigned to each two-line group, with the first word to contain the assigned letter chosen. Multiple assignments of the same word were not allowed, as well as the words 'eunoia' and 'oiseau', with the outcomes for Paragraph 1 shown highlighted red in *Ex.11.2*.

E ‘Eunoia’ is the shortest word in English to contain all
five vowels, and the word quite literally means ‘beauti-

U ful thinking’. *Eunoia* is a univocal lipogram, in which
each chapter restricts itself to the use of a single vowel.

N *Eunoia* is directly inspired by the exploits of Oulipo
(*l’Ouvroir de Littérature Potentielle*) – the avant-garde

O coterie renowned for its literary experimentation
with extreme formalistic constraints. The text makes

I a Sisyphean spectacle of its labour, wilfully crippling
its language in order to show that, even under

A such improbable conditions of duress, language can
still express an uncanny, if not sublime, thought.

Ex.11.2

Each word is split into a minimum of 2 and a maximum of 8 partitions depending on its length (see Appendix 11.1). Because of this fragmentation, the words retain no semantic content and there is no ‘word painting’ in the instrumental or vocal parts of the music, thus increasing abstraction through the rejection of surface-level, superficial mimesis. This rejection is important because it hinders the listener’s ability to trace musical markers within the work as well as preventing sonic outcomes signifying anything exterior to the music being heard.

The word partitions have either defined or undefined pitches, with an example of an undefined pitch being the sound that is produced when singing 'ph' from 'Sisyphean'. To maintain its vertical temporal position relative to the point gesture in which it appears, these undefined pitch classes still maintain a defined pitch in the score but with an 'x' note head. This is because even though these notes have an undefined pitch, they can still be differentiated by vertical displacements – 'ph' can be realised high, mid-level and low, as well as the gradations between these levels.

Music

In an ensemble of six players, the two vocalists comprise one third and the remaining four instruments two thirds of the players available. One can see in *Table 11.1* that the number of word partitions multiplied by 3 gives the number of pitches assigned to the section. The pitch-class content is therefore always split one third to the vocalist(s) and two thirds to the remaining ensemble of players. With the pitches expressed as either 3- or 4-Pgs, basic gestural assignments were delineated for each of the seven content variants listed in *Table 11.1* below. Only whole gestures were allowed, so for example sections with two word partitions and six pitch classes could not be realised as 1.5 4-Pgs.

Word Ptns.	P-c content		3-Pgs	4-Ps
2	6		2	0
3	9		3	0
4	12		0	3
5	15		1	3
6	18		2	3
7	21		3	3
8	24		4	3
		Total	**15**	**15**

Table 11.1

Realised as trichords (3-Pgs) or tetrachords (4-Pgs), the specific pitches are derived from a combinatorial matrix (c-matrix) containing all four forms of set:

P-0	0	1	4	5	3	2	e	t	7	6	8	9
R-0	9	8	6	7	t	e	2	3	5	4	1	0
RI-e	2	3	5	4	1	0	9	8	6	7	t	e
I-e	e	t	7	6	8	9	0	1	4	5	3	2

Ex.11.3

This is almost identical to the c-matrix used in *Objects 3.1*, with a minor adjustment made in the positions of pitch classes 3 and 2 in the first hexachord, and 8 and 9 in the second hexachord of P-0. To each of the four Paragraphs in the work is assigned a different permutation of the above c-matrix, with the fundamental (top row) sets P-0, R-0, RI-e and I-e assigned to Paragraphs 1-4 respectively. This is similar to the c-matrix assignments in *Objects 3.1*, but in *Objects 4* the fundamentals assigned do not all start with '0', and are instead the rows from top to bottom in *Ex.11.3*. With the structure of the c-matrixes fixed as it was in *Objects 3.1*, the outcome of this (*Table 11.2*) is that the four c-matrixes all share the same pitch-class sets but assigned to different rows in each matrix.

Set order for combinatorial matrixes in each Paragraph							
Paragraph 1	**P-0** **R-0** **RI-e** **I-e**	Paragraph 2	**R-0** **P-0** **I-e** **RI-e**	Paragraph 3	**RI-e** **I-e** **P-0** **R-0**	Paragraph 4	**I-e** **RI-e** **R-0** **P-0**

Table 11.2

As shown in Appendix 11.3, these matrixes are partitioned into four sets of two 3x4 sub-matrixes, each containing twelve pitch-classes. The different order positions (1-3, 2-4, 3-5, 4-6), as well as their entangled partners in the second hexachord of the c-matrix, result in different frequencies of trichordal (3-1, 3-2, 3-3) and tetrachordal (4-1, 4-10, 4-24) content.[144] By employing extreme constraint in this parameter (and the eschewing of extended techniques (except artificial harmonics in the double bass part)), the focus is shifted to other parameters such as the distance between impulses and impulse duration, and also the point gestures being projected.

[144] One should note that order positions 2-4/9-11 and 3-5/8-10 are not complete aggregates as they contain repeated pitch classes, with four of the same 4-1 tetrachords in each. Given that these are permutations of the same set ({4,5,6,7}), the vertical temporal positions of the pitch classes alter with each reiteration.

Point Gestures

Building on the point gesture systems employed in *Objects 3.1*, *Objects 4* develops those techniques and also incorporates similar strategies for object projection as those found in *Objects 2*, but with greater variance through the introduction of 3-Pgs and multiple gesture-types within the same temporal space. Like in *Objects 3.1*, 4-Pgs are grouped together to create 4x4-Pg matrixes and are all listed in Appendix 11.4. There are 24 words in *Objects 4* so each word section is assigned a 4-Pg matrix from this list with each assigned once. The 4-Pg matrix acts as the primary source from which parametric and gesture content assignments are made within that word section.

$$1 \quad \begin{array}{|cc|cc|} \hline 1 & 2 & 3 & 4 \\ 4 & 3 & 2 & 1 \\ \hline 2 & 1 & 4 & 3 \\ 3 & 4 & 1 & 2 \\ \hline \end{array}$$

Ex.11.4

Ex.11.4 is taken from Appendix 11.4 and is the top matrix in column A. All matrixes in this column have 4-Pgs on the top row that start with a ‘1’. The remaining three 4-Pg values assign the fundamental 4-Pgs for columns B, C and D. The top row in *Ex.11.4* is the 4-Pg [1,2,3,4], as ‘1’ has already been used ([1,2,3,4]), the remaining ‘2,3,4’ assigns: 2 – [2,1,4,3], 3 – [3,4,1,2] and 4 – [4,3,2,1] (the four rows in *Ex.11.4*). The result of this is shown in the top row of matrixes in Appendix 11.4 and in *Ex.11.5*, below. As can be seen in this example, the four 4x4 matrixes are built from the same four 4-Pgs, reflecting the global c-matrix assignments above.

	A 1				B 2				C 3				D 4			
	1	2	3	4	2	1	4	3	3	4	1	2	4	3	2	1
	4	3	2	1	3	4	1	2	2	1	4	3	1	2	3	4
1	2	1	4	3	1	2	3	4	4	3	2	1	3	4	1	2
	3	4	1	2	4	3	2	1	1	2	3	4	2	1	4	3

Ex.11.5

With groups A, B, C and D assigned to Paragraphs 1-4 respectively, 6-Point gestures (6-Pgs) are used to assign the six matrixes in columns A-D in Appendix 11.4 to the six word sections within each Paragraph. There are only 6 variants of 3-Pg (3!) and 24 variants of 4-Pg (4!). However, for 6-Pgs there are 720 (6!) possible variants. Because of the sheer number of possible 6-Pg permutations, hexachords from the fundamental sets of each Paragraph were translated to the numbers 1-6 by employing a simple modulus: 0/6 = 1, 1/7 = 2… 5/e = 6. The basic outcomes for this are shown in *Ex.11.6*, with the specific matrixes assigned listed in Appendix 11.5.

P-c		**Paragraph**	**Second Hexachord**													
0,6	1	**1**	**P-0**	e	t	7	6	8	9	=	6	5	2	1	3	4
1,7	2	**2**	**R-0**	2	3	5	4	1	0	=	3	4	6	5	2	1
2,8	3	**3**	**RI-e**	9	8	6	7	t	e	=	4	3	1	2	5	6
3,9	4	**4**	**I-e**	0	1	4	5	3	2	=	1	2	5	6	4	3
4,t	5															
5,e	6															

Ex.11.6

Whereas in *Objects 2* only one gesture-type was allowed in each of the 11 sections, in *Objects 4* different gesture-types can be assigned to a word section and to single bars within that section. Instrumentation strategies will be expanded upon in further detail later but for now it is worthy to note that the types of 3- and 4-pgs assigned to a word section are in part determined by the instrumentation of said section. Unlike in *Objects 2*, *Objects 4* has no section, large or small, in which the full sextet of performers (and the quartet minus the vocalists) is playing as a whole, or as anything that would traditionally be called a 'tutti', with the types of ensembles used in this work being solo, duet or trio. This is reflected in the types of 4-Pgs that were derived as fundamental objects for the work, where the full 4-Pg is never expressed as a simultaneous tetrachord.

	Types	
3-Pg	3.1	3P
	3.2	1P+2sim
	3.3	3sim
4-Pg	4.1	4P
	4.2	2P+2sim
	4.3	2sim+2sim
	4.4	1P+3sim

Table 11.3

Table 11.3 lists the 7 gestures employed in the work, with 'P' denoting single points and 'sim' simultaneous (or harmonic, creating simultaneous dyads ('2sim') and triads ('3sim')). Gestures 3.1 and 4.1 are always expressed as three or four points that appear separated and do not overlap, so despite differences in vertical temporal displacements the gestures are held invariant throughout. The remaining gestures (3.2, 3.3, 4.2, 4.3 and 4.4) have multiple possible realisations and are listed in *Table 11.4*.

3-Pgs				4-Pgs					
1P + 2sim		**3sim**		**2P + 2sim**		**2sim + 2sim**		**1P + 3sim**	
1	1P + 2sim1	**1**	3sim1	**1**	2P + 2sim1	**1**	2sim1 + 2sim1	**1**	1P + 3sim1
2	1P + 2sim2	**2**	3sim2	**2**	2P + 2sim2	**2**	2sim1 + 2sim2	**2**	1P + 3sim2
3	2sim1 + 1P			**3**	2sim1 + 2P	**3**	2sim2 + 2sim1	**3**	3sim1 + 1P
4	2sim2 + 1P			**4**	2sim2 + 2P	**4**	2sim2 + 2sim2	**4**	3sim2 + 1P
				5	1P+2sim1+1P				
				6	1P+2sim2+1P				

Table 11.4

The 'sim' part of gestures is demarcated 'sim1' or 'sim2', with 'sim1' denoting a dyad or triad realised on the same impulse point and 'sim2' denoting staggered entries. How these gestures manifest in the score will be discussed later, as before this could be achieved it was important to delineate the capabilities of each instrument alone and in combination with others in order to assign the variants of 3- and 4-Pgs effectively for each instrumentation-type.

Solos		Duets			Trios			
1	Bcl	**1/2**	Bcl	Hn	**-1**	Hn	Vib	Db
2	Hn	**1/3**	Bcl	Vib	**-2**	Bcl	Vib	Db
3	Vib	**1/4**	Bcl	Db	**-3**	Bcl	Hn	Db
4	Db	**2/3**	Hn	Vib	**-4**	Bcl	Hn	Vib
		2/4	Hn	Db				
		3/4	Vib	Db				

Table 11.5

As trills or tremolos are not strictly classified as simultaneous dyads they were not permitted in the work, so the bass clarinet and French horn have a maximum of one pitch class each at a time. The vibraphone and double bass can of course play more notes simultaneously but for the double bass specifically this involves different types of bow or extended techniques such as pizzicato. Double stopped notes on the double bass can however be easily played, so for the double bass and vibraphone the maximum number of simultaneous notes is two. The following section will outline the initial process for delineating gestures for solo, duet and trio instrumentations with and without vocalists.

Solos

	3-Pgs			**4-Pgs**		
	No v	**+ 1v**	**+2v**	**No v**	**+ 1v**	**+2v**
Bcl	3P	1P + 2sim	3 sim	4P	2P + 2sim	2sim + 2sim
Hn	3P	1P + 2sim	3 sim	4P	2P + 2sim	3 sim + 1P
Vib	3P	1P + 2sim	3 sim	4P	2sim + 2sim	3 sim + 1P
Db	3P	1P + 2sim	3 sim	2P + 2sim	2sim + 2sim	3 sim + 1P

Table 11.6

There are three 3-Pgs and three 4-Pgs assigned to each ensemble. One will notice in *Table 11.6* that each 3-Pg is assigned four times and each 4-Pg is assigned three times. This is straightforward for 3-Pgs as there are only three basic gestures (see *Table 11.3*), but for 4-Pgs a rotational system was used, omitting a different 4-Pg in each instrument. In *Table 11.6*, from top to bottom (Bcl to Db) the omitted gestures are 3sim + 1P (4.4), 2sim + 2sim (4.3), 2P + 2sim (4.2), and 4P (4.1). Columns '+1v' and '+2v' are the ensemble plus one vocalist and plus two vocalists respectively, and like the bass clarinet and French horn, each vocalist can only realise one pitch class at a time.

Duets

As was the case with solo instrumentations and also trios, each ensemble is assigned a maximum of three gestures. With duets, the initial stages of assigning gestures were structured differently from those for solos. For 3-Pgs, each gesture is assigned to two instruments: 3P – Bcl/Hn (1/2), 1P+2sim – Hn/Vib (2/3), 3sim – Vib/Db (3/4). With each instrument now assigned either one or two gestures, the different duets can be allotted their respective point gestures (*Table 11.7*).

	3-Pgs			**4-Pgs**			
	No v	**+ 1v**	**+2v**	**No v**	**1 v**	**2 v**	
Bcl/Hn	3P	1P+2sim	3sim	4P	2P + 2sim	2sim + 2sim	
Bcl/Vib	3P	1P+2sim	3sim	4P	2P + 2sim	2sim + 2sim	3 sim + 1P
Bcl/Db	3P	3sim	1P+2sim	4P	2P + 2sim	2sim + 2sim	3 sim + 1P
Hn/Vib	3P	1P+2sim	3sim	4P	2P + 2sim	2sim + 2sim	3 sim + 1P
Hn/Db	3P	1P+2sim	3sim	4P	2P + 2sim	2sim + 2sim	3 sim + 1P
Vib/Db	1P+2sim	3sim	3P	2P + 2sim	2sim + 2sim	3 sim + 1P	

Table 11.7

Within the '3-Pgs' section of *Table 11.7*, the gestures highlighted in red are within duets that only have a total of two gestures initially assigned. All other ensembles have three gestures. This is different for 4-Pgs because each duet has either 3 or 4 gestures in total so gestures will need to be omitted. The gestures highlighted red in the '4-Pgs' section of *Table 11.7* are those that are omitted, leaving three gestures for each duet. The non-highlighted gestures are assigned from left to right to ensembles with 0, 1 and 2 vocalists respectively in the same manner as *Table 11.6*.

Trios

	3-Pgs			4-Pgs		
	No v	**+ 1v**	**+2v**	**No v**	**+ 1v**	**+2v**
Bcl/Hn/Vib	3P	1P + 2sim	3 sim	4P	2P + 2sim	2sim + 2sim
Bcl/Hn/Db	1P + 2sim	3 sim	3P	4P	2P + 2sim	3 sim + 1P
Bcl/Vib/Db	3 sim	3P	1P + 2sim	4P	2sim + 2sim	3 sim + 1P
Hn/Vib/Db	3P	1P + 2sim	3 sim	2P + 2sim	2sim + 2sim	3 sim + 1P

Table 11.8

In *Table 11.8*, 3-Pgs for trios are assigned using a rotational system, shifting gestures one column to the left in each row. 4-Pgs are different in that the instrument omitted from the ensemble will omit a corresponding gesture, leaving three 4-Pgs assigned. The corresponding gestures are listed in *Table 11.9*, with the assigned gestures shown in the 4-Pgs columns in *Table 11.8.*

Gesture		Ins.
4.1	4P	1 - Bcl
4.2	2P+2sim	2 - Hn
4.3	2sim+2sim	3 - Vib
4.4	1P+3sim	4 - Db

Table 11.9

The methods employed to determine the specific instrumentations for each Paragraph and Word section are uniform throughout the work so only Paragraph 1 will be used to provide specific score examples of instrumentation strategies and the point gesture realisations of trichords and tetrachords. The system for global instrumentation assignments are derived in part by the use of complementary instrumentations that are listed in *Table 11.10*.

Solos		**Trios**		**Duets**			
1	Bcl	**-1**	Hn, Vib, Db	**1/2**	Bcl/Hn	**3/4**	Vib/Db
2	Hn	**-2**	Bcl, Vib, Db	**1/3**	Bcl/Vib	**2/4**	Hn/Db
3	Vib	**-3**	Bcl, Hn, Db	**1/4**	Bcl/Db	**2/3**	Hn/Vib
4	Db	**-4**	Bcl, Hn, Vib				

Table 11.10

The complement of an ensemble is the remaining instruments after the deduction of that ensemble from (in this case) the full quartet. So for solo bass clarinet the complementary ensemble is a trio containing horn, vibraphone and double bass. In each Paragraph is assigned two of each ensemble-type, these were assigned in a similar way as the 4-Pg matrix assignments outlined in *Ex.11.6*, but in this case the first hexachord is used.

Paragraph	**First Hexachord**														
1	0	1	4	5	3	2	=	1	2	5	6	4	3	**1,4**	Solo
2	9	8	6	7	t	e	=	4	3	1	2	5	6	**2,5**	Duet
3	2	3	5	4	1	0	=	3	4	6	5	2	1	**3,6**	Trio
4	e	t	7	6	8	9	=	6	5	2	1	3	4		

Ex.11.7

With each ensemble assigned two numbers from 1-6 (far right of *Ex.11.7*), each hexachord assigns the basic ensemble-types for each Paragraph, with the resulting outcomes from the hexachord translations listed in the second column from the left of Appendix 11.6.

Solos/Trios

As the 4-Pg matrix shown in *Ex.11.4* was the initial starting point from which all other matrixes were derived, it was used to form the foundation from which the specific ensembles were allocated. For solos and trios, the assignments are derived using rows two and three in *Ex.11.4*: [4,3,2,1] and [2,1,4,3]. As shown in Appendix 11.6, [4,3,2,1] is assigned to the solos of Paragraphs 1 and 2, [2,1,4,3] to Paragraphs 3 and 4. In Paragraphs 1 and 2 the 4-Pg assigns solo instruments first, with their complements assigned to the following trio. This is the same for Paragraphs 3 and 4, the only difference being that solos come after trios in these Paragraphs and assign the trio instrumentation that precedes it.

Duets

For duets the assignments are realised in a two-step process: Step 1 assigns the set of two complementary duets, Step 2 assigns the order of these complements. There are three fundamental duet sets: 1 – [1,2]/[3,4], 2 – [1,3]/[2,4] and 3 – [1,4]/[2,3]. Because there are three these are assigned using 3-Pgs instead of 4-Pgs.

Step 1

2	3	1
3	1	2
1	2	3

Ex.11.8

Ex.11.8 is the remaining 3x3-Pg matrix from a set of three that were used to determine initial global distributions for vocal material. Only the numbers 2 and 3 from the top row and 3 and 1 from the middle row were needed for Step 1 assignments. Shown in Appendix 11.6, the duets for Paragraphs 1-4 are assigned using the numbers 2, 3, 3 and 1, giving the fundamental duet set assignments:

Paragraph 1: 2 – [1,3]/[2,4]

Paragraph 2: 3 – [1,4]/[2,3]

Paragraph 3: 3 – [1,4]/[2,3]

Paragraph 4: 1 – [1,2]/[3,4]

Step 2

With Step 1 complete, the order in which the duets appear within each Paragraph is still to be determined. For Paragraphs 1 and 2, the preceding solo instrument assigns the specific duets by applying one rule: the duet that follows this solo must not contain the solo instrument. In Paragraph 1, the solo instrument that precedes the first duet is a double bass ([4]). Therefore, the first duet must be [1,3] (see above and Appendix 11.6). In Paragraph 2 the preceding solo is bass clarinet (1), thus assigning [2,3] as the first duet. This is modified slightly for Paragraphs 3 and 4, whereby firstly the second solo (Bcl and Vib respectively) assigns the *second* duet, which in turn assigns the preceding duet. With these assignments in place it is time to focus on how the point gestures are realised in Paragraph 1, discussing the six Word sections separately. As was mentioned above, each Word section is assigned 3x3-Pg and 4x4-Pg matrixes that are used in each to order all variables mediated.

Bars 1-9: the

This section contains only two word partitions, 'th' and 'e', so therefore contains only six pitches expressed as two 3-Pgs (trichords). As its scored for solo double bass and one vocalist the point gestures used are 3P for double bass only and 1P+2sim for double bass with vocalist (*Table 11.6*). This section has the largest t-Sig set (see Chapter Two) so the sparsity of the section is reinforced by virtue of the very few impulses being situated within a longer time-space.

There are 3 3x3-Pg matrixes assigned to each Word section. Listed as they are in *Ex.11.9*, the 3-Pgs used are taken from fixed positions that are the same in all sections with a similar word partition content. For sections with two partitions these are always 3-Pgs in rows 2 and 8.

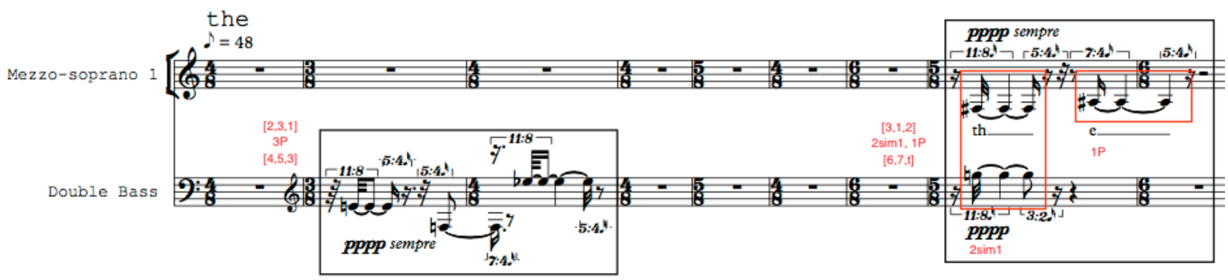
1

1	**2**	**3**		
2	3	1	2 – [2,3,1]	3P
3	1	2		[4,5,3]

3	**1**	**2**
1	2	3
2	3	1

2	**3**	**1**		
3	1	2	8 – [3,1,2]	2sim1, 1P
1	2	3		[6,7,t]

Ex.11.9



Ex.11.10

The gestures in each Word section are distributed globally as evenly as possible across the section. For sections like this one with only two gestures the distributions are based on permutations of the set {0,1,1}, which assigned 1 or 0 gestures to a three-bar sub section (bars 1-3, 4-6, 7-9 in each Word section). As shown in *Ex.11.10*, the permutation used here is [1,0,1].

Bars 10-18: univocal

With a duet (Bcl/Vib) and one vocalist as the instrumentation, the point gestures available in this section are for 3-Pgs 3P without and 1P+2sim with vocalist, and 4-Pgs are 4P without and 2P+2sim with vocalist (*Table 11.7*). The seven gestures, four 3-Pgs and three 4-Pgs, are distributed across the three sub-sections using the set permutation [2,2,3].

	2			
1	**3**	**2**	1 – [1,3,2]	1P, 2sim2
3	2	1		[7,t,e]
2	1	3		

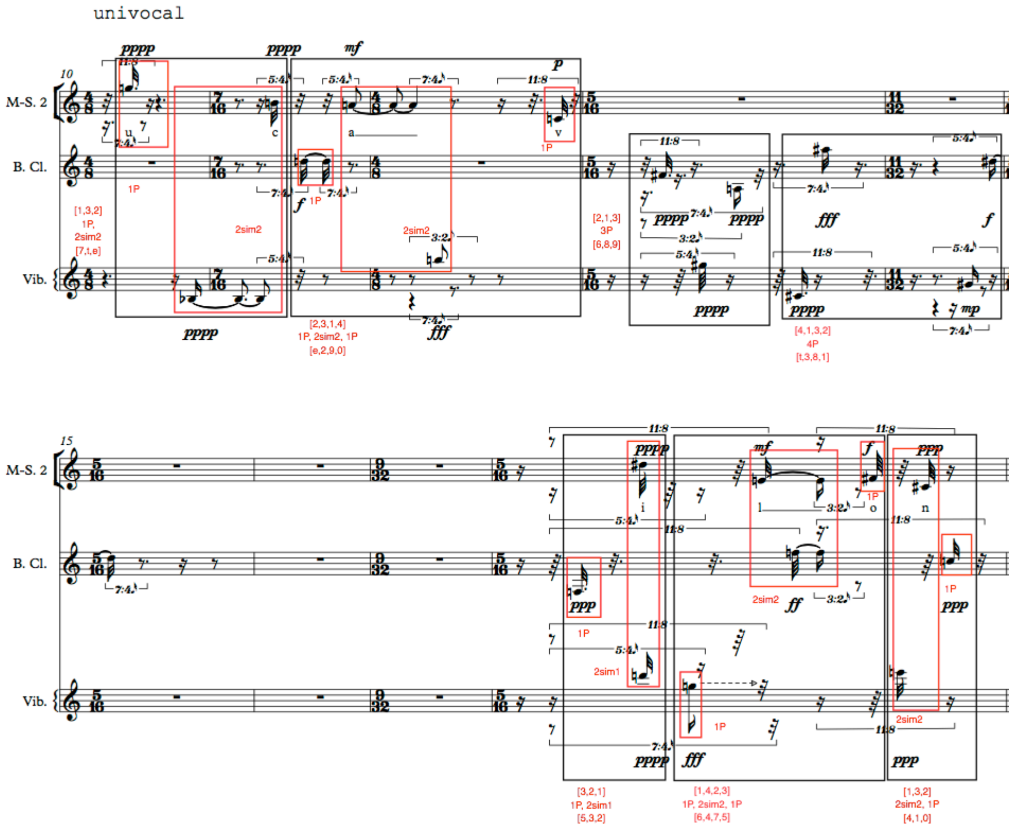
2	**1**	**3**	4 – [2,1,3]	3P
1	3	2		[6,8,9]
3	2	1	6 – [3,2,1]	1P, 2sim1
				[5,3,2]

3	**2**	**1**		
2	1	3		
1	3	2	9 – [1,3,2]	2sim2, 1P
				[4,1,0]

1	4	2	3	2 - [2,3,1,4]	1P, 2sim2, 1P	[e,2,9,0]
3	2	4	1	4 - [4,1,3,2]	4P	[t,3,8,1]
4	1	3	2	1 - [1,4,2,3]	1P, 2sim2, 1P	[7,5,6,4]
2	3	1	4	3 - [3,2,4,1]		

Ex.11.11

Ex.11.11 lists both the 3-Pgs and 4-Pgs used in this section, with the 3-Pg assigned from rows 1, 4, 6 and 9, and the rows of the 4x4-Pg matrix assigned using the first three values of the central 4-Pg [2,4,1,3]. As all the remaining Word sections in this Paragraph have three 4-Pgs, the process by which these are assigned remains the same in all so will not be discussed further. One should note that the 4-Pgs taken from the rows of the 4x4 matrix are only ever used for surface-level gestures, whereas the 4-Pgs derived from the 2x2 squares are only used in the work's underlying construction.



Ex.11.12

Bars 19-27: inspired

With the instrumentation of duet (Hn/Db) plus one vocalist, the 3-Pgs used in this Word section are the same as in Bars 10-18, with the 4-Pgs being 2P+2sim and 2sim+2sim. The six gestures (3x3-Pgs and 3x4-Pgs) are distributed across the three sub-sections using the set [2,2,2]. The 3-Pgs are taken from rows 2, 5 and 9 from the 9 3-Pgs available (*Ex.11.13*). The 4-Pgs are again assigned using the first three values of the central 4-Pg.

5

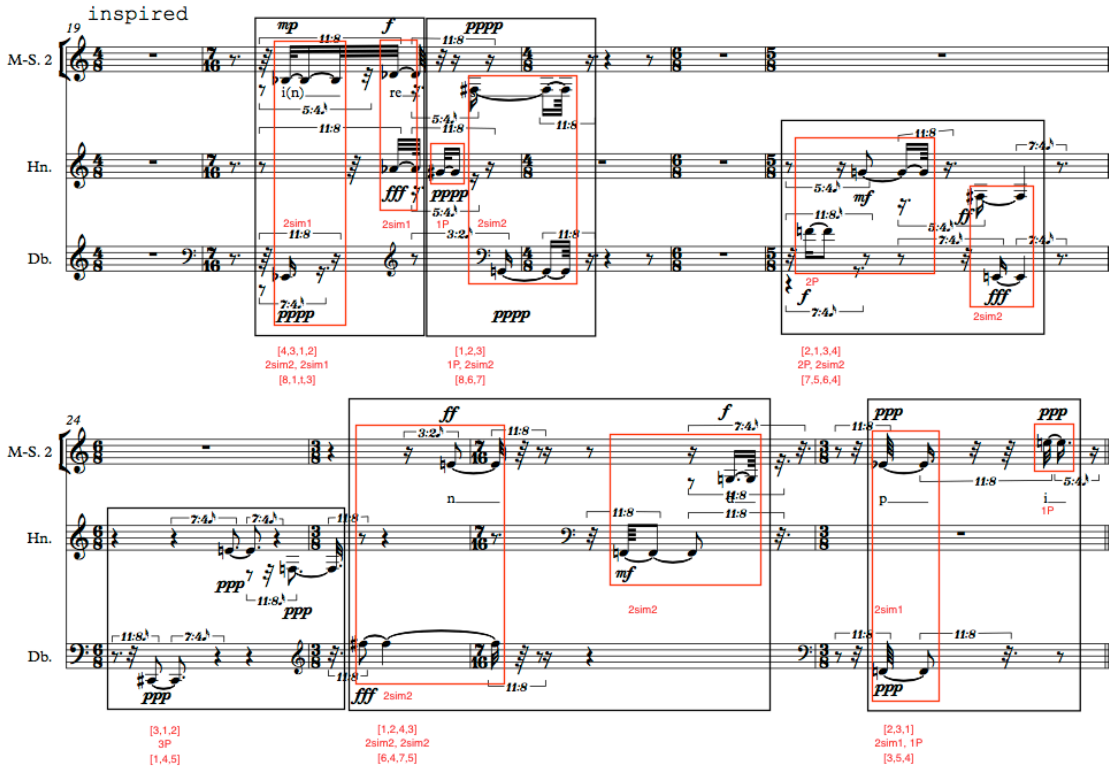
3	**1**	**2**	2 – [1,2,3]	1P, 2sim2	
1	2	3		[8,6,7]	
2	3	1			

2	**3**	**1**	5 – [3,1,2]	3P	
3	1	2		[1,4,5]	
1	2	3			

1	**2**	**3**	8 – [2,3,1]	2sim1, 1P	
2	3	1		[3,5,4]	
3	1	2			

1	2	4	3	4 - [4,3,1,2]	2sim1, 2im1	[8,1,t,3]
3	4	2	1	2 - [2,1,3,4]	2P, 2sim2	[7,5,6,4]
2	1	3	4	1 - [1,2,4,3]	2sim2, 2sim2	[6,4,7,5]
4	3	1	2	3 - [3,4,2,1]		

Ex.11.13



Ex.11.14

One will notice in the score examples above and below that some of the held pitches last for several partitions, such as in the double bass part in bar 25 in *Ex.11.14*. This is particular to gestures containing 2sim2 or 3sim2 elements. 2sim1 and 3sim1 gestures use the durations set out in the pre-compositional process, but sim2 gestures have a cumulative effect, with the last impulse of the sim2 element of the gesture lasting its assigned durational value.

Bars 28-36: coterie

The trio instrumentation (Bcl/Hn/Vib) plus two vocalists assigns the 3-Pgs 3P without and 3sim with vocalists (*Table 11.8*). With only one 3-Pg used, the set chosen from the nine assigned to the section is from row five in *Ex.11.15*. The 4-Pgs used are 4P without vocalists and 2sim+2sim with vocalists and are again assigned using the firth three values of the central 4-Pg.

6

3	**2**	**1**
2	1	3
1	3	2

1	**3**	**2**		
3	2	1	5 – [3,2,1]	3P
2	1	3		[3,5,4]

2	**1**	**3**
1	3	2
3	2	1

1	2	3	4	3 - [3,4,1,2]	2sim1, 2sim2	[8,1,t,3]
4	3	2	1	2 - [2,1,4,3]	2sim2, 2sim1	[6,4,7,5]
2	1	4	3	1 - [1,2,3,4]	2sim2, 2sim2	[7,5,6,4]
3	4	1	2	4 - [4,3,2,1]		

Ex.11.15

The four gestures in Word sections containing four gestures are distributed across the three sub-sections using permutations of the set {1,2,1}, with this section using the permutation [1,2,1], and can be seen in *Ex.11.16*.

Ex.11.16

Bars 37-45: Sisyphean

Like in Bars 19-27, the three 3-Pgs are realised using gestures from rows 2, 5 and 8 (*Ex.11.17*), and the three 4-Pgs again assigned using the first three values of the central 4-Pg. With the instrumentation of solo vibraphone plus one vocalist, the 3-Pgs assigned are 3P without vocalist and 1P+2sim with vocalist, and the 4-Pgs have 4P without vocalist and 2sim+2sim with vocalist. The six gestures are distributed using the set [2,2,2] (*Ex.11.18*).

4

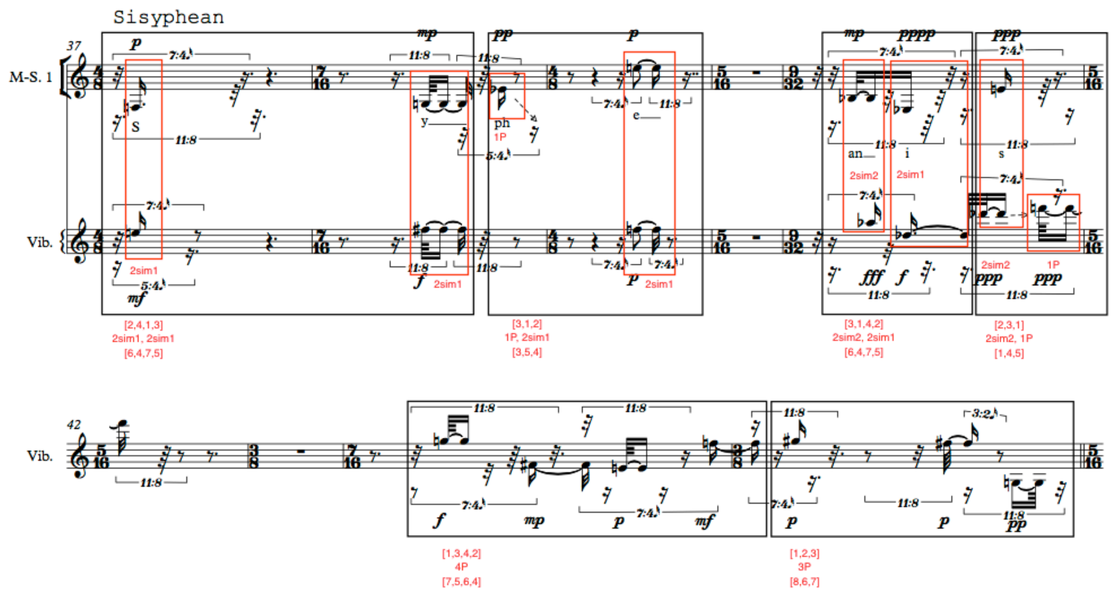
2	**3**	**1**		
3	1	2	2 – [3,1,2]	1P, 2sim1
1	2	3		[3,5,4]

1	3	4	2	4 - [4,2,1,3]	2sim1, 2sim1	[6,4,7,5]
2	4	3	1	3 - [3,1,2,4]	2sim2, 2sim1	[8,1,t,3]
3	1	2	4	1 - [1,3,4,2]	4P	[7,5,6,4]
4	2	1	3	2 - [2,4,3,1]		

1	**2**	**3**		
2	3	1	5 – [2,3,1]	2sim2, 1P
3	1	2		[1,4,5]

3	**1**	**2**		
1	2	3	8 – [1,2,3]	3P
2	3	1		[8,6,7]

Ex.11.17



Ex.11.18

Bars 46-54: improbable

With the same number of gestures as Bars 10-18, the seven gestures in this section are distributed using a permutation of the set {2,2,3}, and as *Ex.11.20* shows, [3,2,2] is used here. The four 3-Pgs are taken from rows 1, 4, 6 and 9 in *Ex.11.19*, the 4-Pgs using the first three values of the central 4-Pg.

	3			
2	**1**	**3**	1 – [2,1,3]	1P, 2sim1
1	3	2		[7,t,e]
3	2	1		

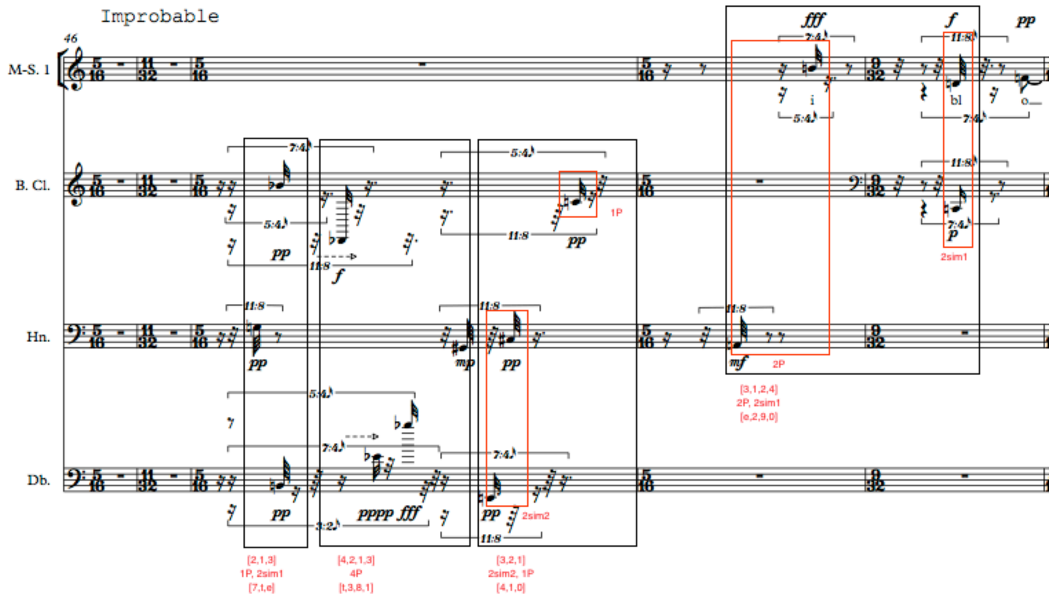
3	**2**	**1**	4 – [3,2,1]	2sim2, 1P
2	1	3		[4,1,0]
1	3	2	6 – [1,3,2]	3sim2
				[5,3,2]

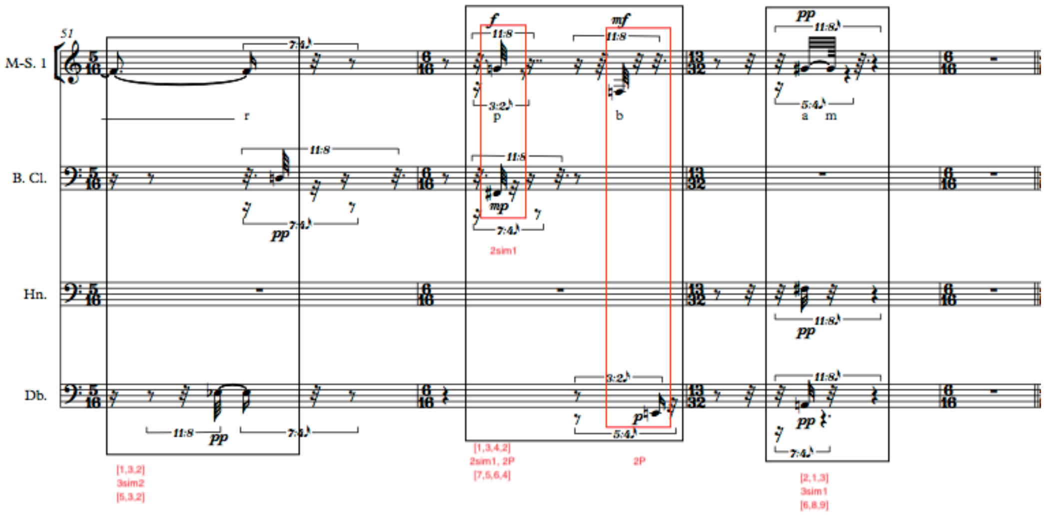
1	**3**	**2**		
3	2	1		
2	1	3	9 – [2,1,3]	3sim1
				[6,8,9]

1	3	2	4	2 - [2,4,1,3]	4P	[t,3,8,1]
4	2	3	1	3 - [3,1,4,2]	2P, 2sim1	[e,2,9,0]
3	1	4	2	1 - [1,3,2,4]	2sim1, 2P	[7,5,6,4]
2	4	1	3	4 - [4,2,3,1]		

Ex.11.19

With the instrumentation of trio (Bcl/Hn/Db) plus one vocalist, the gestures available for 3-Pgs are 1P+2sim without vocalist and 3sim with vocalist, for 4-Pgs 4P without and 2P+2sim with vocalist.





Ex.11.20

Partitioning

The partitioning of the time-space has been at the forefront of my compositional thought for several years now, providing a framework in each piece for the distribution of material across all object strata, with the mechanisms primarily created to distribute the material content within a pre-compositional system as evenly as possible. Take for example the gesture distributions in Paragraph 1 mentioned above. For each Word section a set containing three values was used to assign to each three-bar sub-section a gestural content. For example, Bars 10-18 (*Ex.11.14*) have two gestures assigned to each three-bar sub-section. However, within each sub-section the impulses of the assigned gestures are distributed across one, two or three bars, which results in varying degrees of impulse density within each Word section. Instead of the impulse content being uniform across the section, this process exaggerates the extremes in outcomes, such as the sparsity of Bars 1-9 (*Ex.11.10*). Using Paragraph 1 as an example again, the following will show how these assignments are realised using only one 3x3-Pg matrix for each word section.

Each of the six fundamental 3x3-Pg matrixes is assigned once per Paragraph, using the first hexachords of the p-c sets assigned to the Paragraph (see *Ex.11.7*, above), with *Ex.11.21* showing the outcomes for Paragraph 1.

E - 1			**U-2**			**N-5**			**O-6**			**I-4**			**A-3**		
1	**2**	**3**	**1**	**3**	**2**	**3**	**1**	**2**	**3**	**2**	**1**	**2**	**3**	**1**	**2**	**1**	**3**
2	3	1	3	2	1	1	2	3	2	1	3	3	1	2	1	3	2
3	1	2	2	1	3	2	3	1	1	3	2	1	2	3	3	2	1

Ex.11.21

Each row of the matrixes above assigns a specific constructive variable that when combined reduces the total number of partitions to which an impulse can be assigned. The top row assigns the order of fundamental t-Sigs, with '1' assigned to the t-sig with the lowest numerator value and '3' to the highest. The middle row assigns the number of sub-bars in each fundamental t-Sig with impulses assigned. The bottom row assigns the specific sub-bars when less than 3 are used. One will notice that the middle row of the 3x3-Pg in word section E (*Ex.11.21*), the central fundamental t-Sig (bars 4-6 in the score) should have impulses in all three sub-bars ([2,3,1]), which is not the case in the score. The assignments above are therefore only to be thought of as an initial sketching of how the micro-objects, 3- and 4-Pgs, are to be distributed within the word section.

P-c	No. Pgs	Dist.		
		1	**2**	**3**
6	2	1	0	1
9	3	1	1	1
12	3	1	1	1
15	4	1	2	1
18	5	2	1	2
21	6	2	2	2
24	7	2	3	2

Table 11.11

The reason for this anomaly between the values of the 3x3-Pg matrix in *Ex.11.21* and the outcomes shown in the score is due to the distribution of gestures within the aforementioned Word section. *Table 11.11* lists the number of gestures and their fundamental distributions ('Dist.' Column) for Paragraph 1, which from left to right are assigned the numbers 1, 2 and 3. The top row of the 3x3-Pg matrix assigned to the Word section (*Ex.11.11*, above) is used to determine the gesture distributions within said section. This was not needed in sections with 9, 12 or 21 pitch classes, as their outcomes will always produce the same result (1-1-1 for 9 and 12, 2-2-2 for 21). *Table 11.12* shows the resulting distribution outcomes for Paragraph 1.

	P-c	No. Pgs	Top row	Dist.
E	6	2	[1,2,3]	1-0-1
U	24	7	[1,3,2]	2-2-3
N	21	6	[3,1,2]	2-2-2
O	15	4	[3,2,1]	1-2-1
I	21	6	[2,3,1]	2-2-2
A	24	7	[2,1,3]	3-2-2

Table 11.12

Summary

As shown in the pages above, point gestures are now the dominant compositional tool in my works. The introduction in *Objects 3.1* and development in this work of 4-Pg matrixes has increased cohesion by stripping away some of the more inelegant aspects of point gesture applications in the previous works. Creating sub-sets of point gestures from an initial matrix has aided this process, with a plethora of outcomes available from a very limited set of values. The projection of point gestures and the variety of forms they can take has been advanced greatly in this work, highlighting the strength of the point gesture system to provide a high degree of variance whilst simultaneously increasing cohesion at and between all levels of object strata. The increased restriction of pitch-class, impulse and gesture content in the works from *Objects 3.1* onwards has been key to formalising a more rigid, point-based aesthetic. This has clarified and crystallised the compositional process and related sonic outcomes, producing a more concise and integrated aesthetic framework.

The vocalists and instrumental forces in *Objects 4* work in conjunction to realise the same musical objects (3- and 4-Pgs), with the material content not demarcated into traditional categories such as melody and accompaniment. By distilling the material content to the projection of trichords and tetrachords and realised by the instrumental forces as individual objects, traditional hierarchies such as melody and accompaniment dissolve because they simply have a very limited capacity to exist when these strategies have been enacted.

The normalisation of creative outcomes within the work through the extensive use of point gestures across several object strata is key to my work inhibiting an egalitarian approach towards constructing art objects. For this to be fully realised, a heterarchical approach is needed to promote equality between a work's constituent parts. The use of *Haupstimme* and *Nebenstimme* is detrimental to this approach because of its inherently hierarchical nature, and I see the use of these (and related rhythmic equivalent) as a failure of the Second Viennese School, as it is at odds with the egalitarian nature of the twelve-tone technique they developed.

The remaining compositions are all focused on strategies for superimposing 3- and 4-Pgs, fragmenting the compositional outcomes further. These techniques are first developed in *Objects 5* and *Objects 6.1-3*, two sets of studies for two vocalists and three woodblocks respectively. As will be discussed, *Objects 5* and *Objects 6.1-3* take an extreme approach to a point-based aesthetic, with the works being heavily reduced in material content as well as in some cases the brevity of the works composed. The techniques developed in each set of studies are implemented in the final work, *Objects 7*, which at 30 minutes long and scored for nonet is the most expansive work I have written.

12. Objects

The delineation of 'object strata' within a work, as listed in *Form and Content*, came partly from a process of defining what constitutes a musical 'object', as well as the delineation of different levels of object through the use of top-down decomposition. From the work in totality, to the individual elements of a broken chord or interval, the different strata of musical object have to be mediated both locally and globally in a way that promotes equality of discourse. As the various levels or objects in the work must function in conjunction with each other, a unified strategy is required to order the work and its constituent parts effectively. It is therefore necessary to define the smallest building blocks from which a high degree of variance can be achieved. Before delineating mechanisms from which these can be built, a broad overview of the use of objects in visual arts is required as parallels can be drawn between the two.

As '[o]ne of the principle genres (subject types) of Western art'[145], the still life is perhaps the most obvious and well known example of object representation in the visual arts. At the start of the 20th Century, the Cubists took the still life and developed it further by intersecting and projecting multiple planes and dimensions,

[145] Tateorguk. (2019). Still Life. Retrieved 4 March, 2019, from https://www.tate.org.uk/art/art-terms/s/still-life

splitting and reassembling the portrayed object(s) anew. Georges Braque and Pablo Picasso are the most prominent exponents of cubist techniques in works such as *Glass on Table* (1909-10, Braque) and *Bowl of Fruit, Violin and Bottle* (1914, Picasso). These two works are examples of the two phases of Cubism: analytical (*Glass on Table*) and synthetic (*Bowl of Fruit, Violin and Bottle*).

> Analytical cubism was about breaking down an object (like a bottle) viewpoint-by-viewpoint, into a fragmentary image; whereas synthetic cubism was about flattening out the image and sweeping away the last traces of allusion to three-dimensional space.[146]

One of the most important and influential aspects of synthetic cubism is the use of collage techniques such as *papier collé*, which 'attempt[ed] to introduce the reality of everyday life'[147] into artworks such as in Picasso's *Bottle of Vieux Marc, Glass, Guitar and Newspaper* (1913). Moving from the 2D to the 3D in works such as *Still Life* (1914), Picasso introduced 'found objects' such as scraps of wood, newspaper or pieces of tablecloth into his work, and this had a profound impact of 20th Century art early on with the dada and surrealist artists, the pop artists from the 1950s and 60s, and up to the so-called 'YBAs' in more recent times.[148]

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[146] https://www.tate.org.uk/art/art-terms/s/synthetic-cubism

[147] Tateorguk. (2019). Synthetic cubism. Retrieved 4 March, 2019, from https://www.tate.org.uk/art/art-terms/s/synthetic-cubism

[148] 'Young British Artists', Damian Hurst, Tracey Emin, et al.

Each of these aesthetic approaches (and the styles that appear within the gradient that links them) used the objects employed for different functions. For example, the intention of using disposable, mundane and everyday materials in the *arte povera* movement 'was to challenge and disrupt the values of the commercialised contemporary gallery system'[149], a political objective which was integral to the works. This could also be said of the American pop artists, whose aesthetic approach incorporates and critiques consumer culture by appropriating the techniques and icons of mass-produced consumer products as well as the portrayal of objects from popular culture including 'Hollywood movies, advertising, product packaging, pop music and comic books'[150].

The YBAs took everyday, found objects and presented them in such a way as to provoke a response through shock tactics and clever marketing. Funded by the billionaire former owner of advertising firm Saatchi & Saatchi, '[t]he YBAs created a new and accessible fusion of pop and conceptualism that had the distinctively British feel of an indie band.'[151] They encapsulate the 'anything goes' mentality,

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[149] Tateorguk. (2019). Assemblage. Retrieved 4 March, 2019, from https://www.tate.org.uk/art/art-terms/a/assemblage

[150] Tateorguk. (2019). Pop Art. Retrieved 4 March, 2019, from https://www.tate.org.uk/art/art-terms/p/pop-art

[151] Theguardiancom. (2011). Lewis, B Charles Saatchi: the man who reinvented art. Retrieved 4 March, 2019, from https://www.theguardian.com/artanddesign/2011/jul/10/charles-saatchi-british-art-yba

whereby critical reasoning on the role of art objects is secondary to the shock initiated:

> Sarah Lucas's melons and cucumbers were crude but uncanny – pub surrealism. Hume's candy coloured abstract paintings looked like ice cream served by an American colourfield painter. Hirst's shark was 'Jaws – the art work', with all its sequels, too. The YBAs made art that was simpler, punchier and more fun (but not necessarily more interesting or original) than what had gone before. The YBAs accelerated the trajectory of artistic style towards production line and brand identity.[152]

Being 'punchier and more fun', the aesthetic of the YBAs is regressive and more in line with the entertainment industry than high art. This can be traced back to the Pop artists of the 1950s and 60s who reemployed surface-level mimetic outcomes in the representation of consumerist products/objects. The advances made in the domain of non-representative visual art after the invention of photography retreated as postmodernism became the dominant aesthetic approach.

Artists whose works contain higher degrees of abstraction than the artists mentioned above, artists such as Kandinsky, Malevich and Mondrian, in large part relinquished the mimetic in their works, with all foregrounding the constructive and fundamental elements as opposed to the real-world object-specificity of the works from the artists above. The objects expressed in the latter are typically geometric and point-based,

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[152] Ibid.

interrogating the fundamental parameters or elements of the artwork. In his *Concerning the Spiritual in Art* and *Point and Line to Plane,* Kandinsky made great advances in delineating the fundamentals of art, and in both books there are important insights into both the visual and sonic arts, which he saw as closely related, stating that 'the various arts of to-day learn from each other and often resemble each other.'[153] *Point and Line to Plane* specifically showed how the artistic principles he had delineated can be applied to the sonic arts as well, explained using the opening of Beethoven's 5th Symphony as an example.[154]

I had been working in a point-based aesthetic for a long time before I had read either of Kandinsky's books, but I had independently come to similar conclusions in regards to defining the various degrees of point, gradated from the single point to a group or extended mass of points containing several groups. From this extrapolation from the single point to a collection of groups, the various levels at which these manifest can be mediated using a gradient such as that found in Chapter Eight (*Table 8.1*). The need then arises to codify the fundamental building block(s) from which works can be constructed, returning to the strategy proposed in the first paragraph of this chapter of defining 'the smallest building blocks from which a high degree of variance can be achieved'.

[153] Kandinsky, W. (2006). *Concerning The Spiritual in Art*. London: Tate Publishing

[154] Kandinsky, W. (1980). *Point and Line to Plane*. New York: Dover Publications Inc., pp.43-45.

The smallest possible object is that of a single point. Although an object in its own right, a solitary point is completely self-referential and can only produce one basic outcome: a point ([1]). Two points exhibit more relations, notably intervallic, but it only has three basic outcomes: [1,2] and [2,1], and 1 and 2 simultaneously ([1/2]). When permutations of groups containing three or four points (3-Pgs and 4-Pgs) are used the possibilities open up, giving six and twenty-four outcomes respectively. Trichords and tetrachords are therefore the smallest building blocks from which a high degree of variance can be achieved from a very limited source set: {1,2,3} and {1,2,3,4}.

P-0	0	1	4	5	3	2	e	t	7	6	8	9
R-0	9	8	6	7	t	e	2	3	5	4	1	0
RI-e	2	3	5	4	1	0	9	8	6	7	t	e
I-e	e	t	7	6	8	9	0	1	4	5	3	2

Ex.12.1

Take for example the combinatorial p-c set matrix (c-matrix) used from *Objects 4* and shown in *Ex.12.1*. The c-matrix is an object consisting of 48 pitch classes formed from four p-c sets: P-0, R-0, RI-e and I-e. This 48pitch collection can be viewed as the root pitch-class object, from which smaller micro-level objects can be derived. As shown in this example, the c-matrix is split into four smaller objects, each containing four trichords (horizontal) and three tetrachords (vertical). Simplistically speaking, the four p-c sets are assigned vertical-temporal positions, high to low (top to bottom), providing a multidimensional approach to object projections: similar trichords and tetrachords will therefore be realised in a different form and context each time they are reiterated within the c-matrix.

Building on the work of the Second Viennese School, Milton Babbitt greatly developed this combinatorial approach in his seminal work *Composition for Four Instruments* (1948). Predating European integral serialism, this work provides composers with a wealth of possible structuring devices which can shape objects at every level, such as deriving subsets of the whole ensemble, their distributions, and the projection of trichordal arrays and partitioning of outcomes.[155] In my own works, such as in *Objects 4* and *7*, different ensemble-types can be assigned different forms of 3- and 4-Pgs in order to project trichords and tetrachords in different forms, such as 1P + 2sim (3-Pg) or 2P + 2sim (4-Pg). The methods used to define objects at the smallest level can also be used to directly or indirectly define all other object strata in the artwork. Taken from *Table 8.1* in *Form and Content*, the following will briefly explain how trichords and tetrachords (3- and 4-Pgs), and other methods, can define the various levels of objects present in a work.

Level 8. Micro^4: The point, or sub-set of a gesture

As is the case with all object strata, the point or sub-set of a gesture (for example, the 2sim from a 1P+2sim gesture), can be delineated as an object in its own right, given that it will have a defined parametric landscape and ordering, specifying the means by which it will be expressed. However, each sub-set of a gesture, and by extension all

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[155] Mead, A. (1994). 'Mapping Trichordal Pathways (1947-1960)'. *An Introduction to the Music of Milton Babbitt*. New Jersey: Princeton University Press, pp.54-76.

object strata, exists in relation to not just the content of the level in which it is situated (for example the 2sim above exists in relation to the 1P, with both existing in relation to a shared 3-Pg), but in relation to all other objects and strata with a shared constructive approach (in this example, point gestures).

Level 7. Micro^3: Point gestures

These provide the contours for trichords and tetrachords, and also form sub-groups with other related point gestures (entangled or combinatorial partners, 4x4-Pg matrixes, etc.). These point gestures comprise the smallest complete groups or objects in the works, and are analogous to the individual geometric objects that constitute a work such as Malevich's *Suprematism (Supremus no. 56*) of 1916, or similarly Diagram 25 in *Point and Line to Plane*.[156] From *Objects 4* onwards, the source sets for each work and its sub-sections become increasingly limited, the focus being on creating the highest level of variance from the fewest initial sources.

Level 6. Micro^2: Sub-bar partitions

These are partitions within second-level time signatures. In *Objects 4*, each word section consists of three large time signatures that are split into three smaller time

[156] Kandinsky, W. (1980). *Point and Line to Plane*. New York: Dover Publications Inc., (Appendix)

signatures. For example, 11/8 is partitioned 4/8–3/8–4/8. Depending on the time signature, these sub-bars can be split into one, two, three or more sub-bar partitions, so a 4/8 can be partitioned quaver–crotchet–quaver (or in two as crotchets, or as four quaver partitions). Point gestures can then be used to determine which of these partitions will contain impulses, providing local distribution strategies. Implemented as they are, the systems for partitioning the time-space into discreet demarcated areas consisting of either the presence of objects or lack thereof is an important detail when considering the expressive capacity of the artwork in part and as a whole. As shown in this thesis, the underlying object constructs that enable the realisation of the smallest objects (*Levels 8* and *7*, above) play as important a role in the work as the surface-level objects expressed as trichords and tetrachords.

Level 5. Micro^1: Sub-bars of Level 4

As was the case with Micro^2-level objects, point gestures can be used to determine event-content at this level by delineating systems that govern global point gesture distributions. Using the example from above, 11/8 is split into three bars: 4/8, 3/8 and 4/8. Using values from a 3-Pg can determine how many of these sub-bars will contain impulses (in this instance 1, 2 or 3) and can also determine the order in time of these sub-bars if desired. As was the case in *Objects 4*, assigning different instrumental combinations, such as with or without vocalists, at this level affects how the smallest group objects, trichords and tetrachords, are realised at the Micro^3 and Micro^4 levels by virtue of the instrumental restraints in place.

Level 4. Macro^4: Demarcated partitions/sections within Level 3

With the order of first-level time signatures determined by point gestures, trajectories used at the sub-bar level can also be reflected here. As each of the first-level time signatures are of different lengths the relative saturation levels of each will be affected as a result. For example, there is roughly a 50% increase in total time-space from 11/8 to 17/8. If assigned the same number of trichords and/or tetrachords, the saturation and density levels between the two time signatures will be noticeably different. The objects at *Level 5*, *4* and *3*, have equivalences as the black grid lines in the *De Stijl* works of Mondrian, demarcating areas in which differently sized coloured points of the emptiness of white are situated.

Level 3. Macro^3: Semi-large sections

Semi-large sections, such as a 'Word section' in *Objects 4*, are mediated through various global and local (levels 6, 5 and 4) systematic devices. In the global sense, each of these semi-large sections is related to the other semi-large sections that make up the largest sections. Systems by which to order parameters at this level can be achieved using point gestures and also by projecting p-c set values onto the semi-large sections, to for example determine instrumental forces or regions of the c-matrix used. For example, the projection of a p-c set in *Objects* assigns the global order of sectional saturation levels, with the least saturated assigned 0, the most e (from the pitch-class set). With pitch-class sets derived along egalitarian principles, these are an apt starting point from which to delineate global strategies for work trajectories instead of from ingrained desires or received notions of form. Milton Babbitt developed the use of set projections further with a technique known as the 'time-point system'[157], which furnishes the composer with methods that link pitch-class structure to rhythmic and structural methodologies and outcomes. In *Objects 7*, these semi-large sections (of which there are six for each *Level 2* structure) are ordered using entangled 6-Pgs that demarcated the trio constructs present (see Chapter Sixteen).

Level 2. Macro^2: Largest sections

As mentioned in the previous paragraph, in *Objects* 7, *Level 2* objects consist of several demarcated sections, and in relation to this work are demarcated by the construct of the trio assigned. These sections would be akin to movements in traditional forms of art music, but it would be a misnomer to explicitly define these sections as such as they are not separated in this way. As a totality, *Level 2* sections in *Objects 7* are directional, with the trio construct migrating between instrumental families throughout the course of the work, the six sections presenting each of the six migration variants once.

157 Mead, A. (1994). 'Mapping Trichordal Pathways (1947-1960)'. *An Introduction to the Music of Milton Babbitt* (pp. 45-51). New Jersey: Princeton University Press

Level 1. Macro[1]

The largest object, the work, is the assimilation of all other object strata (levels 2-8). The final form of the work thus becomes fully realised when the various systems for each level's objects have been completed and realised in the final score. Although, as was the case in *Entanglement*, at the start of this process a broad outline for the trajectory and form this object will take (in *Entanglement,* the French horn moves from low to high and the trombone high to low), the compositional processes I set forth in each work alters the trajectory and internal discourse of the work-object in its final form. With the score providing the instructions from which the performer(s) interpret the work it is a different type of object than the examples from the visual arts mentioned on the previous pages, the *Level 1* object in these examples being the artwork referenced. However, the instructions in the musical score define what the work will sound like in performance, so a combination of the two, score and performance, is needed for the work to be fully realised and understood as an object. Either viewing the score in the absence of a recording or listening to a recording without access to the score, the receiver or consumer of the work-object can only approximate how its inner structures, systems and methods of construction are delineated.

As will be shown in Chapter Fourteen, the notion of the work-object is extrapolated further, with the works predominantly conceived as part of a larger group or collection of works. Curated performances of the various demarcated groups of works in Chapter Fourteen, for example a performance of all solo/quintet couplings in the

Wreckhead Ensemble series or a complete performance of all seven studies in *Objects 6*, would in a sense form a meta-object consisting of the complete works of each series or sub-series (however different they might be).

As mentioned before, after the proto-quantum works the objects within each work explained above no longer took an aspect of science, such as the 'quantum spin' effect in *Probability Interpretation*, as their initial conception, with the representation of non-musical objects eschewed in favour of the expression of point gestures. One needs to be hypercritical when it comes to one's artistic output and the components and methods of conception and construction therein, with the drawing of parallels between the sonic and visual arts useful in this respect as it points to a common thread between different art media. This is useful when describing the methods and reasoning by which the work-object and its defined object strata are projected in each work.

An important concept here is that of 'received material': pre-formed objects that have the capacity to project onto its audience an affirmation of a certain culture, historical epoch or style, brand, etc. For example, using a plagal cadence could inflect religiosity in a work given its extensive use to signify the amen at the end of church hymns, or tutti rhythmic ostinati to symbolise war, or the diminished tetrachord to evoke the mysterious or dreams. These have an equivalent in the visual arts with the use of readymades or found objects, with both the sonic and visual outcomes representing an amalgamation of disparate, pre-formed objects that are integral to building a sense of familiarity and comfort in its audience.

Point gestures are therefore paramount as the principal constructive object in the works I compose because they do not have the historically accrued referential power that are inherent to the examples in the previous paragraph. They can therefore form the foundational basis from which the quantum aesthetic espoused in this thesis can take root and manifest, foregrounding and promoting equality through the unification of objects at all levels of the work's construction.

13. *Objects 5: Vocalised Objects 2 – Five short studies in the superimposition of point gestures*, for two mezzo-sopranos (2017)

Originally intended to act as a framing device enveloping the four Paragraphs in *Objects 4*, *Objects 5* contains the five words Christian Bök was unable to use, 'despite efforts to include them' [158], in the five chapters (A, E, I, O and U) of *Eunoia*: parallax, belvedere, gingivitis, monochord and tumulus. The five studies in *Objects 5* are initial attempts at superimposing micro-objects, with each of the works requiring bespoke systems to take into consideration the different amounts of 3- and 4-Pgs required to realise the pitch classes assigned to the studies. As *Objects 5* are satellite works of *Objects 4*, the compositional techniques employed are near identical, albeit with slight modifications to, for example, consider the reduction in total pitch-class content. As there only two vocalists, each only permitted to perform a single pitch-class at any given time, the gestural palette is extremely limited so systems for delineating different forms of 3- and 4-Pgs (i.e. 1P+2sim or 2sim+2P) were not needed.

As has been touched on in previous chapters, the works from *Objects 2* onwards show a marked reduction across all parameters, distilling and streamlining the compositional process resulting in an increasingly extreme form of point-based music.

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[158] Bök, C. (2001). *Eunoia*. (1st ed.). Edinburgh: Canongate Books Ltd., p.104.

Through the superimposition of point gestures these extremes are exaggerated further as the point gestures are abstracted further by staggering the entries, with the combined gestures forming in a sense meta-gestures that are distributed across a section or sections within each study.

Words

Where as in *Objects 4* some of the word partitions contained more than one letter ('th' from 'the', for example), the words in *Objects 5* are partitioned into their constituent letters. The total letter content, as well as the number of vowels, is used to derive fundamental point gestures, the initial global assignments for parameters such as pitch-class (p-c) content and time signature (t-sig) sets, as well as distribution systems for the impulses assigned.

	Letters	**Vowels**	**Cons.**	**P-c**	**t-Sig set**	**5-Pg**
P a r a l l a x	8	3	5	16	**B**	2
B e l v e d e r e	9	4	5	18	**D**	4
G i n g i v i t i s	10	4	6	20	**E**	5
M o n o c h o r d	9	3	6	18	**C**	3
T u m u l u s	7	3	4	14	**A**	1

Table 13.1

Table 13.1 outlines the process by which the letter and vowel content of each word is used to delineate each study's pitch-class content and t-Sig set. Outlined in Chapter Two, the t-Sig sets in *Objects 5* are derived from the same meta-set of t-Sigs used in *Objects 4* but in this work each subset contains four t-Sigs instead of three. The total duration of each set was calculated with the longest to shortest marked A to E respectively. As in *Objects 4*, the word with the highest p-c content is assigned the t-Sig set with the shortest duration, the smallest p-c content the longest duration. Vowel content is used to differentiate between the two words that contain 9 letters. Monochord has the fewest vowels so is assigned C, belvedere D.

With the t-sig set assignments listed in *Table 13.1*, and with the global ordering of the works being A, E, I, O and U, this gives the outcome B, D, E, C, A. Converted into the numbers 1-5, this gives a 5-Pg of [2,4,5,3,1]. This 5-Pg is the fundamental source from which all other point-gestures in the five works are derived. To create 4-Pgs, the '5' of this 5-Pg is removed, leaving a 4-Pg of [2,4,3,1]. This 4-Pg is then assigned as the central 4-Pg of a 4x4-Pg matrix, shown below.

	1			**2**	
[2,4,5,3,1]	3	4	2	1	1 - [3,4,2,1]
	1	2	4	3	2 - [2,1,4,3]
[2,4,3,1]	4	3	1	2	3 - [4,3,2,1]
	2	1	3	4	4 - [1,2,3,4]
	3			**4**	5 - [2,4,3,1]

Ex.13.1

With the central 4-Pg of *Ex.13.1*, [2,4,3,1], assigned the number '5', a fundamental 4-Pg (derived from the 2x2 squares in *Ex.13.1*) can be assigned to each of the five studies. Using the 5-Pg [2,4,5,3,1], the outcome of this is:

Parallax: 2 – [2,1,4,3]

Belvedere: 4 – [1,2,3,4]
Gingivitis: 5 – [2,4,3,1]
Monochord: 3 – [4,3,2,1]
Tumulus: 1 – [3,4,1,2]

This is another example of the use of structural pivots or axial relations within the deeper structures and assignment mechanisms of the work. In this sense, the 4-Pg assignments above are assigned around the central study *Gingivitis* reflecting the 4x4-Pg matrix in *Ex.13.1*. As well as assigning the order of fundamental t-Sigs for each work, these 4-Pgs formed five new 4x4-Pg matrixes that are used for assignments in their respective study (see Appendix 13.1).

Partitions and global impulse distributions

Unlike in *Objects 4*, impulses are only allowed within the space of a crotchet, with the partitions for each t-Sig shown in Appendix 13.2. With six of the fundamental t-sigs having only three available partitions, and 13/8 and 17/8 having four, there is a large reduction in the number of partitions from which to choose from compared to those in *Objects 4*. With the reduction in impulse content, a maximum of two pitch classes can appear in each partition. Distributing these impulses was straightforward as they are always relatively evenly distributed and are shown in *Table 13.2*, below.

Words	P-c	Macro Dist.	Micro Dist.	
Parallax	16	4-4-4-4	4 - 1-2-1	
Belvedere	18	4-5-4-5	4 - 1-2-1	5 - 2-1-2
Gingivitis	20	5-5-5-5	5 - 2-1-2	
Monochord	18	5-4-5-4	5 - 2-1-2	4 - 1-2-1
Tumulus	14	3-4-3-4	3 - 1-1-1	4 - 1-2-1

Table 13.2

To order the macro-distributions in belvedere, monochord and tumulus, the root 4-Pg for each was used, with values 1 and 3 of the 4-Pg assigning the lowest value, 2 and 4 the highest. For example, the [1,2,3,4] assigned to Belvedere gives the distribution 4-5-4-5. These 4-Pgs are also used to assign a specific partition when more than one is present (such as in 13/8 and 17/8), with 1 and 3 assigning partition 1, 2 and 4 partition 2.

iDur and iDist

The iDur sets in *Objects 5* are the first eight prime numbers and are listed in *Table 13.3*. From these eight numbers five four-value sets were delineated, arranged by shortest to longest and assigned to t-Sig sets E-A respectively. Unlike in other works, the full range of iDist and iDur sub-sets are not used in these studies, although within each a different sub-set is used every six bars.

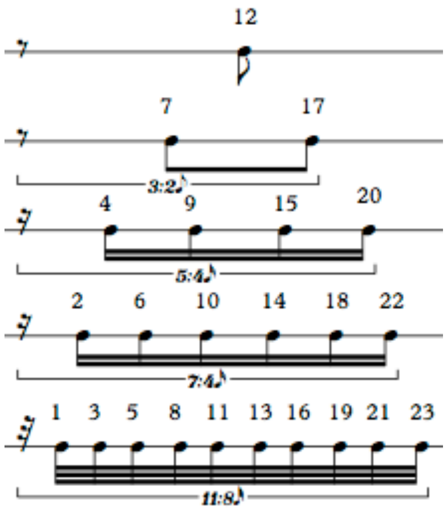
	iDur
E	2,3,5,7
D	3,5,7,11
C	5,7,11,13
B	7,11,13,17
A	11,13,17,19

Table 13.3

The process by which iDist sets are assigned is outlined in Appendix 13.3 and 13.4, with the iDist sets for 3-Pgs assigned using the central 4-Pgs from the 4x4-Pg matrix assigned to each study and the fundamental 5-Pg [2,4,5,3,1]. Each 4-Pg is split in two, with the first two values assigned to the first six bars of the study, the second two values to the second six. The first 4-Pg value gives the number of values in the iDist set, with the corresponding 5-Pg value then allocating which of the 5 sets of that value to assign. This is the end of the process for sets with one or four values; with sets of two or three values, the second 4-Pg value is used to determine between the two sets that are grouped together (i.e. 1,2 – 1.1 and 1,3 – 1.2 in Appendix 13.3), with 4-Pg values of 1 and 3 assigning '.1' sets, 2 and 4 '.2'. All iDist outcomes for 3-Pgs are listed in Appendix 13.4.

One will notice that values have been marked 'N/A' from the 31/32 macro-bar of the third study, I (7-12 of I in Appendix 13.4). This is because iDist sets from this point to the last study are entangled complements (first two macro-bars of A – last two of U, second two of A – first two of U, etc.) and therefore the above process was not needed. 4-Pg iDist values for a six-bar section are the complements of the iDist values for the same section. For example, the 3-Pg iDist set for bars 1-6 of A is {1,3,4,5}, so the 4-Pg iDist set will contain only one value, {2}.

The iDist and iDur systems outlined above are all inputted into the score using an impulse array. With the fundamental unit for time-point layers the crotchet there are five time-point layers that make up the impulse array: 2, 3, 5, 7 and 11. Superimposed and minus each layer's first impulse point gives a total of twenty-three impulse points per crotchet unit (*Ex.13.3*). This method is used in my works from *Objects 4* onwards and stems from research into the music of Gordon Downie who uses an approach similar to this in his piano works and *Forms* series. This limitation in tuplet-type is another example of the distillation of compositional processes in the more recent works, whereby the pool of possibilities within each parameter has been heavily reduced in order to clarify the mechanics of the underlying processes.



Ex.13.3

Pitch-class sets

The p-c content in *Objects 5* is derived from the same 12x4 c-matrix used for Paragraph 1 in *Objects 4*. The central 4-Pg from *Ex.13.1*, [2,4,3,1], is used to assign the specific 3x4 sub-matrixes to each study. As there are two studies that contain 18 pitch classes, these are assigned the same sub-matrixes ('4', see *Table 13.4*) but realised differently in each.

		[2,4,3,1]
Parallax	16	2
Belvedere	18	4
Gingivitis	20	3
Monochord	18	4
Tumulus	14	1

Table 13.4

Trichords and tetrachords are each assigned to one of the two sub-matrixes using the central 4-Pg of the 4x4-Pg matrix assigned to each study. Only the second two values are used for this, with the first of the two assigning trichords and the second tetrachords. For example, *Parallax* has the central 4-Pg [4,1,2,3]. With 1 and 3 assigning the sub-matrix on the left (in Appendix 13.5), 2 and 4 the right, the outcome for *Parallax* is: 2 – trichords right sub-matrix, 3 – tetrachords left sub-matrix. The specific pitch classes assigned are discussed in the following section, with the focus being on the 3- and 4-Pgs used and how the different object superimposition strategies are realised within each study.

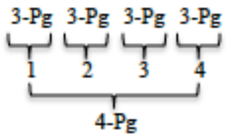
Object superimpositions: *Parallax, Belvedere, Gingivitis, Monochord* and *Tumulus*

In *Probability Interpretation* and *Two-Slit Experiments* different layers of material were delineated and assigned to a specific denominator class of t-Sig. When t-Sigs from different classes shared the same time-space, the different material-types assigned to each were superimposed and performed simultaneously with one or two other classes (such as 7/8–14/16–28/32, for example), giving several types of material, or 'objects', simultaneously. However, in the previous works based primarily on point gestures, the surface-level gestures never overlapped or intersected each other, with the focus of the compositional process on how the various permutations of each gesture could be mediated and realised with the instrumental forces assigned. With these processes now formalised to a large degree, the focus of *Objects 5, Objects 6.1-3* and *Objects 7* is in devising methods to superimpose and intersect 3- and 4-Pgs. Because of differences in p-c and gesture content for each study in *Objects 5*, a different strategy for object superimpositions was required for each.

Parallax

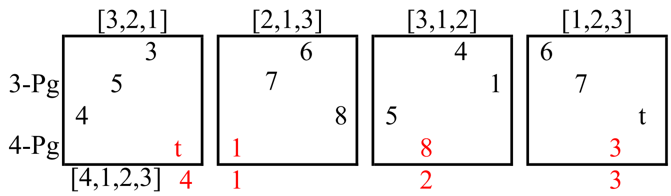
Parallax has 16 pitch classes, realised as four 3-Pgs and one 4-Pg. The 4-Pg is split evenly across the four 3-Pgs so for each 3-Pg there is one p-c from the 4-Pg, shown in *Ex.13.4*. In relation to a 3-Pg, a 4-Pg point can be realised at four different positions.

The central 4-Pg, [4,1,2,3], orders these positions as well as the order of trichords, which are (from the top row to the bottom) assigned the numbers 1-4 respectively.



Ex.13.4

						4-Pgs		3-Pgs	
1	2	1	4	3	**4**	[4,3,2,1]	-4	[3,2,1]	[4,5,3]
2	3	4	1	2	**1**	[2,1,4,3]	-4	[2,1,3]	[7,6,8]
3	1	2	3	4	**2**	[3,4,1,2]	-4	[3,1,2]	[5,4,1]
4	4	3	2	1	**3**	[1,2,3,4]	-4	[1,2,3]	[6,7,t]



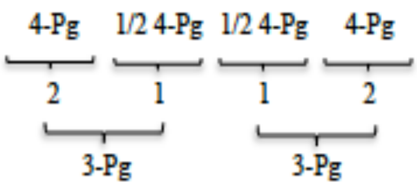
Ex.13.5 *Ex.13.6*

Ex.13.7 shows how the results listed in *Ex.13.5* combined with the position outcomes shown in *Ex.13.6* as realised in the score, with trichords and tetrachords highlighted in red and blue respectively.

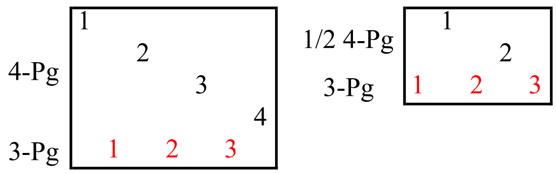
Ex.13.7

Belvedere

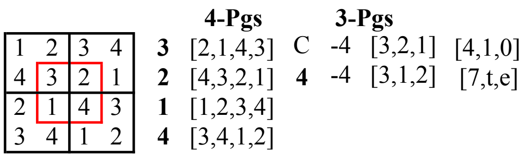
Belvedere has 18 pitch classes, realised as three 4-Pgs and two 3-Pgs. As shown in *Ex.13.8*, each 3-Pg is partitioned across 1.5 4-Pgs. Unlike in *Parallax* where 4-Pg points were assigned in relation to 3-Pgs, only three positions were delineated for 3-Pgs in relation to 4-Pgs (*Ex.13.9*). The central 4-Pg for this study is [3,2,1,4], with a 3-Pg of [3,2,1] derived from this gesture by removing the '4'. This was used to allocate positions for the first 3-Pg within the first 1.5 4-Pgs. With two 3-Pg points assigned to the first and third 4-Pg, the value of the 3-Pg assigns two positions: 1 – 1 and 2, 2 – 1 and 3, 3 – 2 and 3. The values for 3-Pg points where only half a 4-Pg is present selects only one position.



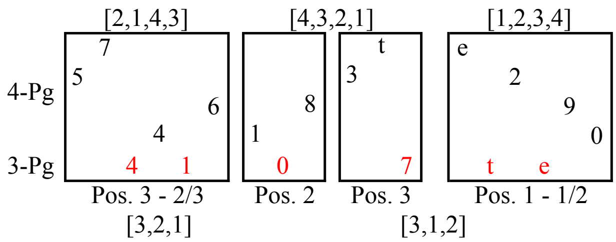
Ex.13.8



Ex.13.9



Ex.13.10



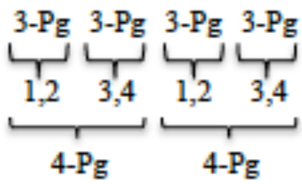
Ex.13.11

Ex.13.12

3-Pg points appear in positions 2 and 3 (value '3' of the 3-Pg) within the first 4-Pg and position 2 for the first half of the second 4-Pg. To assign these for the second 3-Pg, the remaining value (4) from the central 4-Pg assigned the 4-Pg on the bottom row of the assigned 4x4-Pg matrix ([3,4,1,2]). From this a 3-Pg of [3,1,2] was derived, assigning the 3-Pg point positions for the remaining 1.5 4-Pgs (*Ex.13.11*). The 3-Pg [3,2,1] also assigns the trichords (3 - [4,1,0], 2 - [7,t,e]) as well as the 4-Pgs from the 4x4-Pg matrix (*Ex.13.10*) assigned to the study, governing the contours of each 4-Pg, with *Ex.13.12* showing how these outcomes are realised in the score.

Gingivitis

Gingivitis has 20 pitch classes, realised as four 3-Pgs and two 4-Pgs, so for every two 3-Pgs there is one 4-Pg. As shown in *Ex.13.6*, 4-Pg points can appear in one of four positions. With [3,4,2,1] the central 4-Pg, the row outcomes are listed in *Ex.13.14* and *Ex.13.15*.

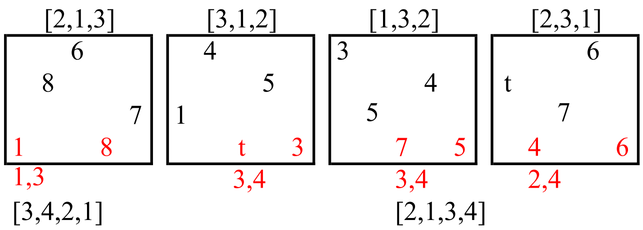


Ex.13.13

2	4	3	1
1	3	4	2
4	2	1	3
3	1	2	4

	4-Pgs		**3-Pgs**	
3	[4,2,1,3]	1,3	[2,1,3]	[8,6,7]
4	[3,1,2,4]	4,3	[3,1,2]	[1,4,5]
2	[1,3,4,2]	3,4	[1,3,2]	[3,5,4]
1	[2,4,3,1]	2,4	[2,3,1]	[t,7,6]
			[3,t,1,8]	[3,4,2,4]
			[5,7,4,6]	[2,1,3,4]

Ex.13.14



Ex.13.15

Initially, to assign point positions the first two values of each 4-Pg were used, but this was later rejected due to a lack of variance. Instead of this, the values used (highlighted red in *Ex.13.14*) are staggered, giving three instead of two outcomes for

4-Pg point positions. The central 4-Pg also assigns the order of trichords and the 3-Pg derived from this 4-Pg assigns the tetrachord assignments.

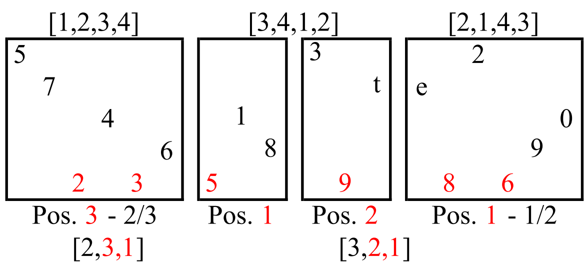
Ex.13.16

Assignments for this study are constructed in the same way as those for Belvedere (see *Ex.13.8*), but in this study the central 4-Pg is [2,3,4,1] so the 3-Pg points are assigned to different positions. *Monochord* has 18 pitch classes, realised as three 4-Pgs and two 3-Pgs. With the first three values of the central 4-Pg assigning the 4-Pgs 2, 3 and 4, the fourth (1 – [4,3,2,1]) as well as the central 4-Pg have 4s removed to form two 3-Pgs (3-Pgs column in *Ex.13.17*). The 3-Pg impulse positions are assigned using the second and third values of the 3-Pgs (highlighted red in *Ex.13.17*), with *Ex.13.19* showing these outcomes realised in the score.

4	3	2	1
1	2	3	4
3	4	1	2
2	1	4	3

	4-Pgs	**3-Pgs**			
2	[1,2,3,4]	C	[2,3,1]		
3	[3,4,1,2]	1	[3,2,1]		
4	[2,1,4,3]				
	[2,3,4,1]	[2,3,1]	3 - 2,3	1	
	[4,3,2,1]	[3,2,1]	2	1 - 1,2	

Ex.13.17

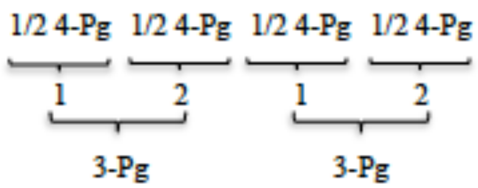


Ex.13.18

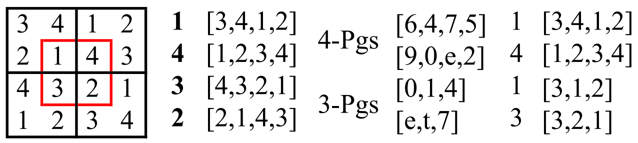
Ex.13.19

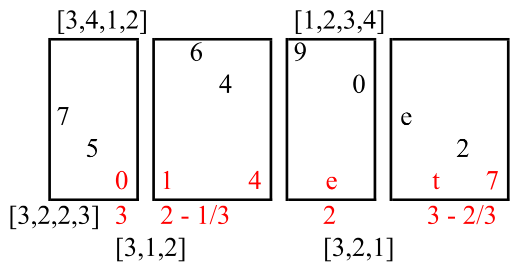
Tumulus

Tumulus contains only 14 pitch classes, realised as two 3-Pgs and two 4-Pgs. As shown in *Ex.13.20*, each 4-Pg is split in two, with either one or two points of the 3-Pg assigned to each. The number of points assigned is governed by the global distribution of pitch classes that are listed in *Table 13.2*.



Ex.13.20

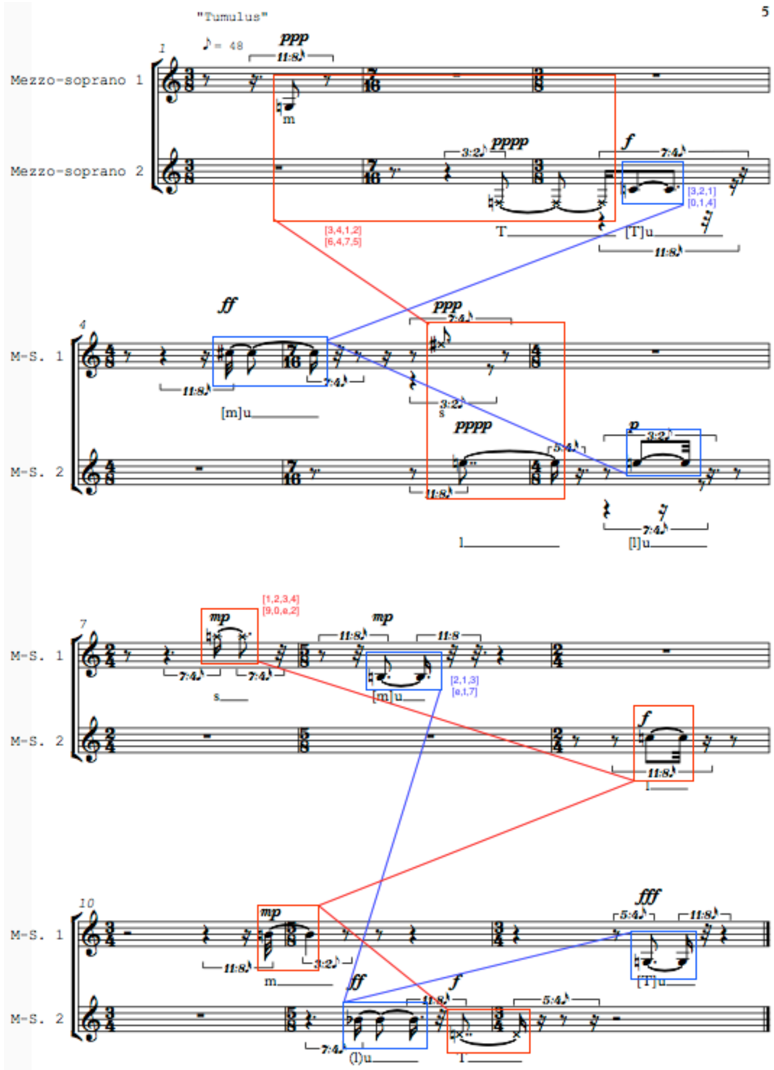




Ex.13.21

Ex.13.22

As in *Belvedere* and *Monochord*, 3-Pgs determine the positions of the 3-Pg points in relation to the 4-Pg's points. Because in this study the 3-Pg point positions are only ever assigned in blocks of two 4-Pg values, this meant a slight modification to the systems in the other studies as the number 4 in each 4-Pg would be redundant. The [3,2,2,3] below the central 4-Pg in *Ex.13.21* solves this problem and also gives different outcomes for each 0.5 4-Pgs (*Ex.13.22*); One 3-Pg point has positions 3 and 2, two 3-Pg points 2 (1,3) and 3 (2,3). This is shown in the score example below.


"Tumulus"
5
Mezzo-soprano 1
Mezzo-soprano 2
M-S. 1
M-S. 2
[3,4,1,2]
[6,4,7,5]
[3,2,1]
[0,1,4]
[1,2,3,4]
[9,0,e,2]
[2,1,3]
[e,t,7]

Ex.13.23

Summary

Outlined above, the principal focus of the five studies was to delineate strategies that enable the superimposition of micro-objects: 3- and 4-Pgs. The works in the Objects series up to this point did not superimpose gestures but were instead realised successively. Reflecting the restrictions imposed in Bök's *Eunioa* as well as *Objects 4*, these five studies take this approach further through a large reduction in pitch-class and gestural content. These were needed to coherently delineate strategies in determining object overlap and intersection at the micro-level before applying these strategies to more complex point gesture forms and strategies.

With a key aesthetic goal of higher levels of abstraction, superimposing point gestures using the methods outlined above is a useful tool for this purpose, in that it breaks the gestures apart and reconstructs and amalgamates them into hybrid gestures. This is exaggerated further by avoiding any sense of 'word painting', or musically descriptive and mimetic outcomes, as well as the use of undefined pitches notated with 'x' note heads.

In *Objects 5* (and *Objects 6.1-3*), this approach is at its most fragmentary and pointillist (or 'punktuelle'[159]), with all except only a few impulses and pitches

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[159] Maconie, R. (1989). *Stockhausen on Music: Lectures and Interviews*. UK: Marion Boyars Publishers Ltd., p35

expressed as detached points. This is reinforced by limiting the number of simultaneous pitch-classes in each vocal part to only one at any given time, as well as distributing them across each study between bars and partitions, extending abstraction by increasing the perception of point autonomy.

14. The work in context

As discussed previously in this thesis, my compositional output since *Objects: Object Distributions* has become ever more concerned with composing as part of a group of works, with the *Objects* series representing the meta-set of all works with the *Objects* prefix. After the proto-quantum works, my compositional aesthetic became ever more focused on and preoccupied with the use of point gestures to mediate sonic outcomes. The first two works, *Objects* and *Objects 2*, were not conceived in terms of their relation to one another, in that although they both use point gestures as a fundamental compositional tool, they are not part of a series in the same sense as the works from *Objects 3.1* onwards.

As one will know from the history of the song cycle, composing groups of works is not a new innovation in music, with the song cycle tradition spanning several centuries being just one example. There is also a rich tradition of composing for a solo instrument in groups, such as for keyboard instrument in Johann Sebastian Bach's *The Well-Tempered Clavier* and Karlheinz Stockhausen's *Klavierstücke I-XIX*. This also extends to series for different solo instruments such as Luciano Berio's *Sequenzas*. For ensembles of two or more instruments there are of course the expansive operatic cycles by, for example, Richard Wagner and Karlheinz Stockhausen[160], as well as smaller works such as Claude Debussy's incomplete *Six*

[160] http://www.karlheinzstockhausen.org/complete_list_of_works_english.htm ; one can see from this list of works that Stockhausen was one of the more prolific composers of work series

sonatas for various instruments. Although there are countless other examples of composers writing works as part of a series or cycle, what initiated this mentality in my own output stems principally from comments attributed to Richard Barrett in Toop's *Four Facets of 'The New Complexity'* paper and Gordon Downie in his interview with Ian Pace:

> 'If [my] musical works are to be optimally self-contextualising, it is preferable that they be presented in the company of one another, rather than in the environment of an inevitably disparate programme whose listeners are required, often in vain, to reacclimatise themselves at short notice perhaps as many as eight times in the course of a concert.'[161]

> 'One of the most important features of the forms series is its systematic and analytical attention to a more or less well defined set of technical and aesthetic issues'[162]

Given that my compositional output since 2012 has been almost solely focused on the emancipation of the point and the defining of a unified aesthetic approach, in order for this to be achieved effectively in the long run it became evident that delineating a group or groups of works in accordance with an over-arching aesthetic trajectory was to me a logical step in the evolution of my compositional practice. And it has afforded me with a means by which to order technical strategies within each series and sub-series, as well as between series.

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[161] Toop, R. (1988). 'Four Facets of "The New Complexity"'. *Contact*, 32(Spring), p.7.

[162] Downie, G. &. Pace, I. (2006/07). 'Gordon Downie and Ian Pace: A Dialogue.' *The Open Space Magazine*(8/9), p.201.

There are, broadly speaking, three groups of works currently being composed: 'Wreckhead Series', 'Vocalised Objects' and 'Vocalised Satellites' (*Table 14.1*). In each series of works there are also subsets of works that are linked to other subsets within the same series and also in relation to other as yet conceptualised series (a series focussing on percussion, both untuned and tuned, and a series based on the nonet from *Objects 7*).

Wreckhead Series:	6 Solos	**Vocalised Objects:**	The New Ennui	Oiseau	Eunoia
	6 Quintets		*Objects 4*	And Sometimes	Chapter A
	15 Duets			Vowels	Chapter E
	15 Quartets			Voile	Chapter I
	20 Trios			W	Chapter O
	1 Sextet			Emended Excess	Chapter U
	63 works				**11 works**
		Vocalised Satellites:	*Objects 5*	*Objects 6.1-6.7*	TBD
			5a: Parralax	*6.1: 3P Gestures*	
			5b: Belvedere	*6.2: 1P+2sim Gestures*	
			5c: Gingivitis	*6.3: 3sim Gestures*	
			5d: Monochord	*6.4: 3P/1P+2sim Gestures*	
			5e: Tumulus	*6.5: 3P/3sim Gestures*	
				6.6: 1P+2sim/3sim Gestures	
				6.7: 3P/1P+2sim/3sim Gestures	
					12 works (currently)

Table 14.1

The works in the Wreckhead series are all derived from a fundamental sextet of bass clarinet, French horn, vibraphone, piano, cello and double bass, with each of the sixty-three instrumentations intended as a work in its own right. This partitioning of the ensemble into its constituent instrumentations is similar to the treatment of ensembles in Milton Babbitt's *Composition for Four Instruments* where 'the piece is divided into sections, each articulated by a different subset of the whole ensemble, which is itself reserved for the concluding section.'[163] The rather exhaustive approach I have taken in the Wreckhead series is different from, for instance, Richard Barrett's approach in his *CONSTRUCTION* series, where not all possible ensembles are assigned a work.[164] There is however a central theme running through Barrett's *CONSTRUCTION* series, 'which is concerned with the relationship between utopian thinking and reality.'[165] We both share an interest in the utopian, however the over-arching 'theme' in the Wreckhead series is aesthetic-technical; the emancipation of the point through the mediation of the individual and the group, essentially the dialectic inherent to any utopian construct, and the means by which this can be realised.

The *Vocalised Objects* series sets the entirety of Christian Bök's book of poetry *Eunoia* to music. Only one of these works, *The New Ennui*, has been set so far (*Objects 4*). *Objects 4* has an accompanying set of satellite works, *Objects 5*, which are studies in the superimposition of point gestures. I have found writing extremely short works quite liberating, using each short study to develop bespoke strategies on the small scale that have the potential to be implemented in longer or larger works. This is to be the case when I set *Oiseau*, which is to be scored for percussion and

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163 Mead, A. (1994) *An introduction to the music of Milton Babbitt*, New Jersey: Princeton University Press, p.57.

164 Richardbarrettmusiccom. (2011). Construction of *CONSTRUCTION*. Retrieved 4 March, 2019, from https://richardbarrettmusic.com/CONSTRUCTIONessay.pdf

165 Ibid.

voice, although the specifics of which have not been defined. Because I have not written for untuned percussion for several years, the seven studies in *Objects 6* are intended to act as prototypes that will inform the compositional process of *Oiseau*.

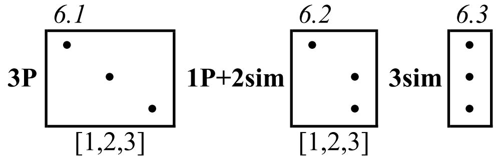
One can see in *Table 14.1* that *Objects 6* is split into three sub-groups demarcated from top to bottom as studies containing one (*6.1-6.3*), two (*6.4-6.6*) and three (*6.7*) gesture types. With the three global series being worked on concurrently, there will also be greater crossover of aesthetic-technical strategies between the different series, with each informing all others. One could look at the eighty-six proposed works in *Table 14.1* and see it as a rather daunting task, given we as composers do not typically think on such a scale and specificity of creative output. I would say the exacting and exhaustive approach I have undertaken is atypical in compositional practice, perhaps even alone in taking on such a scheme, and given the time it takes for me to complete a work varies from days (*Objects 6.1*) to years (*Objects 4*), the time it will take to complete these projects is undefined, and I see myself being consumed by these works for several years, if not decades to come.

Quantum music exists on a continuum of extremes, be that in the extremity of a single point or the work in relation to a hyper-specification of compositional output, so it is paramount to effectively and logically delineate common strategies and modes of realisation so that the various groups of works will still exhibit a more or less uniform approach to give a consistency of output. This is the real challenge in instigating such a far-reaching aesthetic approach and comes back to the utopian dichotomy mentioned above: how can the individual (the single work) and the group (series or series’ of works) be differentiated in their own right (sonically and literally) and yet at the same time be orientated towards the same aesthetic approach and goals that will serve each? This is why I find the point gesture-based system outlined in this thesis to be so compelling when it has been applied. It is inherently self-referential and as has been shown is extremely malleable in the creative process, furnishing the composer with a plethora of strategies for delineating much of the compositional material (both technically and sonically) from a very limited source set.

15. *Objects 6.1-6.3: Three-Point Gesture Studies*, for three wood blocks (2017-2018)

As mentioned in the previous chapter, *Objects 6* is a proposed set of seven studies for three wood blocks that are being composed in preparation for the second set of works in the *Vocalised Objects* series: *Oiseau*. Wood blocks were chosen for *Objects 6* because they have almost no sustaining qualities, reinforcing and exaggerating the heavily reduced point-based aesthetic found in my works from *Objects 3.1* onwards. After the very long gestation period of *Objects 4*, *Objects 5* and *Objects 6.1-3* were in part composed to, in a sense, clear my head after composing a large-scale work.

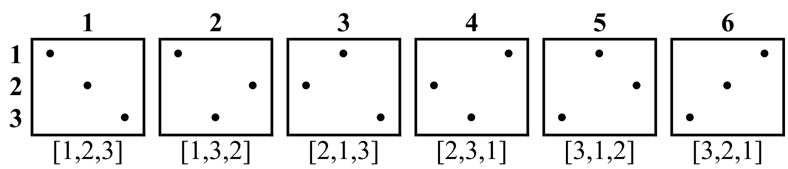
Besides *Objects 6.3*, the works in *Objects 5* and *6* are extremely short in duration and contain very few impulses and gestures, intended to be relatively simple studies in restraint and limited means. With only three fundamental gestures, the use of 3-Pgs only in *Objects 6* is deliberate because of their extremely limited gestural palette, the three gestures being 3P, 1P+2sim and 3sim (*Ex.15.1*). *Objects 6.1, 6.2* and *6.3* form the first of three sub-groups of works, with this sub-group focusing on only one type of gesture from *Ex.15.1* in each (*Objects 6.1-6.3* from left to right).



Ex.15.1

6.1: 3P gestures

With the time signature set at 3/4 throughout, the work is split into six three-bar sections. Each of these sections is assigned a fundamental 3-Pg (1-6 in *Ex.15.2*) and related 3x3-Pg matrix using the entangled 6-Pg [1,4,5,2,3,6]. As well as the fundamental 3-Pg, three secondary gestures are derived from the original 3x3-Pg matrix. Within each three-bar section there are three iterations of the fundamental 3-Pg as well as each secondary gesture played once. These are distributed evenly across the section, with each bar containing one fundamental and one secondary gesture. With identical methods of construction used in each section, only bars 1-3 will be used to show how these are realised.



Ex.15.2

For each of the three bars the secondary gestures are distributed across 1, 2 or 3 partitions, determined by the middle row of the 3x3-Pg matrix assigned (*Ex.15.3*), with the outcomes for bars 1-3 assigned using [2,3,1]. The partitions used are held invariant throughout, with three partitions using all three crotchet partitions, two partitions using the first and third, and one partition using the second, middle partition. Once these are assigned, the partition assignments for the fundamental 3-Pgs are derived. For secondary gestures assigned to one partition the fundamental is assigned to one partition also. When secondary gestures are assigned to two partitions, the fundamental gesture is assigned to one or two partitions depending on the fundamental gesture: gestures 1, 3 and 5 are assigned to one partition, gestures 2, 4 and 6 to two partitions. When secondary gestures are assigned to three partitions, the fundamental is assigned to two partitions and always to the first and third partitions. These are distributed 1-2 or 2-1 across the two partitions using a similar method as secondary gestures across two partitions (above). All distributions are listed in *Table 15.1*.

Bars	Fundamental	Sec. Gest.	Dist.	Fun. Gest.	Dist.	Sec. Gest.	Dist.	Fun. Gest.	Dist.
1-3	1 - [1,2,3]	2 Ptns.	1-2	1 Ptn.	1-2	3 Ptns.	1-1-1	2 Ptns.	1-2
4-6	4 - [2,3,1]	2 Ptns.	2-1	2 Ptns.	2-1	3 Ptns.	1-1-1	2 Ptns.	2-1
7-9	5 - [3,1,2]	2 Ptns.	1-2	1 Ptn.	1-2	3 Ptns.	1-1-1	2 Ptns.	1-2
10-12	2 - [1,3,2]	2 Ptns.	2-1	2 Ptns.	2-1	3 Ptns.	1-1-1	2 Ptns.	2-1
13-15	3 - [2,1,3]	2 Ptns.	1-2	1 Ptn.	1-2	3 Ptns.	1-1-1	2 Ptns.	1-2
16-18	6 - [3,2,1]	2 Ptns.	2-1	2 Ptns.	2-1	3 Ptns.	1-1-1	2 Ptns.	2-1

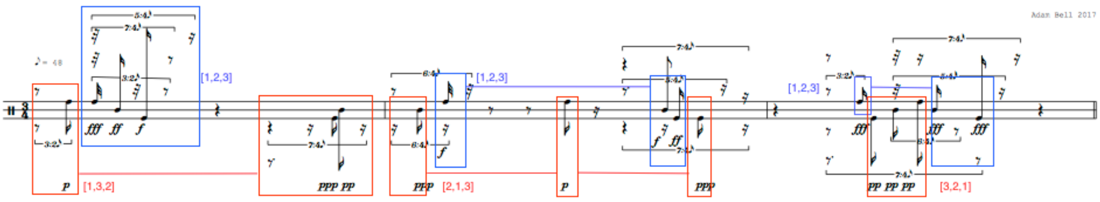
Table 15.1

There are further distributive systems at the level of the impulse array but these will be discussed after a brief overview of the mechanisms by which the number of bar partitions and secondary gestures are assigned in bars 1-3. As shown in *Table 15.1*, the fundamental for bars 1-3 is [1,2,3], giving the 3x3-Pg matrix shown on the left in *Ex.15.3*.

					Secondary 3-Pgs		**Ordered**	
1	**2**	**3**	**[1,2,3]**	Fundamental	[1,3,2]		Bar 1	[1,3,2]
2	3	1	[2,3,1]	Bar partitions	[3,2,1]	[1,2,3] =	Bar 2	[2,1,3]
3	1	2	[3,1,2]	Impulse sets	[2,1,3]		Bar 3	[3,2,1]

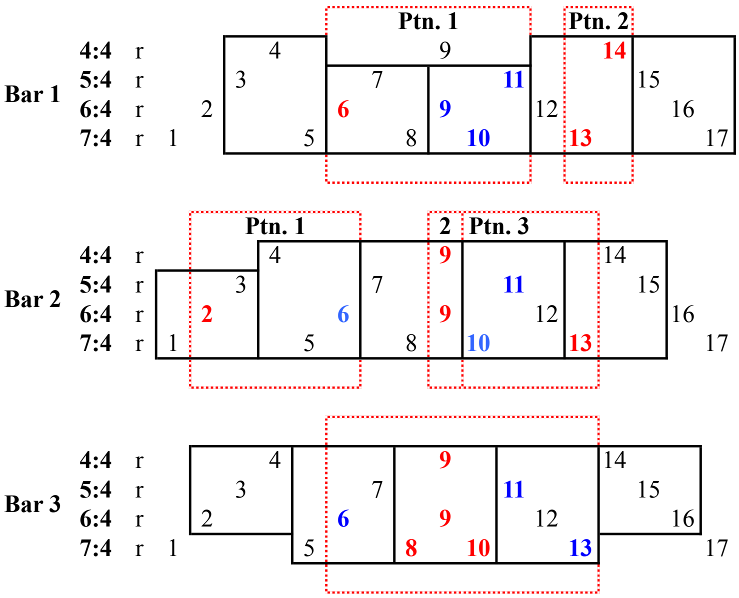
Ex.15.3

This example and that of the score in *Ex.15.4*, shows that the 3-Pg in the second row of the 3x3 matrix, [2,3,1], denotes the number of partitions the secondary gestures are distributed across in bars 1, 2 and 3 respectively. As is shown above, secondary gestures are formed from the diagonal 3-Pg (highlighted red) in the original 3x3-Pg matrix. This diagonal, in this instance [1,3,2], then delineates a new 3x3-Pg matrix (Secondary 3-Pgs column in *Ex.15.3*). The order of secondary gestures is determined by the fundamental 3-Pg ([1,2,3]) and listed in the Ordered column in *Ex.15.3*. In *Ex.15.4*, and the score in general, fundamental gestures have stems pointing up, secondary gestures pointing down.



Ex.15.4

To avoid simultaneities when assigning impulse points, the impulse array is split into five sub-sets of three adjacent impulses, of which there are three variants (see Appendix 15.1). Fundamental and secondary gestures are assigned impulses in different partitions of the impulse array. The bottom 3-Pg from the fundamental matrix is used to assign a specific variant to each bar, with [3,1,2] giving the set outcomes for bars 1-3 (*Ex.15.5*, below). For secondary gestures across three partitions the impulse partitions used are 1, 3 and 5, across two are partitions 2 and 4, and within one partition 3. As can be seen, the fundamental gestures are assigned to impulse partitions between or surrounding the secondary gesture assignments.



Ex.15.5

6.2: 1P+2sim gestures

Like *Objects 6.1*, this work is again split into six three-bar sections, but in this work there are six different time signatures. With one gesture assigned to each bar, this is the sparsest work of the three presented here. As shown in Chapter Two, the time signatures are built around crotchet partitions. These bars have either one or two partitions that are surrounded or separated by rests (*Ex.15.6*).

Ex.15.6

With the gestural outcomes essentially binary (1P+2Sim (1-2) and 2Sim+1P (2-1)), the overarching structure of the work is a trajectory from 1P+2Sim to 2Sim+1P gestures. These were mediated across the work by delineating four gesture sets containing varying degrees of 1-2 and 2-1 gestures, with the four forms shown in *Table 15.2*.

A	3 x 1-2	1-2	1-2	1-2
	2 x 1-2, 2-1	1-2	1-2	2-1
B	2 x 1-2, 2-1	1-2	2-1	1-2
	2 x 1-2, 2-1	2-1	1-2	1-2
	1-2, 2 x 2-1	1-2	2-1	2-1
C	1-2, 2 x 2-1	2-1	2-1	1-2
	1-2, 2 x 2-1	2-1	1-2	2-1
D	3 x 2-1	2-1	2-1	2-1

Table 15.2

For groups B and C in *Table 15.2*, the order of 1-2 and 2-1 gestures is determined using the diagonal 3-Pg from the 3x3-Pg assigned to the section. Section 1 in *Objects 6.2* shares the same 3x3-Pg matrix as that shown in *Ex.15.3*, with the diagonal 3-Pg [1,3,2] assigning the gestures order 1 – [1,2,3], 3 – [3,1,2], 2 – [2,3,1] shown in the score in *Ex.15.7*.

Ex.15.7

With the diagonal already used for these assignments, the entangled partner of this gesture is used in sections using B or C to determine the order of 1-2 and 2-1 gestures. For B, 3-Pg values 1 and 2 assign 1-2 gestures, value 3 2-1 gestures. For C, 1 assigns 1-2 gestures, 2 and 3 2-1 gestures. The outcomes for A-D are assigned using the two forms of 3x3-Pg matrix, the assigned 3-Pgs shown in *Table 15.4*. The two columns contain all six gestures once, with the column to the right derived through entanglement. With these assignments in place, the internally entangled 6-Pg [1,4,2,5,3,6] was used to order these globally because it avoided repetitions of B and C groups in adjacent sections.

	1	**2**	**3**
B	1-2	1-2	2-1
C	1-2	2-1	2-1

Table 15.3

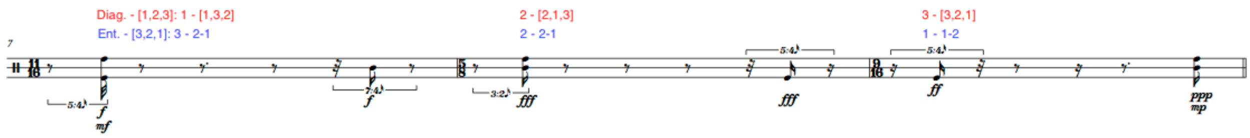
Gestures 1,4,5			**Gestures 6,3,2**		
[1,2,3]	**A**	1-2 x 3	[3,2,1]	**D**	2-1 x 3
[2,3,1]	**B**	1-2 x 2, 2-1 x 1	[2,1,3]	**C**	2-1 x 2, 1-2 x 1
[3,1,2]	**B**	1-2 x 2, 2-1 x 1	[1,3,2]	**C**	2-1 x 2, 1-2 x 1

Table 15.4

With the diagonal 3-Pg demarcating the order of 3-Pgs, the entangled partner of this is used to determine the order of 1-2 and 2-1 gestures in B and C sections. In bars 7-9, Ex.15.8, the fundamental 3-Pg is [1,3,2], which gives the diagonal [1,2,3] (Table 15.5), with *Ex.15.8* the manifestation in the score of the outcomes in Table 15.5.

	3-Pgs	Diagonal	Ordered	Ent.	
	[1,3,2]	[1,2,3]	1 - [1,3,2]	3	1/3, 2
2	[3,2,1]		2 - [2,1,3]	2	2/1, 3
	[2,1,3]		3 - [3,2,1]	1	3, 2/1

Table 15.5



Ex.15.8

The impulse systems employed in *Objects 6.1-3* differ from the other works submitted in that there are no systems for impulse duration because an impulse on a Wood Block has a very limited capacity for the impulse to be sustained when realised solely as points, as they are in these works. In *Objects 6.1* impulses were delineated by partitioning the impulse array into five regions consisting of three consecutive impulse points (*Ex.15.5*, above). With only two impulses per bar in *Objects 6.2*, entangled impulse points were used, listed in *Table 15.6* and shown highlighted red as part of tuplet arrays in Appendix 15.2.

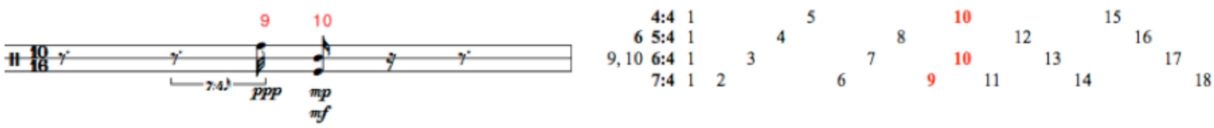
Ent.	Impulses	Gestures	Impulses Set	3-Pg value
1	4,15	1 - [1,2,3]		
2	5,14	4 - [2,3,1]	2,3,6	**1**-2, **2**-3, **3**-6
3	6,13	5 - [3,1,2]		
4	7,12	6 - [3,2,1]		
5	8,11	3 - [2,1,3]	1,4,5	**1**-1, **2**-4, **3**-5
6	9,10	2 - [1,3,2]		

Table 15.6

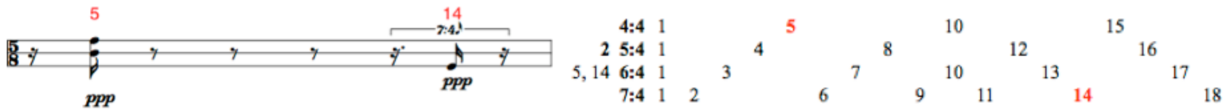
As shown in *Table 15.6*, gesture set {1,4,5} uses impulse set {2,3,6} and gesture set {2,3,6} use impulse set {1,4,5}, so on each iteration of the same 3-Pg a different impulse pairing will be used. Listed in *Table 15.7*, the entangled partner of the diagonal 3-Pg for that gesture is used to assign an impulse set to its three occurrences across the work. *Ex.15.9-11* show the iterations of the [1,2,3] gesture in bars 1, 5 and 12 as well as the highlighted impulse points within the impulse array.

3-Pg	Diag. Ent.	Entangled impulses					
1 - [1,2,3]	[3,1,2]	3: 6 - 9,10	Bar 1	1: 2 - 5,14	Bar 5	2: 3 - 6,13	Bar 12
4 - [2,3,1]	[2,3,1]	2: 3 - 6,13	Bar 3	3: 6 - 9,10	Bar 4	1: 2 - 5,14	Bar 11
5 - [3,1,2]	[1,2,3]	1: 2 - 5,14	Bar 2	2: 3 - 6,13	Bar 6	2: 3 - 6,13	Bar 10
6 - [3,2,1]	[1,3,2]	1: 1 - 4,15	Bar 9	3: 5 - 8,11	Bar 14	2: 4 - 7,12	Bar 16
3 - [2,1,3]	[2,1,3]	2: 4 - 7,12	Bar 8	1: 1 - 4,15	Bar 13	3: 5 - 8,11	Bar 18
2 - [1,3,2]	[3,2,1]	3: 5 - 8,11	Bar 7	2: 4 - 7,12	Bar 15	1: 1 - 4,15	Bar 17

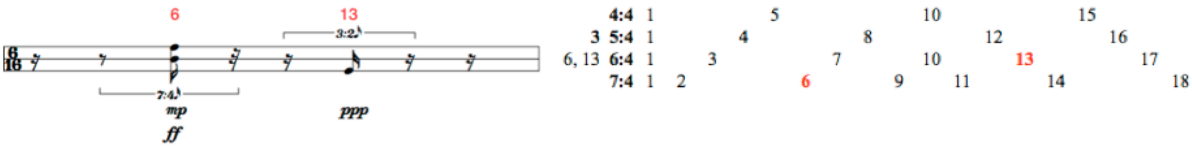
Table 15.7



Ex.15.9



Ex.15.10



Ex.15.11

6.3: 3Sim gestures

When conceptualising this group of works, *Objects 6.3* had a profound impact on me because it seemingly went against everything I had written before in that repetition was strictly avoided. In all other works this is avoided by constantly permutating the gestural content. With 3P and 1P+2sim gestures the order of their internal parts can be varied but with a 3sim gesture there is just one variant. However, the elements of this gesture (high, middle, low) can be varied by dynamic level, with each gesture having one, two or three dynamic levels simultaneously. This was interesting because even though it is the same gesture throughout, each repetition is technically different as their internal dynamic content is constantly reorganised. With 27 gestures for every nine-bar section, across six sections this gives a total of 162 3sim gestures. This extreme level of gestural invariance is one logical end-point of the distillation process seen across the *Objects* series of works, most notably from *Objects 3.1* onwards. Another would have been to assign a single 3sim gesture, but with this only one set of possible outcomes is realised, prioritising that specific construct over all others.

Dynamics		Sub-sets
1 - *ppp*	5 - *mf*	1 - {1,2,3}
2 - *pp*	6 - *f*	2 - {2,3,4}
3 - *p*	7 - *ff*	3 - {3,4,5}
4 - *mp*	8 - *fff*	4 - {4,5,6}
		5 - {5,6,7}
		6 - {6,7,8}

Table 15.8

{1,2,3}	1 Dyn.		2 Dyn.						3 Dyn.	
	[1,1,1]	**1**	[2,1,1]	[3,1,1]	[1,2,2]	[3,2,2]	[1,3,3]	[2,3,3]	[1,2,3]	[2,3,1]
	[2,2,2]	**2**	[1,2,1]	[1,1,3]	[2,1,2]	[2,3,2]	[3,1,3]	[3,2,3]	[1,3,2]	[3,1,2]
	[3,3,3]	**3**	[1,1,2]	[1,3,1]	[2,2,1]	[2,2,3]	[3,3,1]	[3,3,2]	[2,1,3]	[3,2,1]
			1	**2**	**3**	**4**	**5**	**6**		

Table 15.9

There are eight dynamic values used in the work, from *ppp* to *fff*. Numbered 1 to 8 respectively and listed in *Table 15.8*, these were split into six subsets containing three adjacent dynamic values. The work has a simple dynamic trajectory of *ppp* to *fff*, with sections 1-6 assigned dynamic subsets 1-6 respectively using the entangled 6-Pg [1,2,3,4,5,6]. *Table 15.9* lists the twenty-seven permutations for the set {1,2,3}, consisting of three one dynamic sets, eighteen two dynamic sets and six three dynamic sets, with each used in all six dynamic subsets in *Table 15.8*. The three groups of permutations are distributed throughout each section according to a set plan, with the outcomes for gestures with one dynamic fixed at the 1^{st}, 14^{th} and 27^{th} impulse (first, middle and last) and the three dynamic sets distributed between the two dynamic sets. 6-Pgs and 3-Pgs are used to assign the order of all dynamic subsets, with the same processes being used in each nine-bar section. Below will show the outcome for bars 1-9.

As was commented on in Chapter Two, eight internally entangled 6-Pgs were derived, reduced to six, and used to order time signatures with two or three partitions. All eight are used in this system to broadly assign the subsets to each section as well as the fundamental 3-Pgs used to order the assignments (*Table 15.10*).

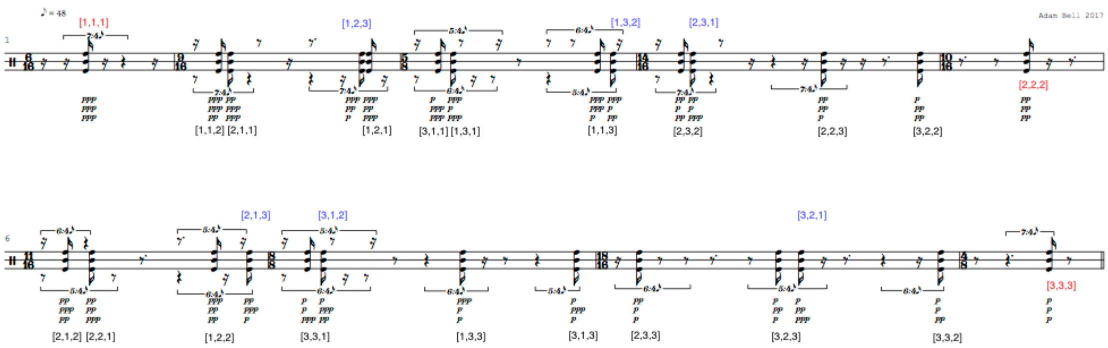
	6-Pg	Use
1	[1,2,3,4,5,6]	Dynamic sub-sets
2	[1,2,4,3,5,6]	S1 - 2 Dyn. Sub-sets
3	[1,3,2,5,4,6]	S2 - 2 Dyn. Sub-sets
4	[1,3,5,2,4,6]	S3 - 2 Dyn. Sub-sets
5	[1,4,2,5,3,6]	S4 - 2 Dyn. Sub-sets
6	[1,4,5,2,3,6]	S5 - 2 Dyn. Sub-sets
7	[1,5,3,4,2,6]	S6 - 2 Dyn. Sub-sets
8	[1,5,4,3,2,6]	Fundamental 3-Pgs

Table 15.10

Section 1 (S1) in *Table 15.10* is assigned the 6-Pg [1,2,4,3,5,6] and the fundamental 3-P [1,2,3]. The 6-Pg assigns the order of two-dynamic subsets numbered 1-6 in *Table 15.9*, with 3-Pgs then used to order the specific permutations of the dynamic set assigned. The outcomes for bars 1-9 are shown in *Table 15.11* below and in the score in *Ex.15.12*.

[1,2,3]	1 Dyn. Order								
[2,3,1]	3 Dyn. Positions								
[3,1,2]	3 Dyn. Positions		1 - [1,1,1]	**3 Dyn. Pos. 1**		**3 Dyn. Pos. 2**		**3 Dyn. Pos. 3**	**3-Dyn. Order**
[3,1,2]	2 Dyn. Sub-sets	1 - {2,1,1}	3 - [1,1,2]		1 - [2,1,1]	1 - [1,2,3]	2 - [1,2,1]		1 - [1,2,3]
[1,2,3]	2 Dyn. Sub-sets	2 - {3,1,1}	1 - [3,1,1]		2 - [1,3,1]		3 - [1,1,3]	2 - [1,3,2]	2 - [1,3,2]
[2,3,1]	2 Dyn. Sub-sets	4 - {3,2,2}	2 - [2,3,2]	4 - [2,3,1]	3 - [2,2,3]		1 - [3,2,2]	2 - [2,2,2]	4 - [2,3,1]
[2,3,1]	2 Dyn. Sub-sets	3 - {1,2,2}	2 - [2,1,2]		3 - [2,2,1]		1 - [1,2,2]	3 - [2,1,3]	3 - [2,1,3]
[3,1,2]	2 Dyn. Sub-sets	5 - {1,3,3}	3 - [3,3,1]	5 - [3,1,2]	1 - [1,3,3]		2 - [3,1,3]		5 - [3,1,2]
[1,2,3]	2 Dyn. Sub-sets	6 - {2,3,3}	1 - [2,3,3]		2 - [3,2,3]	6 - [3,2,1]	3 - [3,3,2]	3 - [3,3,3]	6 - [3,2,1]
		(6-Pg)							(6-Pg)

Table 15.11



Ex.15.12

Mentioned at the start of this chapter, the works in *Objects 6* are being composed in preparation for the *Oiseau* set of works in the *Vocalised Objects* series, scored for percussion and singer(s). As I have not written for untuned percussion for almost a decade, the short studies here are intended to develop methods by which to express un-pitched material effectively within a point-based aesthetic. The first poem in *Oiseau*, ‘And Sometimes’, contains only words without vowels, and with vowel sounds predominantly defining the pitch when words are sung, the degree by which pitches can be projected clearly is significantly reduced, which is reinforced and exaggerated by using un-pitched percussion.

As can be seen in these works, I have eschewed traditionally idiomatic percussive devices such as rolls or rudiments as I did not want to write the works in a stereotypically percussive style, i.e. rhythmic ostinati or resorting to the ‘bombastic’ and flamboyant. This is in part a reason for choosing wood blocks for *Objects 6*, in that their small and unassuming presence is the inverse of what could be termed bombastic or flamboyant. By being so restrained these works resist the approval of its consumers, either by the extreme brevity and sparsity of *Objects 6.1* and *6.2*, or the

162 repetitions of what is essentially the same gesture in *Objects 6.3*, continue the aesthetic ‘distillation process’ enacted most acutely from *Objects 3.1* onwards.

The four remaining studies in this set are still to be written or conceptualised to a large degree. However, there is an aim in the remaining studies of somehow incorporating mechanisms from each of the studies focusing on one gesture in their respective studies for two (*6.4-6.6*) and three (*6.7*) gestures-types, but the approach to be taken has not been clarified.

The final work, *Objects 7*, uses methods developed in *Objects 4, 5* and *6* but on a much larger scale. Scored for nine instruments and lasting 30 minutes, the sparsity of content is realised using almost continuous changes in instrumentation as well as extensive gestural overlap and superimposition. Decoupling and reordering the elements of each gesture significantly increases point autonomy and sonic abstraction, hindering the capacity of the consumer to trace the various elements to their constituent gesture, in effect eschewing compositional and structural markers throughout.

16. *Objects 7: Trio migrations*, for nonet (2017-2018)

As will be shown, *Objects 7* applies similar methods of point gesture superimposition and distribution as those found in *Objects 5* and *6* but on a much larger scale. With the highly reduced and sparse aesthetic approach found in the most recent works from *Objects 3.1* onwards[166] and most acutely in *Objects 5* and *6*, when applied in this work the resulting sonic outcomes exhibit a high degree of invariance across the totality of the work, however when one looks more closely one will see a high degree of internal variance in the content for each of the ensembles present within a given section or bar in the score.

In *Objects 4* the gestural content was presented linearly, in that each gesture started and finished before another began. The studies in *Objects 5* and *6* sought to emancipate the elements of each gesture further, be they single points or simultaneous chords, by splitting the elements of each gesture and inserting elements of another gesture between them.[167] Thus the elements appear fragmented and less rooted to an identifiable gestural construct, resulting in the work in large part being weightless and in a constant state of flux.

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[166] Although one can trace this approach further back to include sections of *Objects* and *Objects 2* (as well as in the proto-quantum works, given that all parameters exist within a gradient of outcomes), it is only from *Objects 3.1* onwards that this reduced or distilled aesthetic approach is expressed consistently throughout each work.

[167] See Chapters Thirteen and Fifteen (specifically *Objects 6.1*).

Like in *Objects 6.3*, in this work there is a relentless insistence on achieving sonic outcomes that are uniform throughout but varied on each reiteration. Karel Goeyvaerts is influential here, in particular his *Nr. 4 'met dode tonen'* (1952) which exhibits a high degree of invariance whilst simultaneously being varied throughout: the tones 'migrate' from sounding simultaneously, to becoming staggered, and finally returning to a simultaneous iteration. This long drawn out process containing slight alterations in the sonic outcomes is a fundamental process driving both *Objects 6.3* and *7*, with *Objects 6.3* concentrating on slight modifications in the dynamic content of each gesture and *Objects 7* concentrating on different trio constructs, hence the suffix *Trio Migrations*.

Trios

The nonet instrumentation is constructed using three instrumental families with each family containing three instruments. From top to bottom in *Table 16.1* these families are numbered 1-3 (far left), the instruments are numbered 1-9 (far right), and within each family the instruments are also numbered 1-3 (second column from the right). From this instrumentation six variants of trio can be formed based on the number of instrumental families (F) and the position of the instruments in the score (R), listed in *Table 16.2*. The instrumental make-up of the trios is directional in function, slowly migrating between instrumental families at both the macro- and micro-level by first delineating the order of trio variants for the first three thirty-bar macro sections.

	Flute	Fl.	1	1
1	Clarinet	Cl.	2	2
	Bassoon	Bsn.	3	3
	French Horn	Hn.	1	4
2	Trumpet	Tpt.	2	5
	Bass trombone	Tbn.	3	6
	Violin	Vln.	1	7
3	Viola	Vla.	2	8
	Cello	Vc.	3	9

Table 16.1

		Trio			**Variants**	**Per section**
1	1F3R	{1,2,3}	{4,5,6}	{7,8,9}	3	1
2	2F3R	{1,2,6}	{1,2,9}	etc.	18	3
3	2F2R	{1,2,4}	{1,2,5}	etc.	36	6
4	3F1R	{1,4,7}	{2,5,8}	{3,6,9}	3	1
5	3F2R	{1,4,8}	{1,5,8}	etc.	18	3
6	3F3R	{1,5,9}	{1,6,8}	etc.	6	1

Table 16.2

The six trio variants listed in *Table 16.2* can be ordered within each macro section using 6-Point gestures (6-Pgs). However, the total number of 6-Pgs is 720 (1x2x3x4x5x6 (or 6!) = 720), so a means by which to limit the set of possible 6-Pgs is required. In relation to *Objects 6.3* in Chapter Two, *Table 2.28* listed eight entangled 6-Pgs starting and ending with 1 and 6 respectively, and are reproduced in *Table 16.3* below. As shown is this table, the interval content and the number of different values is calculated. [1,2,3,4,5,6] was omitted as it is the most invariant and linear of all eight 6-Pgs. From the remaining seven, [1,5,3,4,2,6] was assigned as the 'fundamental' 6-Pg of the work (discussed later) because although it shares the highest interval content value ('Total' column) with [1,4,2,5,3,6], it has three instead of two interval values ('Values' column) so is more varied.

	6-Pgs	**Intervals**	**Values**	**Total**
1	[1,2,3,4,5,6]	1,1,1,1,1	1 - 1	5
2	[1,2,4,3,5,6]	1,2,1,2,1	2 - 1,2	7
3	[1,3,2,5,4,6]	2,1,3,1,2	3 - 1,2,3	9
4	[1,3,5,2,4,6]	2,2,3,2,2	2 - 2,3	11
5	[1,4,2,5,3,6]	3,2,3,2,3	2 - 2,3	13
6	[1,4,5,2,3,6]	3,1,3,1,3	2 - 1,3	11
7	[1,5,3,4,2,6]	4,2,1,2,4	3 - 1,2,4	13
8	[1,5,4,3,2,6]	4,1,1,1,4	2 - 1,4	11

Table 16.3

1	**4**	[1,3,5,2,4,6]	
2	**6**	[1,4,5,2,3,6]	
3	**8**	[1,5,4,3,2,6]	
			Retrograde
1	**4**	[1,3,5,2,4,6]	[6,4,2,5,3,1]
3	**8**	[1,5,4,3,2,6]	[6,2,3,4,5,1]
2	**6**	[1,4,5,2,3,6]	[6,3,2,5,4,1]

Ex.16.1

	Family-Family		**Trio-types**
	3 - Strings	**S**-W	[1,3,5,2,4,6]
Ent. [3,1,2]	1 - Woodwind	**W**-B	[1,5,4,3,2,6]
	2 - Brass	**B**-S	[1,4,5,2,3,6]
	3 - Strings	**S**-B	[6,3,2,5,4,1]
	2 - Brass	**B**-W	[6,2,3,4,5,1]
	1 - Woodwind	**W**-S	[6,4,2,5,3,1]

Table 16.4

Globally the trio migrations are ordered in two groups of three sections: sections 1-3 and sections 4-6, with each of the six sections assigned one of the three families as its root trio. As shown in *Table 16.3* and listed in *Ex.16.1*, 6-Pgs 4, 6 and 8 all contain value totals of 11, so these were chosen to order the trio-types in sections 1-3. Listed linearly (top of *Ex.16.1*), the third and fourth values of the top two 6-Pgs are the same (5 and 2, highlighted red), so to avoid this repetition 6-Pgs 6 and 8 swapped positions, giving the 3-Pg [1,3,2]. With [1,3,2] in effect the system outcome for assigning the trio-types for sections 1-3, its entangled partner [3,1,2] is used to assign the root families for the same sections (*Table 16.4*). As is seen in this table, trio-types in sections 4-6 are the retrograde of sections 1-3.

	[3,1,2]	3-1	S-W
R1	[1,2,3]	1-2	W-B
R2	[2,3,1]	2-3	B-S

Ex.16.2

As was shown in previous chapters, when combined in a 3x3-Pg matrix the second and third 3-Pgs are rotated versions of the first (R1 and R2 in *Ex.16.2*). Combining [3,1,2] with R1 ([1,2,3]) gives the root families and the family they migrate to (right of *Ex.16.2*) for the first half of the work. In section 4 the root trio returns to strings so the migrations for sections 4-6 are to families that were not migrated to in sections 1-3. For example, in the first half of the work strings migrate to woodwind, woodwind to brass, and brass to strings. In the second half strings migrate to brass, brass to woodwind, and woodwind to strings, thus all families migrate to the other families once. Appendix 16.1 lists the order of trio-types for each section using the 6-Pgs listed in *Table 16.4*.

Table 16.2 listed the number of variants for each trio-type, a condensed version of which is shown in *Ex.16.3*. The number per section for 2F3R, 2F2R, 3F2R and 3F3R trios is their number of variants divided by six, distributing the trio-types evenly across the six sections. 1F3R and 3F1R, having only three variants, has each assigned twice across the work. Totalling the 'Per section' column of *Ex.16.3* gives fifteen different trios per section, resulting in fifteen two-bar micro-sections. The text following *Ex.16.3* will outline assignment strategies for the six trio-types.

	Trios	Variants	Per section
1	1F3R	3	1
2	2F3R	18	3
3	2F2R	36	6
4	3F1R	3	1
5	3F2R	18	3
6	3F3R	6	1

Ex.16.3

IF3R: Always the root family of the section so is automatically assigned.

2F3R: In trios with two families, the instrumentation is always two instruments from the root family and one from the family the root is migrating to. There are six variants for each root family, which are split into two groups of three trios. So for example with strings as the root family there are three 2F3R trios with two strings and one woodwind, and three with one brass instrument. These are ordered using the diagonal 3-Pg derived from the 3x3-Pg matrix assigned to the section.

2F2R: Like 3F2R, these trios are constructed using two from the root family and one from the family the root is migrating to. For each trio-type (i.e. S-W (SSW) or W-B (WWB)) there are six variants, so the 6-Pg used to order the trio-types for each section is also used to order 2F2R assignments.

3F1R: The 3-Pg [1,3,2] assigns the trios [1,4,7], [3,6,9] and [2,5,8] to sections 1-3 respectively, and in sections 4-6 the inverted retrograde ([2,1,3], or R2 from *Ex.16.2*) is assigned to 4-6 respectively.

3F2R: There are three main variants, ranges 1/2, 1/3 and 2/3 (numbered 1-3 respectively), with the trios assigned using a two-step process. The basic range combinations were assigned using the same 3-Pgs that formed the outcome of family migrations: [3,1,2] and [3,2,1]. There are two subsets of three trios for each range combination (for example {1,1,2} and {1,2,2} for the 1/2 combination), with the three from each subset ordered using the diagonal 3-Pg of the section. The two sub-sets are assigned to either values 1, 4 and 5 or 2, 3 and 6, so the fundamental 6-Pg [1,5,3,4,2,6] used to assign the root 3-Pgs for each section also assigns trio subsets.

3F3R: The retrograde of [1,5,3,4,2,6] is used to assign one to each section. Their internal make-up is derived from the six 3-Pgs ([1,2,3], [1,3,2], etc.), which from left to right assigns either the top (1), middle (2) or bottom (3) instrument from each family.

Appendix 16.2 lists all variants of trio with the source sets for Section 1 (enclosed in red). In relation to Appendix 16.2, *Table 16.5* lists the outcomes for Section 1 (bars 1-30). 1F3R trios are always the root family, and in Section 1 this trio is assigned to the first two bars. 2F2R trios are assigned to bars 3-14, with their order assignments derived from the [1,3,5,2,4,6] 6-Pg which ordered globally the trio-types in Section 1.

Bars	**Trios**				**Sextet**
1,2	**1**	1F3R	Strings	7,8,9	1,2,3,4,5,6
3,4	**3**	2F2R	[1	1,7,8	2,3,4,5,6,9
5,6		2F2R	3	1,7,9	2,3,4,5,6,8
7,8		2F2R	5	2,8,9	1,3,4,5,6,7
9,10		2F2R	2	2,7,8	1,3,4,5,6,9
11,12		2F2R	4	3,7,9	1,2,4,5,6,8
13,14		2F2R	6]	3,8,9	1,2,4,5,6,7
15,16	**5**	3F2R	[1	2,5,9	1,3,4,6,7,8
17,18		3F2R	3	2,6,9	1,3,4,5,7,8
19,20		3F2R	2]	2,6,8	1,3,4,5,7,9
21,22	**2**	2F3R	[1	3,7,8	1,2,4,5,6,9
23,24		2F3R	3	1,8,9	2,3,4,5,6,7
25,26		2F3R	2]	2,7,9	1,3,4,5,6,8
27,28	**4**	3F1R	1-1-1	1,4,7	2,3,5,6,8,9
29,30	**6**	3F3R	6 [3,2,1]	3,5,7	1,2,4,6,8,9

Table 16.5

Appendix 16.3 shows the 3F2R trios assigned to the 6-Pg values [1,4,5] and [2,3,6], which correspond to the two fundamental 3x3-Pg matrixes that can be formed from the six 3-Pgs:

1- [1,2,3]	2- [1,3,2]
4- [2,3,1]	6- [3,2,1]
5- [3,1,2]	3- [2,1,3]

Ex.16.4

With [3,1,2] and [3,2,1] being the outcomes for sections 1-6 respectively and section 1 assigned '1' from [1,5,3,4,2,6], the sub-set highlighted in red in Appendix 16.3 is used. '1' assigns the root 3-Pg [1,2,3], which when combined into a 3x3-Pg matrix has a resulting diagonal of [1,3,2], giving the order outcomes for bars 15-20 in *Table 16.5*. The subset for 2F3R trios is always two instruments from the root family and one from the family that is being migrated to, highlighted red in Appendix 16.2, with [1,3,2] also used to order these trios. [1,3,2] and its inverted retrograde [2,1,3] are used to assign the range from which the trio instruments are assigned, with '1' assigning [1,4,7] (1,1,1) to bars 27 and 28. 3F3R gestures use the 6-Pg [6,2,4,3,5,1] to assign one trio to each Section, which for Section 1 is derived using the corresponding number 3-Pg: 6 – [3,2,1], assigning instruments 3 – bassoon (W3), 5 – trumpet (B2) and 7 – violin (S1).

Complements

Each two-bar sub-section is assigned both a root trio (above) and a complementary ensemble of between one and six instruments, which is derived from the remaining six instruments of the nonet after the root trio has been removed. As will be shown in the section on gestures later, the root trios and complements are assigned either 3-Pgs or 4-Pgs, and in most cases the gesture-type containing the most pitches in total is assigned to the trios, the least to complements.

	1F3R	[1,5,3,4,2,6]
Group 1	2F2R	[5,3,1,6,4,2]
	3F1R	[3,1,5,2,6,4]
	2F3R	[4,6,2,5,1,3]
Group 2	3F2R	[2,4,6,1,3,5]
	3F3R	[6,2,4,3,5,1]

Table 16.6

Table 16.6 lists the six trio-types, split into the two groups explained in Chapter Two (see *Table 2.31*), with the right of *Table 16.6* listing six 6-Pgs, the values directly corresponding to the number of instruments within the complementary ensemble. The 6-Pgs in Group 1 are derived by rotating the first three values of the top 6-Pg one space to the left to produce the second row (2F2R trios), and repeated again to produce the third row (3F1R trios). The corresponding entangled 6-Pg value (1-6, 2-5, 3-4) is assigned at the corresponding antipode within the 6-Pg (first to last, second to fifth and third to fourth positions). Group 2's outcomes are the retrograde of Group 1's.

Assigning the specific instrumentation for all complements except sextets was achieved on a section-by-section basis and guided by a defined set of principles for each variant of complement, informed by the F and R values of the root trio. The complements were in a sense sketched from the root trios using the principles outlined in *Table 16.7*, and for many cases these alone derived the outcomes because they limited the pool from which the instrument(s) of the complement could be chosen. How this is the case is explained beneath *Table 16.7*.

Compliment	**Root trio**	**Compliment construction**
Solos	All trios	1 from family migrating towards (tow)
Duets	1F3R	2 tow
	All other trios	1tow, 1 not
Trios	1F3R	3 tow
	2F3R	2 tow, 1 not
	2F2R	2 not, 1 tow
	3F trios	1 of each family
Quartets	1F3R	3 tow, 1 not
	2F3R, 2F2R	2 tow, 2 not
	3F trios	2 tow, 1 not, 1 root
Quintets	1F3R	3 tow, 2 not
	2F3R, 2F2R	2 tow, 3 not
	3F trios	2 tow, 2 not, 1 root
Sextets	All trios	Remaining instruments

Table 16.7

The column on the far right of *Table 16.7* lists the fundamental characteristics of each complement's construction. The instrumentation of the sextets is self explanatory, and to an extent this is true of the solos as well. However, another step is needed for solos because there are one, two or three possible outcomes depending on the root trio. The outcomes with more than one possibility are assigned using either 3- or 4-Pgs, which are sometimes used across more than one trio/complement variant within the same macro-section.

Table 16.8 lists the solo assignments for each section, with the instruments highlighted in red. In section 1, the first value of the diagonal 3-Pg [1,3,2] assigned '1' as the solo instrument.[168] In section 2, '5' is assigned using the second value of the diagonal 3-Pg [3,2,1] (the first value is used for quintet delineation). In section 3 there is only one possible outcome, which always results in two instruments in each range. This is also true in section 4, although more than two can be assigned from each range depending on the availability of instruments from the family being migrated to. In none of these cases can the solo be assigned to the top row because that range is never used in the trios. In section 5 the solos have one of two options, so the first three values of the central 4-Pg [2,1,4,3] is used to assign the solos. The values 1 and 3 assign the top instrument, 2 and 4 the bottom. In section 6 the solo instrument is assigned from the same range as the root family instrument.

[168] All assigned instrument values relate back to *Table 16.1*, with the instruments in the score numbered 1-9 from top to bottom.

Section	Bars	Trio		Compliment
1	1,2	1F3R	7,8,9	[1] (1)
S-W				
2	39,40	3F1R	3,6,9	[5]
W-B				
3	77,78	2F2R	4,5,7	[8]
B-S	79,80	2F2R	4,6,9	[7]
	81,82	2F2R	5,6,8	[9]
	83,84	2F2R	4,5,8	[7]
	85,86	2F2R	4,6,7	[9]
	87,88	2F2R	5,6,9	[8]
4	111,112	3F2R	2,6,8	[5]
S-B	113,114	3F2R	2,5,9	[6]
	115,116	3F2R	2,6,9	[5]
5	123,124	2F3R	3,4,5	2 - [2]
B-W	125,126	2F3R	2,4,6	1 - [1]
	127,128	2F3R	1,5,6	4 - [3]
6	151,152	3F3R	1,5,9	[7]
W-S				

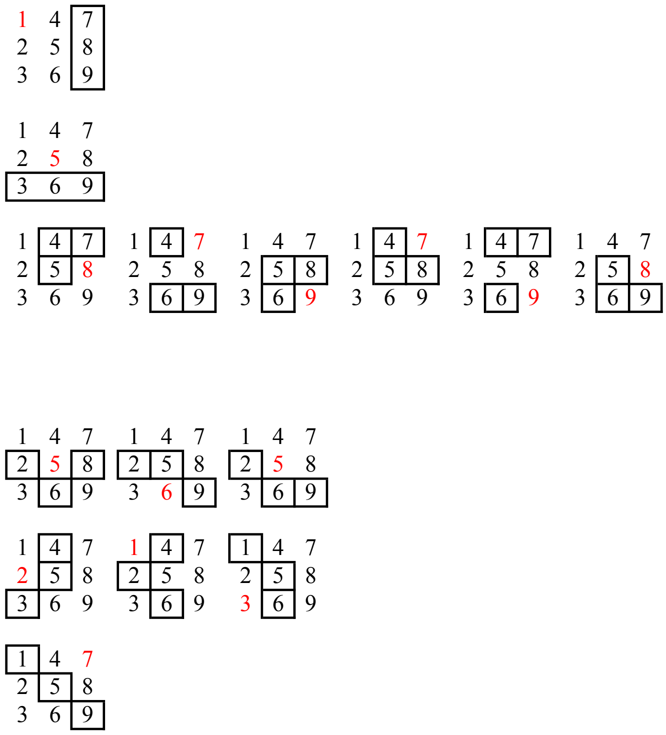


Table 16.8

Duets are also assigned using similar methods as solo instruments, however in some case these were somewhat looser in nature. For example, in bars 15 and 16 in section 1, the family towards instrument is in the same range as the root family instrument, so in order to avoid three instruments in the same range, 4 was chosen from the brass family. In bars 17/18 and 19/20, instruments 3 and 5 (respectively) cannot be assigned, as that would give three instruments in the same range. Therefore 1/5 and 3/4 are the resulting duets. In section 2 the family towards instrument is in the same range as the root family instrument, giving the duet [4,9] (the 9 assigned instead of 7 so as to avoid three instruments in the same range).

Section	Bars	Trio		Compliment
1	15,16	3F2R	2,5,9	[3,4]
S-W	17,18	3F2R	2,6,9	[1,5]
	19,20	3F2R	2,6,8	[3,4]
2	59,60	3F3R	1,6,8	[4,9]
W-B				
3	71,72	2F3R	4,6,8	3 - [2,9]
B-S	73,74	2F3R	5,6,7	1 - [1,8]
	75,76	2F3R	4,5,9	2 - [3,7]
4	117,118	3F1R	2,5,8	[3,6]
S-B				
5	149,150	1F3R	4,5,6	[2,3]
B-W				
6	167,168	2F2R	2,3,9	[6,8]
W-S	169,170	2F2R	1,3,9	[6,7]
	171,172	2F2R	1,2,8	[5,7]
	173,174	2F2R	2,3,8	[5,9]
	175,176	2F2R	1,3,7	[4,9]
	177,178	2F2R	1,2,7	[4,8]

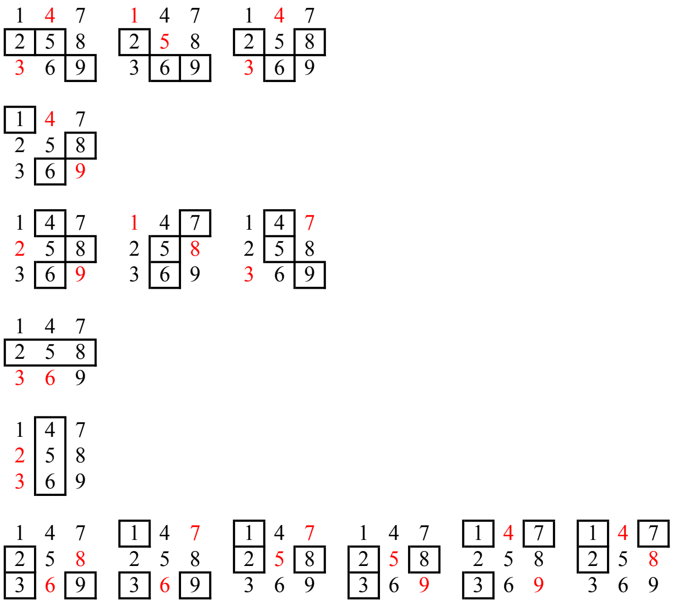


Table 16.9

With the diagonal 3-Pg ([2,3,1]) used to order the root trio construct in bars 89 and 90, the first rotation 3-Pg [3,1,2] is used to assign the duets in bars 71-76, giving duets with ranges 2/3 (3), 1/2 (1) and 1/3 (2). As can be seen in the *Table 16.9*, in bars 71 and 72, the stringed instrument cannot be from range 2 as it is already assigned in the trio, so it has to be from range 3 (9). Similar reasoning is used in bars 73/74 and 75/76. Section 4 uses the first value of the 3-Pg [3,2,1] (the second rotation from the diagonal 3-Pg [2,1,3]), assigning duet instruments from range 3 ([3,6]). Section 5 duets use the third value from the diagonal 3-Pg [1,2,3], giving the woodwind duet [2,3]. Section 6, reflecting the two ranges in the trio construct, is delineated from the same ranges as the trio. In each instance there is only one possible outcome.

The three other complementary ensembles (trios, quartets and quintets (sextet is automatically assigned)) are constructed using the same or similar methods of delineation as those found in solos and duets above. The exhaustive approach taken in the previous pages is a consequence of a desire in myself to have concrete technical-aesthetic answers for questions such as why an impulse is in a certain place within a bar, or the instrumentation of said bar. All parameters and their outcomes for me have to relate back to a fundamental set of principles or methods of realisation. This is why almost this entire chapter has so far concentrated on just two mechanisms: the migration of root trios and their complementary ensemble assignments. These parameters, as well as those outlined in the corresponding section of Chapter Two, form the structural backbone of the work and typically take up a significant part of the compositional process, so reflecting this was the purpose of the previous pages. The hyper-specificity of outcomes permeates the entirety of the work, and in order to explain the degree to which the fundamental structural elements are worked through, developed and assigned during the compositional process, it was important to reflect this long drawn-out process here. Instead of repeating the previous pages on solo and duet assignments for trios, quartets and quintets, the remaining text will discuss the gestural content for both root trios and complementary ensembles and how these are realised in the score, whilst at the same time discussing some of the notational issues as an outcome of hyper-specification in the impulse parameter.

Gestural content

Gestural content is either expressed as trichords or tetrachords and are derived in the same way as they are in *Objects 4* and *5*, with each two-bar sub-section in *Objects 7* assigned 1-4 trichords and/or 1-3 tetrachords. There are fifteen subsets of gesture combinations, so each subset is used once every 30-bar macro-section. Listed linearly as they are in *Table 16.10*, the subsets are split into five groups of three, and ordered in each 30-bar section globally using the 6-Pg assigned to the section (*Table 16.4*), as well as 3-Pgs to order the five sub-groups internally.

			3-Pg	4-Pg	Gestures	P-cs	Trio	P-cs	Compliment
	1	1	2	0	2	6	1 x 3-Pg	3	1 x 3-Pg
1	2	2	1	1	2	7	1 x 4-Pg	4	1 x 3-Pg
	3	3	0	2	2	8	1 x 4-Pg	4	1 x 4-Pg
	1	4	3	0	3	9	2 x 3-Pgs	6	1 x 3-Pg
2	2	5	2	1	3	10	2 x 3-Pgs	6	1 x 4-Pg
	3	6	1	2	3	11	2 x 4-Pgs	8	1 x 3-Pg
	1	7	3	1	4	13	3 x 3-Pgs	9	1 x 4-Pg
3	2	8	2	2	4	14	2 x 4-Pgs	8	2 x 3-Pgs
	3	9	1	3	4	15	3 x 4-Pgs	12	1 x 3-Pg
	1	10	4	1	5	16	4 x 3-Pgs	12	1 x 4-Pg
4	2	11	3	2	5	17	3 x 3-Pgs	9	2 x 4-Pgs
	3	12	2	3	5	18	3 x 4-Pgs	12	2 x 3-Pgs
	1	13	4	2	6	20	4 x 3-Pgs	12	2 x 3-Pgs
5	2	14	3	3	6	21	3 x 4-Pgs	12	3 x 3-Pgs
	3	15	4	3	7	24	4 x 3-Pgs	12	3 x 4-Pgs

Table 16.10

With each value of the 6-Pg [1,5,3,4,2,6] assigned to sections 1-6 respectively, the values are used for two purposes: to assign the fundamental 3-Pg for that section (1 – [1,2,3], 2 – [1,3,2], etc.) and also removes the corresponding number in the 6-Pg assigned to that section, giving five values. The outcomes for each section are shown in *Table 16.11*, with the remaining 6-Pg values assigning their respective 3-Pgs to the five sub-sets of gestures. The values from the 6-Pg are transferred to the values 1-5, giving the order of gesture subsets for each thirty-bar section. The specific outcomes for all sections are listed in Appendix 16.4.

Section	**6-Pg**							
1	[1,3,5,2,4,6]	-1	[3,5,2,4,6]	3 - [2,1,3]	5 - [3,1,2]	2 - [1,3,2]	4 - [2,3,1]	6 - [3,2,1]
		1-5	[2,4,1,3,5]	**2**	**4**	**1**	**3**	**5**
2	[1,5,4,3,2,6]	-5	[1,4,3,2,6]	1 - [1,2,3]	4 - [2,3,1]	3 - [2,1,3]	2 - [1,3,2]	6 - [3,2,1]
		1-5	[1,4,3,2,5]	**1**	**4**	**3**	**2**	**5**
3	[1,4,5,2,3,6]	-3	[1,4,5,2,6]	1 - [1,2,3]	4 - [2,3,1]	5 - [3,1,2]	2 - [1,3,2]	6 - [3,2,1]
		1-5	[1,3,4,2,5]	**1**	**3**	**4**	**2**	**5**
4	[6,3,2,5,4,1]	-4	[6,3,2,5,1]	6 - [3,2,1]	3 - [2,1,3]	2 - [1,3,2]	5 - [3,1,2]	1 - [1,2,3]
		1-5	[5,3,2,4,1]	**5**	**3**	**2**	**4**	**1**
5	[6,2,3,4,5,1]	-2	[6,3,4,5,1]	6 - [3,2,1]	3 - [2,1,3]	4 - [2,3,1]	5 - [3,1,2]	1 - [1,2,3]
		1-5	[5,2,3,4,1]	**5**	**2**	**3**	**4**	**1**
6	[6,4,2,5,3,1]	-6	[4,2,5,3,1]	4 - [2,3,1]	2 - [1,3,2]	5 - [3,1,2]	3 - [2,1,3]	1 - [1,2,3]
		1-5	[4,2,5,3,1]	**4**	**2**	**5**	**3**	**1**

Table 16.11

Trichords and tetrachords (expressed using permutations of 3-Pgs and 4-Pgs respectively) are realised differently depending on the size of the ensemble. These are formed on a gradient that moves from 3P/4P gestures to 3Sim/4Sim (3S/4S) gestures as the number of instruments increases. The same set of gesture variants as those found in *Objects 4* are used in this work as well but with the addition of 4Sim gestures. This work also differs from *Objects 4* in that all instruments are only allowed to play a single pitch at any given time (in *Objects 4*, the double bass and vibraphone could play up to two pitches simultaneously).

Listed in *Table 16.12* are three 3-Pg gesture-types (3P, 2S+P and 3S), with each gesture having four variants containing different numbers of sustained (h) and unsustained (p) points, with the specific variant assignments for each ensemble shown in *Table 16.13*. Each ensemble is assigned two variants for each gesture, delineated using the six two-value sets from the values 1-4: 1/2, 1/3, 1/4, 2/3, 2/4 and 3/4. The gesture variants are assigned in groups of two gestures, assigning the complementary variant set to the second gesture. As solos and sextets have only one 3-Pg each these are assigned in conjunction, with the sextet assigned the complement (3,4) of the solo assignments (1,2). The duet, trio, quartet and quintet assignments all contain two gestures so are individually assigned, with the column on the right of *Table 16.13* listing the complementary variant groups.

3-Pgs	Variants
3P	1 - 3p
2S+P	2 - 2p1h
3S	3 - 2h1p
	4 - 3h

Table 16.12

Solo	1	**3P**	1,2	1 - 3p	2 - 2p1h				
Duet	2	**3P**	1,3	1 - 3p	3 - 2h1p	**2S+P**	2,4	2 - 2p1h	4 - 3h
Trio	2	**3P**	1,4	1 - 3p	4 - 3h	**2S+P**	2,3	2 - 2p1h	3 - 2h1p
Quartet	2	**2S+P**	1,4	1 - 3p	4 - 3h	**3S**	2,3	2 - 2p1h	3 - 2h1p
Quintet	2	**2S+P**	1,3	1 - 3p	3 - 2h1p	**3S**	2,4	2 - 2p1h	4 - 3h
Sextet	1	**3S**	3,4	3 - 2h1p	4 - 3h				

Table 16.13

A similar process is used to delineate gestures and their variants for 4-Pgs, and listed in *Table 16.14* are five gestures ranging from 4P to 4S, with five variants of each. Whereas with 3-Pgs the ensembles are assigned either one or two different gestures, with 4-Pgs solos to sextets are assigned one, two or three different gestures.

4-Pgs	Variants
4P	1 - 4p
2S+2P	2 - 3p1h
2S+2S	3 - 2p2h
3S+P	4 - 1p3h
4S	5 - 4h

Table 16.14

1 - 1,2,3	6 - 1,4,5
2 - 1,2,4	7 - 2,3,4
3 - 1,2,5	8 - 2,3,5
4 - 1,3,4	9 - 2,4,5
5 - 1,3,5	10 - 3,4,5

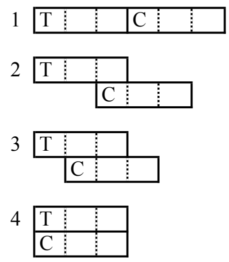
Ex.16.5

Table 16.15 shows that for 4-Pgs each gesture has three possible variants, assigned using one of the ten three-value sets listed in *Ex.16.5*. These are assigned sequentially from top to bottom in *Table 16.15*, with solos, duets and trios using variant sets 1-6 from *Ex.16.5*, and quartets, quintets and sextets using sets 5-10.

Solo	1	**4P**	1 - 1,2,3	1 - 4p	2 - 3p1h	3 - 2p2h											
Duet	2	**4P**	2 - 1,2,4	1 - 4p	2 - 3p1h	4 - 1p3h	**2S+2P**	3 - 1,2,5	1 - 4p	2 - 3p1h	5 - 4h						
Trio	3	**2S+2P**	4 - 1,3,4	1 - 4p	3 - 2p2h	4 - 1p3h	**2S+2S**	5 - 1,3,5	1 - 4p	3 - 2p2h	5 - 4h	**3S+P**	6 - 1,4,5	1 - 4p	4 - 1p3h	5 - 4h	
Quartet	3	**2S+2P**	5 - 1,3,5	1 - 4p	3 - 2p2h	5 - 4h	**2S+2S**	6 - 1,4,5	1 - 4p	4 - 1p3h	5 - 4h	**3S+P**	7 - 2,3,4	2 - 3p1h	3 - 2p2h	4 - 1p3h	
Quintet	2	**3S+P**	8 - 2,3,5	2 - 3p1h	3 - 2p2h	5 - 4h	**4S**	9 - 2,4,5	2 - 3p1h	4 - 1p3h	5 - 4h						
Sextet	1	**4S**	10 - 3,4,5	3 - 2p2h	4 - 1p3h	5 - 4h											

Table 16.15

With the gestural content possibilities broadly defined for each ensemble, a gradient for the superimposition of gestures was developed that mediated the extent to which the salient parts of each gesture (for example the three separated points in 3P gestures) are decoupled by the insertion of elements from other gestures. Unlike in *Objects 5* and *6*, defining the positioning of gesture elements in this work was not achieved using only point gesture values but was instead freer and guided by defined strategies for each of the fifteen gesture groups. Appendix 16.5 lists the five smallest (by point content) of these groups, each with four variants of superimpositions.



Ex.16.6

Ex.16.6 is a reproduction of the smallest gesture group shown at the top of Appendix 16.5 and will be used to explain how these inform gesture superimposition. T and C denote the trio and complement ensemble gesture respectively, and a rule that features throughout the work is that an element from the gestures assigned to the root trio is always assigned as the first impulse within a two-bar section. Appearing without any overlap in *Ex.16.6*, the trio gesture in the first variant is fully realised before the complement's gesture is realised. The first point of the complement in the second variant overlaps the trio's by one square (or point), so the first element of the complement's gesture would be assigned between the second and third of the trio's gesture. This process is repeated for variants 3 and 4, shifting the complement gesture one space to the left each time. When more elements are superimposed, outcomes that favoured multiple notes to be played concurrently were chosen. For example, the 3-Pgs of variant 3 could be expressed as 3p for T and h,p,p for C. The sustained pitch at the start of the complement gesture would appear between the first and second points of the trio gesture, and sustained to allow for the remaining trio points to be realised before completing the complementary gesture.

Each 30-bar section has the superimposition variant of each gesture sub-set ordered using exactly the same method, with bars 1-30 shown in *Table 16.16* (the fifteen gesture subsets (*Table 16.10*) are listed from 1 to 15 in the G-Set column). *Ex.16.7* shows the 4x4-Pg matrix assigned to bars 1-30, with the central 4-Pg [1,3,2,4] giving the order of 2x2 4-Pgs and are listed to the right of the matrix. These are then assigned to each gesture subset, listed in the P-cs columns, determining the 3x4 aggregates assigned to each section (Appendix 16.6). The inverse of these values (1-4, 2-3, 3-2, 4-1) are used to assign the superimposition variants for each two-bar sub-section and are listed in the G.Sup columns of *Table 16.16*.

2	3	1	4	1	[2,3,4,1]
4	1	3	2	3	[3,2,1,4]
3	2	4	1	2	[1,4,3,2]
1	4	2	3	4	[4,1,2,3]

Ex.16.7

G-Set	P-cs	G.Sup	G-Set	P-cs	G.Sup	G-Set	P-cs	G.Sup	G-Set	P-cs	G.Sup
1	2	3	5	3	2	9	1	4	13	4	1
2	3	2	6	2	3	10	4	1	14	1	4
3	4	1	7	1	4	11	3	2	15	2	3
4	1	4	8	4	1	12	2	3			

Table 16.16

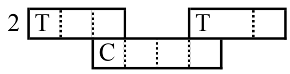
The capacity for point gestures to shape the sonic outcomes in a work across all object strata is, I believe, its strongest asset, providing the composer with a means by which to unify the compositional process. Up to this point in the chapter point gestures of various sizes have been used in systems for family migrations, trio-types and their distributions, complementary ensembles, the distribution of gesture subsets and their corresponding variants, and also the degree to which said gestures are superimposed. These are all in addition to the point gesture system used to assign the time signatures outlined in the corresponding section of Chapter Two. And one can see from *Ex.16.7* and *Table 16.16* that this can be achieved by using very limited set of initial point gestures or values. For example, *Table 16.16* defines the basic gestural distribution and architecture, as well as the source sets for pitch-class content for bars 1-30, and yet all of these assignments can be traced back to the central 4-Pg [1,3,2,4].

The one remaining strata to be considered here is the content in the score, essentially the notated realisation of trichords and tetrachords using 3- and 4-Pgs respectively, and will be discussed using six two-bar examples from bars 1-30. Each example is of a different trio-type and complement size, with all forms of gesture (3P-3S and 4P-4S) and superimposition variants presented in the six examples.

Bars 1 and 2

Bars	Compliment	Gestures		
1,2	Solo	1	**3P**	3p
[7,8,9]	[1]	2	**4P**	4p
		3	**2S, 1P**	2p, 1h

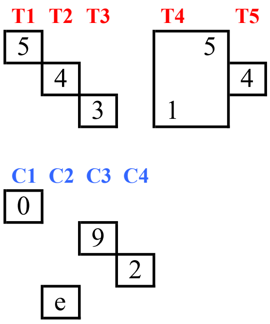
Table 16.17



Ex.16.8

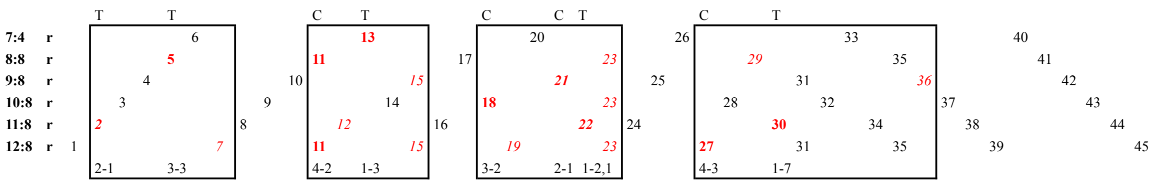
Assigned the trio 1F3R ([7,8,9], strings) and solo complement ensemble ([1]), with the three gestures (G.Set 5) distributed two trichords to the trio and one tetrachord to the solo (*Table 16.17*). The trio is assigned 3P and 2S+1P gestures, the complement a 4P gesture and with a superimposition variant of 2 (*Ex.16.8*). Appendix 16.7 gives an overview of the superimposition outcomes for the six two-bar sections used as examples here and in the remaining text.

Trio			
3 - [3,5,4]	**3P**	3p	[1,2,3]
1 - [1,4,5]	**2S, 1P**	2p, 1h	[3,1,2]
Compliment			
1 - [0,9,2,e]	**4P**	4p	[1,4,2,3]



Ex.16.9

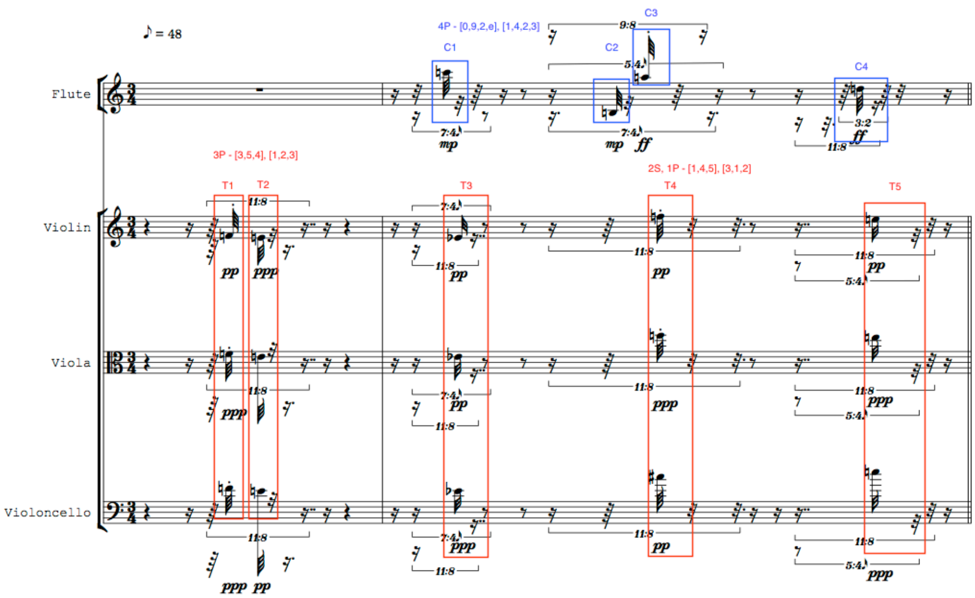
Ex.16.9 lists the trio and complement gestures, with T1-5 and C1-4 in this example corresponding to the boxed areas in the score example *Ex.16.11*. Impulses in the first 3/4 bar of this example are assigned to one partition, the second three. Comparing examples *16.8-16.11,* as well as Appendix 16.7, one can see how the superimpositions are realised in practice, with the impulse points determined using an impulse array containing time-point layers 7:4, 8:8, 9:8, 10:8, 11:8 and 12:8, the impulse assignments for bars 1 and 2 shown in *Ex.16.10*.



Ex.16.10

Comparing *Ex.16.10* and *Ex.16.11* one will notice the hyper-specificity of the impulse parameter, with the bold highlighted values in *Ex.16.10* corresponding to impulse points in *Ex.16.11* (the boxes in the former demarcating impulse points within different partitions). The red values in italics in *Ex.16.10* denote the end of the impulse, with the following impulse point in the array used as a notational marker for performers to stop. When this marker is from another time-point layer these are placed half in/out of the stave (either top or bottom) and in *Ex.16.11* this is first seen in the second impulse of the string part. This is only used when the impulse duration is two or more, with impulse durations of one assigned a staccato accent.

The remaining examples will each only briefly discuss broad assignment overviews, with all outcomes for the five remaining two-bar sections shown in the tables and examples provided as well as Appendix 16.7.

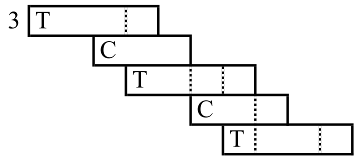


Ex.16.11

Bars 7 and 8

Bars	Compliment	Gestures		
7,8	Quintet	1	**3S, 1P**	3h, 1p
[2,8,9]	[1,3,4,5,6]	2	**3S**	3h
		3	**2S, 2P**	2S-2h, P-p, P-h
		4	**2S, 1P**	2h, 1p
		5	**1P, 2S, 1P**	P-h, 2S-2h, P-p

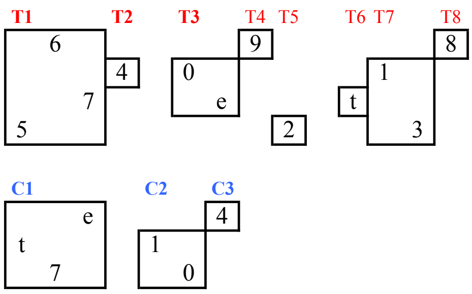
Table 16.18



Ex.16.12

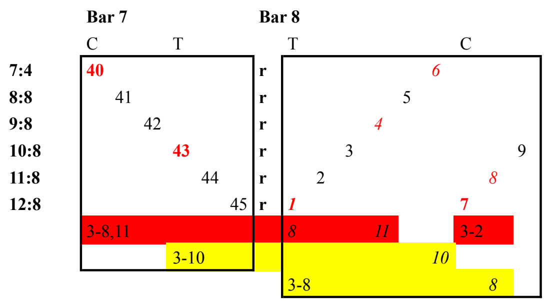
This section is assigned the trio 2F2R ([2,8,9]) and quintet complement ensemble ([1,3,4,5,6]), with the five gestures (G.Set 12) distributed three tetrachords to the trio and two trichords to the quintet (*Table 16.18*). The trio is assigned 3S+1P and 2S+2P (x2) gestures, the complement 3S and 2S+1P, with the gestures using superimposition variant 3 (*Ex.16.12*). The impulses are distributed across three partitions and two partitions in bars 7 and 8 respectively.

Trio			
1 - [6,4,7,5]	**3S, 1P**	3h, 1p	[4,1,3,2]
3 - [9,0,e,2]	**2S, 2P**	2S-2h, P-p, P-h	[2,3,1,4]
2 - [8,1,t,3]	**1P, 2S, 1P**	P-h, 2S-2h, P-p	[3,2,4,1]
Compliment			
1 - [e,t,7]	**3S**	3h	[2,3,1]
4 - [0,1,4]	**2S, 1P**	2h, 1p	[2,3,1]

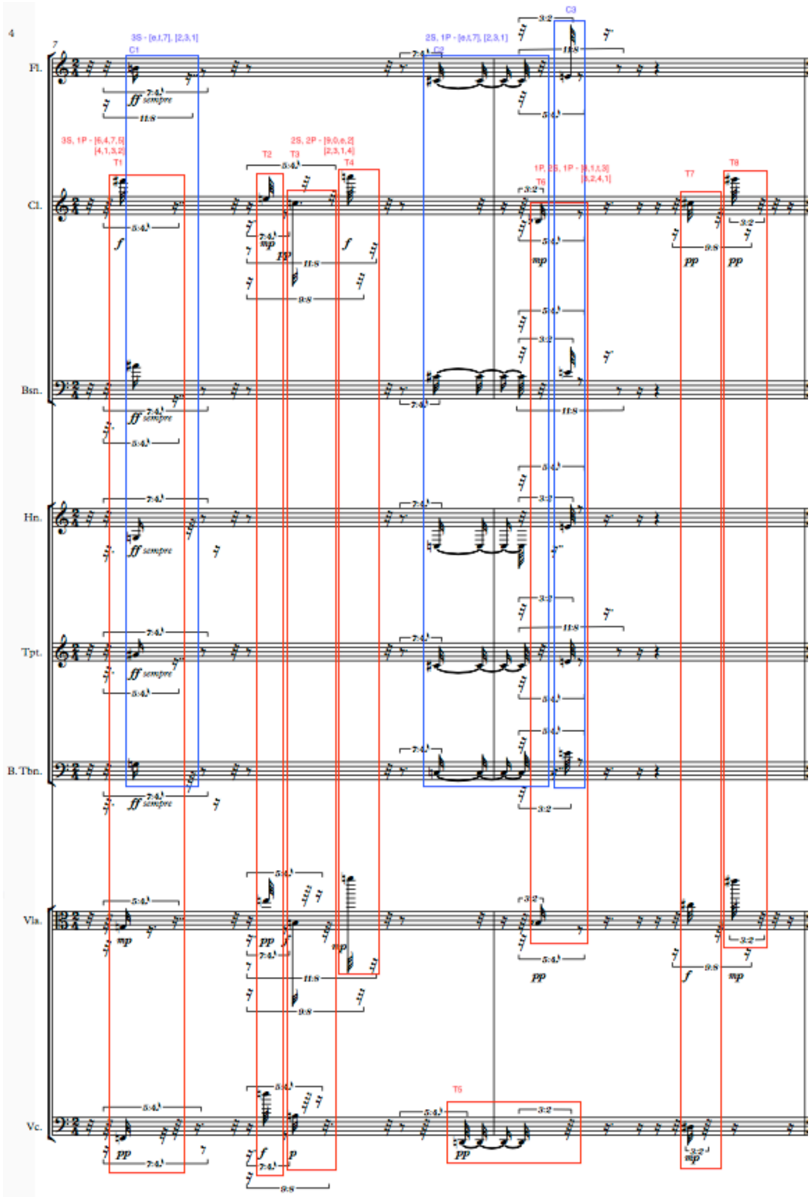


Ex.16.13

One will notice from the annotated score example in *Ex.16.15* (end of bar 7, cello and complement, C2 and T5) that sustained impulses have the capacity to last for durations longer than assigned in the compositional process. This was also true in *Objects 4*, where sim2 (staggered entries) gestures lasted until the final impulse was played. Because this two-bar section uses superimposition variant 3, coupled with a greater number of sustained impulses than were in bars 1 and 2, their durations are able to span across two partitions in one or two bars. An abridged time-point array of the end of bar 7 and the start of 8 is shown in *Ex.16.14* (trio = T/yellow, complement = C/red).



Ex.16.14

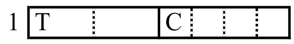


Ex.16.15

Bars 15 and 16

Bars	Compliment		Gestures	
15,16	Duet	1	**2S+2S**	4p
[2,5,9]	[3,4]	2	**4P**	p, p, p, h

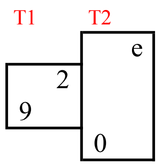
Table 16.19



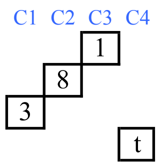
Ex.16.16

This section is assigned the trio 3F2R ([2,5,9]) and duet complement ensemble ([3,4]), with the two gestures (G.Set 3) using superimposition variant 1 (*Ex.16.16*) and the two tetrachords appear consecutively in the score. The trio is assigned a 2S+2S gesture, the complement 4P.

Trio
1 - [e,2,9,0] **2S+2S** 4p [3,2,4,1]



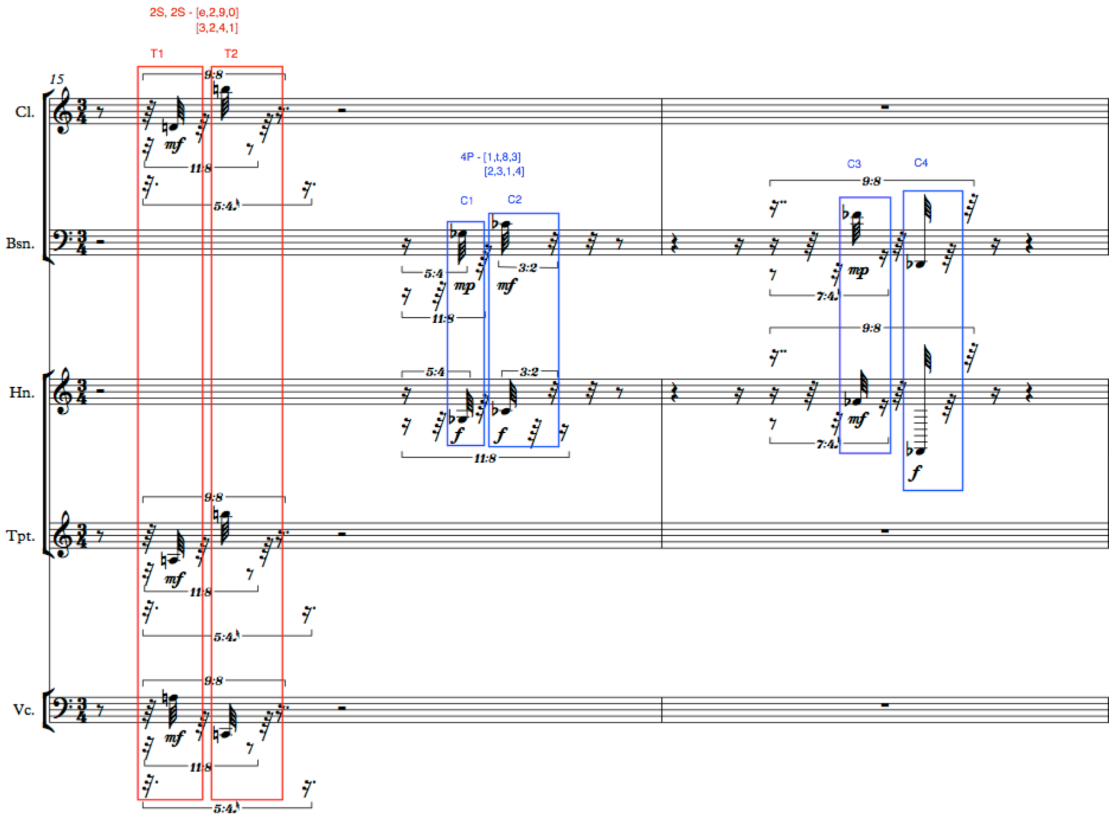
Compliment
2 - [1,8,3,t] **4P** p, p, p, h [2,3,1,4]



Ex.16.17

One can see from the annotated score in *Ex.16.18* that the gesture impulses are assigned to two partitions and one partition in bars 15 and 16 respectively, and with seven of the eight impulses unsustained points (*Ex.16.17*), the silences between these impulses has the effect of exaggerating the separation of gestures (*Ex.16.16*) further.

This is prevalent throughout the work and is a by-product of bar partitioning, with the partitions surrounded by rests of varying sizes (see Appendix 16.8).

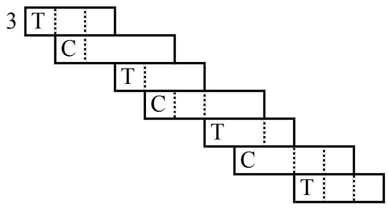


Ex.16.18

Bars 25 and 26

Bars	Compliment		Gestures	
25,26	Quartet	1	**3P**	3p
[2,7,9]	[1,3,5,6]	2	**1P, 3S**	1P-p, 3S-h,p,h
		3	**1P, 2S**	1h, 2p
		4	**2P, 2S**	2p, 2h
		5	**2S, 1P**	2h, 1p
		6	**2S, 2P**	4h
		7	**3P**	3h

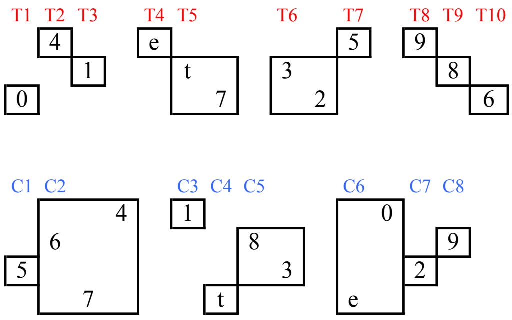
Table 16.20



Ex.16.19

These bars are assigned the trio 2F3R ([2,7,9]) and quartet complement ensemble ([1,3,5,6]), with the seven gestures (G.Set 15) using superimposition variant 3 (*Ex.16.19*). The trio has 3P, 2S+1P (x2) and 3P gestures, and the complement 1P+3S and 2P+2S (x2) gestures.

Trio			
3 - [4,1,0]	**3P**	3p	[3,1,2]
2 - [7,t,e]	**1P, 2S**	1h, 2p	[1,2,3]
1 - [5,3,2]	**2S, 1P**	2h, 1p	[2,3,1]
4 - [6,8,9]	**3P**	3h	[1,2,3]
Compliment			
3 - [4,6,5,7]	**1P, 3S**	1P-p, 3S-h,p,h	[3,2,4,1]
2 - [1,8,3,t]	**2P, 2S**	2p, 2h	[1,4,2,3]
1 - [0,9,2,e]	**2S, 2P**	4h	[4,1,3,2]



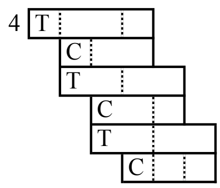
Ex.16.20

Bars 25 and 26 use the G.Set with the maximum number of gestures. As these are assigned to two and one partition in bars 25 and 26 respectively (*Ex.16.21*), the seven gestures in *Table 16.20* are realised in the fewest possible partitions, in effect increasing impulse saturation.

Bars 27 and 28

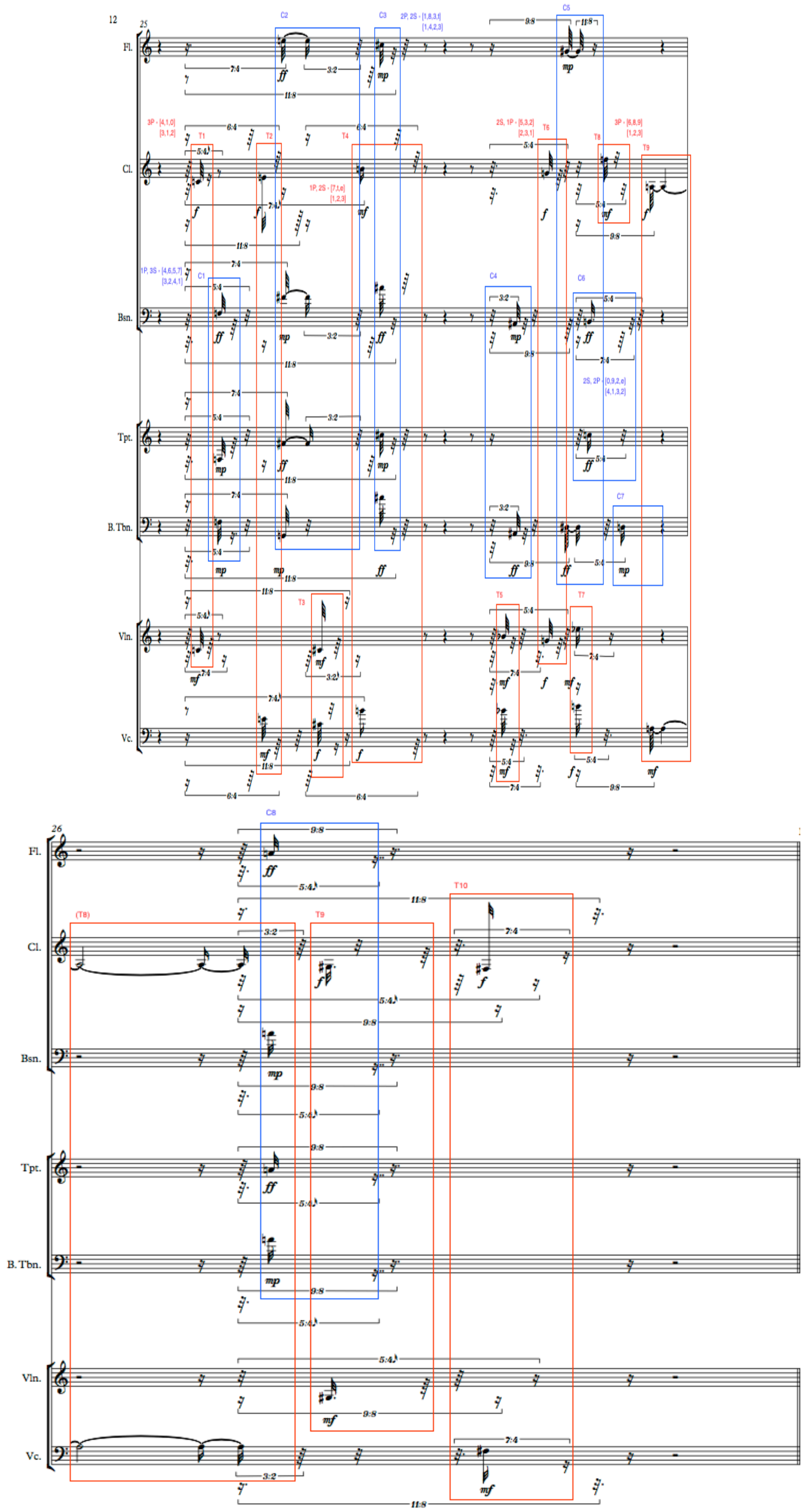
Bars	Compliment		Gestures	
27,28	Trio	1	**1P, 2S, 1P**	P-h, 2S-2h, P-p
[1,4,7]	[3,6,9] (3)	2	**1P, 2S**	1p, 2h
		3	**2S+2S**	4h
		4	**2S, 1P**	2p, 1h
		5	**2S+2S**	4p
		6	**3P**	3p

Table 16.21



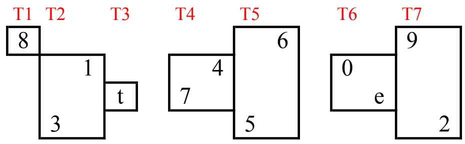
Ex.16.22

This section is assigned the trio 3F1R ([1,4,7]) and trio complement ensemble ([3,6,9]), with the six gestures (G.Set 14) using superimposition variant 4 (*Ex.16.22*). The root trio has 2P+2S and 2S+2S (x2) gestures, the complement trio 1P+2S (x2) and 3P gestures.

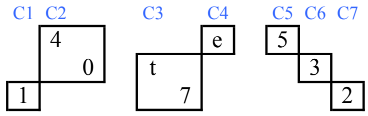


Ex.16.23

Trio				
2 - [8,1,t,3]	**1P, 2S, 1P**	P-h, 2S-2h, P-p	[1,4,2,3]	
1 - [6,4,7,5]	**2S+2S**	4h	[3,2,4,1]	
3 - [9,0,e,2]	**2S+2S**	4p	[2,3,1,4]	

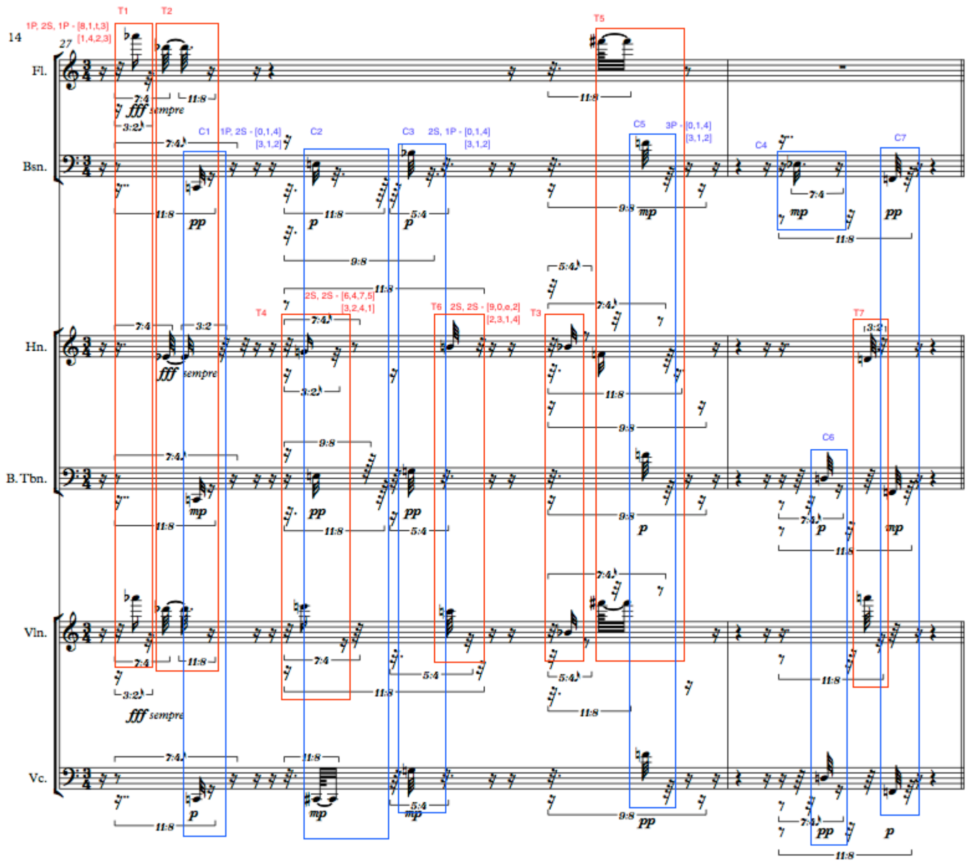


Compliment				
4 - [0,1,4]	**1P, 2S**	1p, 2h	[3,1,2]	
1 - [e,t,7]	**2S, 1P**	2p, 1h	[2,3,1]	
2 - [2,3,5]	**3P**	3p	[1,2,3]	



Ex.16.24

As can be seen in *Ex.16.24*, superimposition variant 4 results in non-linear outcomes in both the trio's and complement's gestures, with T1-7 and C1-7 from *Ex.16.24* ordered T1, T2, T4, T6, T3, T5, T7 and C1, C2, C3, C5, C4, C6, C7 in the score (*Ex.16.25*). The four other sections explained above had each ensemble's gestures assigned linearly, so each is realised (however segmented) as a whole.



Ex.16.25

Bars 29 and 30

Bars	Compliment		Gestures	
29,30	Sextet	1	**3P**	3h
[3,5,7]	[1,2,4,6,8,9]	2	**4S**	1p3h-h,h,p,h
		3	**1P, 2S**	1p, 2h
		4	**2S, 1P**	2p, 1h
		5	**4S**	2p2h-h,p,h,p
		6	**3P**	3p

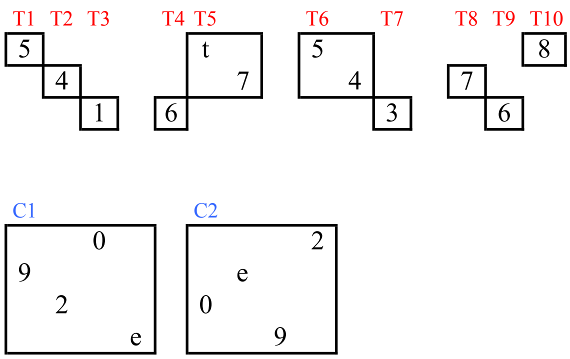
Table 16.22

1 

Ex.16.26

This final two-bar example is assigned the trio 3F3R ([3,5,7]) and sextet complement ensemble ([1,2,4,6,8,9]), with the six gestures (G.Set 13) using superimposition variant 1 (*Ex.16.26*), so the annotated score in *Ex.16.28* can be easily deciphered in reference to *Ex.16.26* and *Ex.16.27*. The root trio has 3P, 1P+2S (x2) and 3P gestures, the sextet 4S (x2) gestures.

Trio			
1 - [1,4,5]	**3P**	3h	[1,2,3]
4 - [t,7,6]	**1P, 2S**	1p, 2h	[3,1,2]
3 - [3,5,4]	**2S, 1P**	2p, 1h	[1,2,3]
2 - [8,6,7]	**3P**	3p	[2,3,1]
Compliment			
1 - [0,9,2,e]	**4S**	4 - 1p3h-h,h,p,h	[2,3,1,4]
3 - [2,e,0,9]	**4S**	3 - 2p2h-h,p,h,p	[3,2,4,1]



Ex.16.27

Ex.16.28

The same compositional techniques outlined in the examples and tables above are used in all other two-bar sections, with the extremely sparse and fragmented aesthetic sustained for the duration of the work. Although there are sections that have a higher level of impulse saturation and are therefore less sparse, the manner in which the material is realised and the overall sonic effect remains consistent throughout. With the construction of the work and sonic outcomes therein being modular in nature, the work exists as a series of sonic blocks, the instrumentation of which is shifting constantly throughout.

This extreme form of non-developmental, point-based music was achieved by the advances in object superimposition developed in *Objects 5* and *6*, two sets of studies that share some of the same qualities as this work but on smaller scales. The relentless nature of *Objects 6.3*, where the 3Sim gesture is the only gesture played throughout (albeit altered slightly on each of the 162 iterations), is particularly important in regards to *Objects 7*, in that throughout the duration of this work the trichords and tetrachords, although realised differently, are treated identically throughout. Therefore there is no evolution in and between gestures, which would mark a more organic or developmental approach, something that would negate the aesthetic initiated at the start of the work.

Once a point-based aesthetic approach has been formalised, the addition of objects that are not strictly pointillist in nature would sound odd in the work, so the idea of inserting these elements was not an option. With all of what could be termed 'decorative' elements expunged from the aesthetic discourse, at the core of the work's conception, construction and realisation is a desire and requirement inherent to the processes used to be enacted consistently and to completion, the work essentially becoming the end product of a series of interrelated systems and outcomes. In this work the system that is the focus on the migration of trios between instrumental families, with the completed system forming the skeletal structure of the work. The pitched material, using the same combinatorial matrix as that in *Objects 4* and *5* but with only one variant used throughout (reading from top to bottom P-0, R-0, RI-e and I-e), reflects and reinforces the sparse aesthetic approach enacted in this work. The gestural content is in a constant state of flux, never settling on any one realisation or dominant archetype, with each being constantly restructured and realised in a different manner, yet simultaneously staying consistently similar throughout.

17. Conclusions; Towards Utopia: Point Gestures as a Compositional Determinant

The compositional output and mechanisms detailed in Chapters Two, Three, Five, Seven, Nine, Eleven, Thirteen, Fifteen and Sixteen and the texts in the Introduction and Chapters Four, Six, Eight, Ten, Twelve and Fourteen detail an all-encompassing aesthetic approach that has its musical roots in the approach adopted by the Second Viennese School, the post-1945 avant-garde European composers, the so-called 'New Complexity' composers, the music and texts written by Gordon Downie and the early works of the American composer Milton Babbitt. As well as these there were of course other, non-musical influences on the music composed, notably the sciences, politics and the visual arts. Although not literally represented in the works, these influences played an equally important role in forming a global aesthetic approach – the focus of my research since 2009.

The purpose of this conclusion is two-fold: to discuss the past (a summary of the works presented in this thesis) and to consider the future of this aesthetic approach. The works will be summarized in isolation as well in relation to each other by delineating the trajectories of the various compositional processes that have been developed over the course of this research. As shown in the previous chapters and outlined below, not all of the processes devised (or works composed) have necessarily been successful in the creation of music and so have been abandoned in favour of other methods that were able to order sonic objects more efficiently and rigorously.

After completing a work, the degree to which I find it a success has always been taken from a pessimistic viewpoint. I find the faults or mistakes in the work, be they compromises in the pre-compositional process (used primarily to rectify minor deviations or inconsistencies in the resulting outcomes), or the degree to which the notational strategies result in redundant or superfluous elements, usually through the over-complication of a given parameter or notational strategy. I have found that, in order to fully develop as an artist, I prefer to be hypercritical of all matters pertaining to one's output in order to fully interrogate the methods employed and the deeper aesthetic reasoning that inform the works produced. Instead of removing these works from the final submission I have left them in to better demonstrate the progression and development of my aesthetic approach.

Towards Utopia: Point Gestures as a Compositional Determinant

As explained in Chapter Three, the proto-quantum works are not literal representations of the scientific principles relating to their respective titles. Although there are some musical 'equivalents' of these principles, for example 'quantum spin' in *Probability Interpretation*, the majority were used for initial conceptual and sonic starting points from which the pieces could be constructed, delineating forms of musical object that could be varied through a process of parametric mediation over the course of the work.

In contrast to the probabilistic and mimetic approach taken in the proto-quantum works, the works prefixed *Objects* are focused on the use of point gestures to derive micro- and macro-level outcomes, resulting in random processes being completely abandoned from *Objects 3.1* onwards. In part a reaction to the notational inconsistencies and excesses pertaining to *Objects 3.1* and the works before, *Objects 4-7* progressively refine or 'distil' the underlying processes by severely limiting the available variants of parametric sets (for example the total number of combinatorial pitch-class matrixes used), with the intention of streamlining and clarifying the systems developed in the previous works by stripping each parametric system and notational outcomes of their inelegant and excessive elements.

I found this to be a liberating process, with the later works in particular being extremely sparse in nature, perhaps best described by the useful contradiction 'varied invariance'. With the works focusing on point gesture projection, there is a clinical stillness to these works, pushing the point-based aesthetic to extreme degrees. The following will outline a summary of the development and refinement of techniques first introduced in the proto-quantum works, the emergence of point gestures as a key compositional device, their role in the quantisation of compositional output, utopian traits within the works, and the potential for these methods to shape future research avenues and compositional output.

Probability Interpretation, Two-Slit Experiments, Entanglement (2009-10)

Point gestures were not explicitly employed in *Probability Interpretation* (2009), and were only first used as a compositional device in *Two-Slit Experiments* (2010). In the pre-compositional notes for *Probability Interpretation* there is a mention of time signature assignments being derived from three columns using the six fundamental 3-Pgs, but these were not considered as fully at the time as I should have. From *Two-Slit Experiments* onwards all of the works have accompanying spreadsheets that were used to list information relating to constructive principles and parametric assignments more concisely, as well as clearer pre-compositional notes.

As highlighted, an egalitarian theme runs through the body of work presented here. The quantising of events and the parameters that shape them through processes that reinforce equality can be seen in instrumental (solos or duets) and time signature assignments. There are three types of instrumentations: solo cello, solo double bass and duet. With each denominator class of time signature having 12 numerator values (2/8…13/8, 14/16…25/16, 26/32…37/32), and each used only once in the work, there are therefore twelve solo cello bars, twelve solo double bass bars, and twelve duets bars.

The assignments relating to micro-level events (for example the dispersal of pitch classes between multiple pitch ranges) are achieved through similar means. Using the pitch range example, if there are multiple pitch ranges the pitch classes assigned would be evenly distributed between the assigned ranges, for example, twelve pitch classes across two pitch ranges will have six pitch classes assigned to each. Egalitarian methods like this are present in all my works written since 2009, with the processes refined and clarified by each work. I have shown that, through the expansion in the use of point gestures, one is able to bind the works more coherently.

Two-Slit Experiments uses point gestures extensively for both macro- and micro-level systems. The egalitarian nature of this work's construction is evident in Chapter Three.2, most obviously in the partitioning of the 88 keys of the piano (see *Ex.3.2.2*). Whereas in *Probability Interpretation*, where each 3-bar section can have repeated denominator class assignments (for example in bars 1-3 there are two bars with /8 denominators), in *Two-Slit Experiments* one of each denominator class is present in each 3-bar section, rectifying the inconsistencies of time signature assignments found in *Probability Interpretation*.

Employing three denominator classes (/8, /16 and /32), these were assigned using 3-Pgs. As there are six 3-Pgs and eighteen 3-bar macro-sections, each 3-Pg is assigned three times over the course of the work. These were assigned in three groups of six 3-Pgs using a random number generator, with the outcomes for the first six sections (bars 1-18) being 3, 2, 6, 4, 5 and 1 (see *Table 2.5*).

As well as 3-Pgs, 4-Pgs are used in this work to determine macro- and micro-level assignments, most notably in assigning fundamental set-types (P, I, R and RI) for /16 and /32 denominator classes and the vertical-temporal positions of /32 class material. The non-interference cluster content of the /32 class are points dispersed across four pitch ranges (see Appendix 3.2.1). To these ranges the numbers 1, 2, 3 and 4 (from high to low, 67-88 (1) to 1-22 (4)) were assigned, enabling 4-Pgs to assign pitch-classes to regions of the piano. These gestures are assigned by allocating gestures in groups of four containing one of each A, B, C and D gesture. *Table 3.2.3* listed all assignments for bars 20/32 to 24/32, with a gesture assigned a second time only when all other gestures had been used.

Entanglement (2010) is the only work where each instrument has the same number of pitch classes across the duration of the work. This work has importance because its key structural and conceptual device, the entanglement or coupling of objects and event outcomes, is the only compositional tool to survive from the proto-quantum works. Entanglement processes in this work assigned the same (total) number of pitch classes to structural antipodes, for example, as antipodes of each other, bars 1 and 27 are assigned the same number of pitches (four in each, *Table 3.3.1*). The aspect of entanglement that interests me most is the capacity for it to increase cohesion and equality. As well as this, by 'entangling' certain parametric values or intra- and inter-level objects, the total number of stages required to assign these parameters or objects can be drastically reduced.

4-Pgs are used in only one instance explicitly and that is for assigning fundamental set-types (*Table 3.3.3*). 3-Pgs are used more extensively, including time signature assignments within the central 3-bar section, the combinatorial partner of 'F-sets' (*Table 3.3.*4) that determines the pitch-class combinatorial matrix used, and also the order of time signatures in the central section of the work (Bars 13-15). These bars are assigned time signatures that share their temporal size with two others (*Table 2.13*). Only one of each (in rows 1, 2 and 3 of this table) is assigned in this section. As was mentioned in Chapter Two, two 3-Pgs (chosen by a random number generator) were used to firstly assign the row from *Table 2.13*, and secondly the denominator-type.

Since several variants of combinatorial matrix could be devised, I developed a system that assigned a combinatorial partner to the fundamental set and, from that, derived a full combinatorial matrix. There are three possible combinatorial partners for each F-set, listed in *Table 3.3.5*. As shown, each 3-Pg derived outcomes for three bars (*Table 3.3.6*), and from these designated the remaining two set-types to complete the combinatorial matrix.

There is a clear distinction between the proto-quantum works and the works in the Objects series. As described in Chapters Two and Four, the proto-quantum works remain heavily reliant on representative forms, for example by deriving musical equivalents of scientific phenomena (such as quantum spin). I came to view this mimetic approach as counter to the deep-rooted goal of increasing the level of abstraction in the works I compose. Works in the Objects series successively reject reliance on the sciences and stochastic processes by developing systems that became ever more reliant on the use of point gestures, enabling egalitarianism to be more fully integrated into the compositional process. This series can be split into three main groups: *Objects* and *Objects 2*, *Objects 3.1*, and *Objects 4-7*. Although *Objects 3.1* is important in its relation to the work as part of a series (see Chapter Fourteen), in part initiating the trajectory of the works that followed, in the context of the above groupings, I view it as an axial work marking a transition between the methods and means of expression in *Objects* and *Objects 2* to those used in *Objects 4-7*.

Objects: Object Distributions, *Objects 2: Four-Point Gestures*

Comparing the proto-quantum scores with the score of *Objects: Object Distributions,* one can see a significant leap in notational detail and technical difficulty, with the work achieving a more rigorous and abstract point-based aesthetic. 3- and 4-Pgs provide the means through which a highly ordered and egalitarian process of composition is achieved without the need to imbue the score with the surface-level mimesis found in the proto-quantum works.

Structurally *Objects* is different to the works preceding it because the sectional time signature assignments are grouped together by their respective saturation levels (*Table 5.1*), with their specific orderings (how they appear within the 5-bar section) determined using a random process (see *Table 2.16*). Whereas in the first two proto-quantum works there were specific material-types assigned to each denominator class, in the works from *Entanglement* onwards this is no longer the case. As the quantum aesthetic became more refined and unified in the Objects series, the need to designate different types of material to each denominator class became irrelevant, with the micro-objects (typically trichords and tetrachords) realised in such a way that reinforces equality in the works. This is more apparent in the ensemble works (*Objects 2*, *4* and *7*), as the instrumental forces can equally or relatively equally share the content of the gestures more explicitly.

The use of point gestures became more refined with the introduction of linked gestures. There are two ways in which gestures are linked, either by being entangled with one other or as a complement. Entangled partners are fixed and are always those gestures that appear at their antipode within the total set of gestures. For 3-Pgs the entangled partners are gestures 1 and 6, 2 and 5, and 3 and 4, giving:

1 – [1,2,3] ent. 6 – [3,2,1]
2 – [1,3,2] ent. 5 – [3,1,2]
3 – [2,1,3] ent. 4 – [2,3,1]
4 – [2,3,1] ent. 3 – [2,1,3]
5 – [3,1,2] ent. 2 – [1,3,2]
6 – [3,2,1] ent. 1 – [1,2,3]

One should note that the total value of the gesture numbers for entangled partners is the total number of gestures plus 1. So, with 3-Pgs the number is 7 and for 4-Pgs the number is 25.

As there are only nine complementary gestures for every 4-Pg (see *Table 5.4*), the set from which gestures can be assigned has been reduced from a theoretical total of 23 gestures (if only one gesture has been assigned) to just nine (or one with entangled partners). Limiting the total number of possible gestures that can be assigned through these two methods enables the assignment process to be streamlined and work more efficiently.

Using these two types of gesture, sub-sets of four 4-Pgs could be delineated and assigned to sections in the work to act as a principal source for assignment values. Example of these 4x4-Pg sets were shown in *Table 5.7*, where the sets were used extensively to demarcate vertical-temporal displacements in sections [0,2,1] and [e,9,t].

Point gestures are used extensively for most of the parameters in this work by building on the progress made in the proto-quantum works whilst devising new, more efficient methods of production. One can see that from a very limited set of values (three in 3-Pgs, four in 4-Pgs) one is effectively able to create entire works from permutations of two very limited sets: {1,2,3} and {1,2,3,4}.

The pitched material in *Objects* was expressed as either single points or simultaneous dyads. This approach is developed in *Objects 2*, with these two elements being used to delineate three fundamental 4-Pgs: four points (4P), two points with one simultaneous dyad/double-stop (2P+1DS) and two double-stopped dyads (2DS). These gestures are varied by the addition of 1, 2, 3 or 4 glissandi to each gesture, with each variant of gesture assigned to only one bar/section in the work. Whereas 3-Pgs are used in only a few instances in the work, for example in assigning dynamics or in *Table 7.2* for assigning specific gesture-types to sections, the use of 4-Pgs, as the full title of the piece infers, is more prevalent in this work.

The systems for the tuplets' starting positions were dependent on the number of tuplets assigned to the bar. Two tuplets per bar splits the assigned 4-Pg, with the first two values assigning macro-partitions and the second assigning two micro-partitions. For bars with three tuplets all 4s are removed from the 4-Pgs, omitting the fourth macro-partition of each bar, and using the remaining values of the 4-Pg to assign the tuplets to micro-partitions. Bars with four tuplets use 4-Pgs to assign tuplets to all macro-partitions. The 4-Pgs chosen were assigned using the same system used in *Objects*, using entangled and complementary partners.

The use of 4-Pgs to derive glissandi assignments is extensive in this work. Some of the glissando assignments, such as in bars 5 and 11, are determined by the instrumentation (itself derived using 4-Pgs) of the tetrachords assigned. The remaining glissandi bars incorporate 4-Pgs by a different means, highlighting the many ways in which point gestures can be used and manipulated to achieve a deeper coherence within the work. *Objects 2* is also the last work to use silences measured in seconds to separate sections. There were three works that used this technique, *Probability Interpretation*, *Objects* and *Objects 2*, with *Objects 2* having its silences ordered and assigned using 4-Pgs (*Table 7.4*). With sections in *Objects 2* lasting for a single bar, notating these silences using a full page instead of a small box at the bottom of each page (as shown in *Probability Interpretation*) foregrounds and reinforces the isolation and separation inherent in a work which assigns one form of gesture to each section. *Objects 2* both begins and ends with a page of silence, framing the work completely.

As well as the broad reduction in impulse content and notational saturation, the split that marks the separation of aesthetic approaches in the Objects series was first initiated in *Objects 3.1*.

Objects 3.1: Solo piece [1] – Problems in Utopia

This work was significantly revised after a masterclass at Brunel University, with the original version having double the number of impulses as well as extended techniques. The work felt extremely bloated and excessive and the extended techniques ineffective in the way I had written them. I set about drastically reducing the pitch-class and impulse content, cutting it by a half and removing all extended techniques. The results of this was a propensity for sparsity and uniformity of outcomes, something I found aesthetically freeing from the maximalist approach informed by the New Complexity composers I had admired, in which my music for several years up to this point could in theory be situated.

Between this work and *Objects 2*, there was an unfinished sketch of a string trio that attempted to develop more complex and intricate methods for the partitioning of bars, which in both the string trio sketches and *Objects 3.1* used tuplets spanning the entirety of the bar, with new sub-partitions demarcated by the numerator value of the tuplet. For example, a 5:4 tuplet could in theory assign five partitions to a bar. In hindsight, I found the score-based outcomes of this to be an inelegant means by which to achieve point and partition autonomy, overcomplicating the issue and creating greater degree of notational redundancy.

These issues are rectified in *Objects 4-7* using a far more simplistic approach, splitting the bars into partitions of a quaver or crotchet in size, separated by rests of various sizes. However, *Objects 3.1* made great advances in formalising a unified approach for the creation of 4x4-Pg matrixes. Chapter Nine showed that the 24 4-Pgs could be grouped together into six subsets containing four 4-Pgs (*Ex.9.2*), with these fundamental constructs used in all of the remaining works. An integral tool in the compositional process, it has been shown that these matrixes have the capacity to assign all of the parametric and sonic outcomes without the need to use random processes, whilst simultaneously giving similar (but more refined) outcomes. The works are also more consciously focused on formulating a rigorously constructed and conceptualised point-based aesthetic.

As the first work in a group of sixty-three, *Objects 3.1* also marks the point in my output where greater consideration and planning was taken in the choice of works to be written. Outlined in Chapter Fourteen, *Table 14.1,* were three groups of works; the Wreckhead, Vocalised Objects and Vocalised Satellites Series, in total at least 86 works. This quantising of compositional output is a means by which to meticulously plan future compositional activity around an agreed set of common goals or technical mechanisms. So far in the Wreckhead series, only broad strategies for solo works have been formulated, which will explore the capabilities of point gesture matrixes to affect sonic outcomes. The intended quintet complements of these solo works are to build upon and refine the techniques developed in the solo works to inform works using larger forces.

This approach requires a significant amount of forethought in relation to how the specific ensemble-types are ordered and constructed within each specific work and also in relation to all other instrumentations within its class as well as its complement. This process stems from methods developed in the works preceding this one where the ensemble used (for example the string quartet in *Objects 2*) is partitioned into sub-ensembles that are assigned to different sections or bars, and is also influenced by the partitioning of ensembles in Milton Babbitt's *Composition for Four Instruments* (1948).

With 3-Pgs and 4-Pgs more manageable using the methods outlined above and in the previous chapters, in *Objects 3.1* and the remaining works larger point gestures (5-Pgs and 6-Pgs) begin to be used more often, with 5-Pgs used in this work to assign the order of omitted denominator classes in *Table 2.21*, 'first-level' dynamics in *Table 9.16*, as well as to assign specific accent sets to bars in *Table 9.21*. 5-Pgs have only been needed in a limited number of situations, partly because most of the systems are based on 3- or 4-Pgs, but also because of the vast increase in the number of available point gestures. There are 120 5-Pgs (1x2x3x4x5, or 5!) and 720 (6!) 6-Pgs, which is a substantial increase from the number of 3- and 4-Pgs.

Objects 4: Vocalised Objects – The New Ennui, *Objects 5: Vocalised Objects 2 – Five short studies in the superimposition of point gestures, Objects 6: 3-Point Gestures Studies, Objects 7: Trio Migrations*

Objects 4 is the first in another series of works, Vocalised Objects, setting the entirety of Christian Bök's book of poetry *Eunoia* to music. This work corrected the inelegant partitioning systems of *Objects 3.1* and before and also greatly improved the methods by which impulses were assigned and notated. This work is the first work in which a mature and unified aesthetic and technical approach has finally been reached, with the most competent mechanisms by which to achieve these clarified and set in place. The most interesting facet of this work is the different ways in which micro-gestures (trichords and tetrachords, 3- and 4-Pgs) are specified and realised.

Instrumentation was an important factor in demarcating sub-sets of gestures that were different compared to other instrumentations. All six performers (and the quartet without vocalists) are never assigned to a section as a whole, reflected also at the level of the 4-Pg by never allowing the full tetrachord to be realised simultaneously, a 4sim gesture, with 3sim+1P being the closest gesture to 4sim in the work. This gesture partitioning (for a list of all gestures see *Table 11.4*), stems from the notion of complementary ensembles/instrumentations. For example, a 3sim+1P gesture would equate to a trio plus a solo in ensemble terms; '2sim + 2P' a duet and two solos.

Because the vocalists are restricted to singing only one pitch-class each at any given point in the work, the variety of gestures types used in *Objects 4* are not present in

Objects 5, with gestures in this work realised as three of four separated points. On occasion the two vocalists sing within the same partition resulting in a staggered dyad. However, this is not determined by gesture-type but instead by the distribution of pitch classes within the studies.

With its sparse orchestration and heavily reduced impulse and gesture content, *Objects 5* is the first work in the *Objects* series to focus on the superimposition of 3- and 4-Pgs, with each of the five studies deriving different methods by which this can be achieved depending on the gesture content. With this set of studies forming the first sub-group of works in the Vocalised Satellites series, their function is very much like the complementary works in the Wreckhead series. The brevity and sparsity of the studies in *Objects 5* is intended to concisely work on a specific set of problems: gesture superimposition and intersection. All of the following point gesture-based works expressed the gestures successively without, for example, staggering the entries of different gestures or segmenting, superimposing or reconfiguring them in ways that could increase point autonomy and abstraction.

By forcing oneself to radically reduce the totality of the material and procedures used, one can clarify the underlying processes needed to ensure that they can be effective when applying and adapting these strategies in larger scale works such as *Objects 7*. This is not just prevalent in *Objects 5*, with *Objects 6* taking a meticulous and extremely limited approach to gesture projection, and each study focusing on a single type of 3-Pg: 3P, 1P+2Sim and 3Sim.

In preparation for the next Vocalised Objects work, *And Sometimes* (within the Oiseau sub-group), the seven intended studies in *Objects 6* were formulated with the intention to familiarise myself with writing for and notating untuned percussion instruments. *And Sometimes* uses only words that do not contain vowels. With consonants in *Objects 4* and *5* primarily treated as having an undefined pitch focus, the vocal parts in this work will more than likely have a more pronounced noise quality instead of pitch clarity, so I concluded from this that *And Sometimes* would be scored for untuned percussion and vocalist(s), the specifics of instrumentation is currently undecided. With the first four texts in *Oiseau* being very limited in length and word use, enacting extreme limitations in the studies of *Objects 5* and *6* is also used to test the validity of these procedures to inform the sonic trajectories within and between the works in the Oiseau sub-group and also for the same procedures to be used in singular, large scale works.

The strategies for gesture superimposition and intersection in *Objects 5* and *6* were essential components in the realisation of *Objects 7.* The extreme point-based aesthetic of *Objects 4-6* has been successfully integrated in a large, 30 minute work. Like *Objects 6.3*, *Objects 7* has procedures that enable the migration from one state to another as a fundamental construct. In *Objects 6.3* this system is focused on small changes in the dynamic specifications of 3Sim gestures, and a near-identical system is used in *Objects 7* to delineate slight changes in the instrumentation of trios. With *Objects* 7 almost five times longer than *Objects 6.3*, the sonic outcomes in the former are glacial in comparison not just to *Objects 6.3* but all other works submitted in this thesis. What I believe encapsulates *Objects 4-7* is their complete indifference to compositional norms of development, instead insisting on establishing a uniform sound world at the start of each work, which is at no point changed to any significant degree.

In this brief overview of the compositions submitted here I have highlighted the key constructive devices present across the works written since 2009. Some of the devices that I felt uneasy using due to a lack of the required mathematical capacity, such as with stochastic processes, were abandoned to focus on the growing use of point gestures to determine parametric and sonic outcomes. As a result, from *Objects 3.1* onwards the works embody a greatly refined, point-based approach that has achieved a higher level of abstraction. When coupled with the large reduction in pitch-class content in these later works by use of only a very limited set of trichords and tetrachords at a reduced number of transposition levels, the works more clearly articulate the forms and constructive devices underpinning the works. By forcing the listener's ear away from colouristic, timbral devices such as extended playing techniques, the music forces the listener to instead focus on other parameters, such as impulse distance and duration, the difference in saturation levels between bars and sections, or the projection and distribution of micro- and macro-level objects.

Applying processes such as top-down decomposition to break down the facets of a problem or process (in this case music composition) into smaller, more manageable components or steps, has antecedents in Wassily Kandinsky's texts *Concerning the Spiritual in Art* (1912) and *Point and Line to Plane* (1926), 'proceed[ing] in a meticulously exact and pedantically precise manner.'[169] It is through these methods a unified approach is attained, assembling the constructive and sonic objects along the egalitarian principles that form the work's utopian construct.

As explained in the introduction of this thesis and also Chapters Four, Eight, Ten and Twelve, the visual arts have played an important role in informing my compositional practice. The advancements in the visual arts in the first quarter of the 20th Century with Cubism and De Stijl have had a lasting impact on the music I compose. The representation of multiple dimensions and perspectives in Pablo Picasso's Cubist period, as well as its angular lines and plane intersections, have analogues in music such as multidimensional combinatorial matrixes or the constant reconfiguration of 3- and 4-Pgs in *Objects 4-7*. The use of demarcated silences in *Probability Interpretation, Objects* and *Objects 2* are informed by the grid works of Piet Mondrian, with comparisons drawn between the demarcated white boxes and inter-sectional silences, and the boxes painted with prime colours analogous to the played bars, with this link perhaps most easily drawn in light of the comments above regarding *Objects 2*.

From *Objects 5* onwards, the visual art informing my aesthetic is heavily informed by the work of Kandinsky (explored earlier) and also the Suprematist works of Kazimir Malevich, both of which are focused on the expression and development of a geometric approach to object formation. As was mentioned in Chapter Eight,

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169 Kandinsky, W. (1979). *Point and Line to Plane*. New York: Dover Publications, p21

Malevich's *Suprematist Composition: White on White* (1918) has been the source of digital reproduction and manipulation by a Twitter account called 'The Kazimir Effect'[170], which as I wrote describes itself as 'An Exercise in Visual Poetry' (see Chapter Eight). *Objects 5-7* are heavily indebted to the extensively permutational approach taken by this Twitter account, with analogues to this account most notable in works such as *Objects 6.3*, which is essentially the same gesture played 162 times (slightly altered on each iteration).

In the introduction and also Chapters Six and Eight, the pervasive political discourse informs the salient characteristics of each work's constructs at a fundamental level. At the root of my political stance is the belief that an egalitarian society is the most desirable. This is not a controversial view, as an equal society would eliminate physical and systemic barriers to active engagement, thus making the society more productive overall. I believe this is true for the majority of people from all positions within the political spectrum because the vast majority of interactions and intentions between different people are peaceful and respectful.

Respectful debate of opposing and potentially offensive views on any number of topics is needed for the inherent differences between opposing societal or political factions to be negotiated before these matters become even more stratified. At some level this requires people to question their ingrained views and beliefs, for society to be more cohesively productive. At the start of my research in 2009, I would have been

[170] https://twitter.com/kazimireffect/status/828548034422140930

inclined to say the systems in place in society should be torn up and radically overhauled, without taking due care for the wider societal ramifications. This is still in part true, although I now believe the means through which this can be achieved are more sustainable through societal evolution rather than revolution. I believe we as a society in the United Kingdom are one of the more peaceful, free and equal in the world, but the stark contrasts in life experiences and opportunities within our culture, and the growing degree to which subsets of the population feel alienated and excluded, illustrate inherent flaws in the way our society is constructed and managed.

The works and accompanying texts presented in this thesis were focused on the formalisation of a unified aesthetic approach, that I term Quantum Music. A fundamental objective of my research since 2009 has been the codification of processes, systems and aesthetic strategies that enable the artwork to promote an egalitarian and utopian ideal. The apparent near-impossibility of the realisation of a society that is utopian in nature is rooted in all the works I have written during this period. The notational and physical barriers within each work, such as the amount of performance directions in the earliest works or the use of secondary tuplets to define impulse durations in the most recent works, effectively hinder the perfect realisation of the work, keeping the works in a constant state of flux, perpetually on the brink of fragmentation and internal collapse.

Appendices

2.1

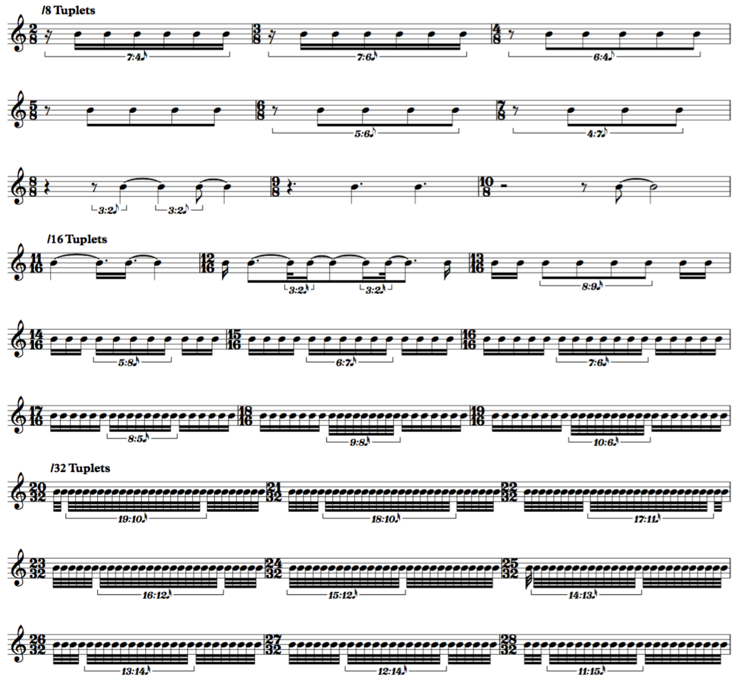
		[1,5,3,4,2,6]	**[5,3,1,6,4,2]**	**[3,1,5,2,6,4]**	**[4,6,2,5,1,3]**	**[2,4,6,1,3,5]**	**[6,2,4,3,5,1]**
[1,5,3,4,2,6]	**1**	[4,2,6,1,5,3]	[6,4,2,5,3,1]	[2,6,4,3,1,5]	[5,1,3,4,6,2]	[1,3,5,2,4,6]	[3,5,1,6,2,4]
[5,3,1,6,4,2]	**2**	[2,6,4,3,1,5]	[4,2,6,1,5,3]	[6,4,2,5,3,1]	[1,3,5,2,4,6]	[3,5,1,6,2,4]	[5,1,3,4,6,2]
[3,1,5,2,6,4]	**3**	[6,4,2,5,3,1]	[2,6,4,3,1,5]	[4,2,6,1,5,3]	[3,5,1,6,2,4]	[5,1,3,4,6,2]	[1,3,5,2,4,6]
[4,6,2,5,1,3]	**4**	[1,3,5,2,4,6]	[5,1,3,4,6,2]	[3,5,1,6,2,4]	[4,2,6,1,5,3]	[2,6,4,3,1,5]	[6,4,2,5,3,1]
[2,4,6,1,3,5]	**5**	[3,5,1,6,2,4]	[1,3,5,2,4,6]	[5,1,3,4,6,2]	[2,6,4,3,1,5]	[6,4,2,5,3,1]	[4,2,6,1,5,3]
[6,2,4,3,5,1]	**6**	[5,1,3,4,6,2]	[3,5,1,6,2,4]	[1,3,5,2,4,6]	[6,4,2,5,3,1]	[4,2,6,1,5,3]	[2,6,4,3,1,5]

Proto-quantum

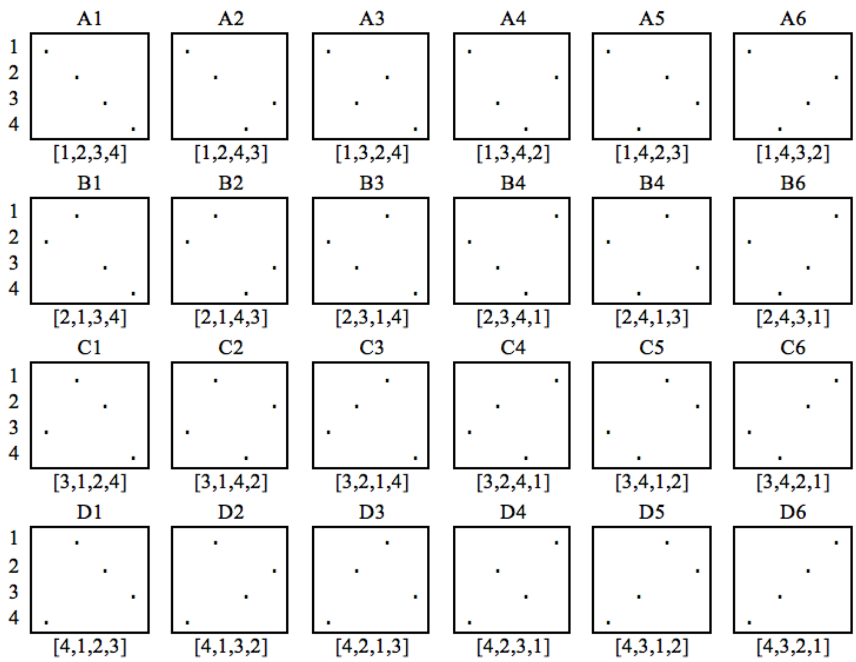
3.2.1

/8				**/16**				**/32**			
1-22	**23-44**	**45-66**	**67-88**	**1-22**	**23-44**	**45-66**	**67-88**	**1-22**	**23-44**	**45-66**	**67-88**
22	44	66	***C8* - 88**	22	44	66	***C8* - 88**	22	44	66	***C8* - 88**
21	43	65	87	21	43	65	87	21	43	65	87
20	42	***C6* - 64**	86	20	42	***C6* - 64**	86	20	42	***C6* - 64**	86
19	41	63	85	19	41	63	85	19	41	63	85
18	***C4* - 40**	62	84	18	***C4* - 40**	62	84	18	***C4* - 40**	62	84
17	39	61	83	17	39	61	83	17	39	61	83
***C2*16**	38	60	82	***C2*16**	38	60	82	***C2*16**	38	60	82
15	37	59	81	15	37	59	81	15	37	59	81
14	36	58	80	14	36	58	80	14	36	58	80
13	35	57	79	13	35	57	79	13	35	57	79
12	34	56	78	12	34	56	78	12	34	56	78
11	33	55	77	11	33	55	77	11	33	55	77
10	32	54	***C7* - 76**	10	32	54	***C7* - 76**	10	32	54	***C7* - 76**
9	31	53	75	9	31	53	75	9	31	53	75
8	30	***C5* - 52**	74	8	30	***C5* - 52**	74	8	30	***C5* - 52**	74
7	29	51	73	7	29	51	73	7	29	51	73
6	***C3* - 28**	50	72	6	***C3* - 28**	50	72	6	***C3* - 28**	50	72
5	27	49	71	5	27	49	71	5	27	49	71
***C1* 4**	26	48	70	***C1* 4**	26	48	70	***C1* 4**	26	48	70
3	25	47	69	3	25	47	69	3	25	47	69
2	24	46	68	2	24	46	68	2	24	46	68
1	23	45	67	1	23	45	67	1	23	45	67

3.2.2


/8 Tuplets
7:4
7:6
6:4
5:6
4:7
3:2
3:2
3:2
3:2
/16 Tuplets
8:9
5:8
6:7
7:6
8:5
9:8
10:6
/32 Tuplets
19:10
18:10
17:11
16:12
15:12
14:13
13:14
12:14
11:15

3.3.1


A1 A2 A3 A4 A5 A6
1
2
3
4
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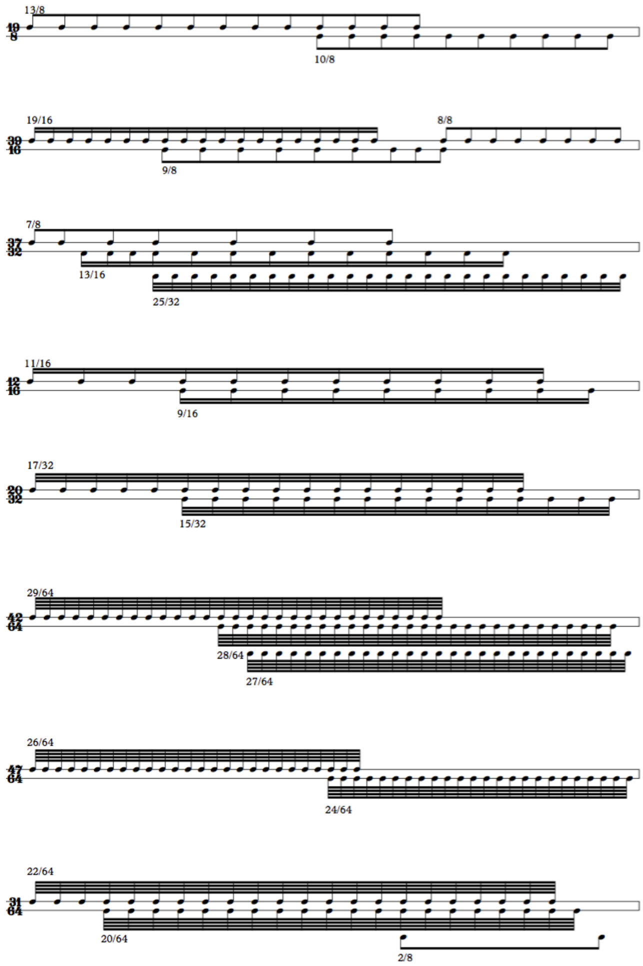
B1 B2 B3 B4 B4 B6
[2,1,3,4] [2,1,4,3] [2,3,1,4] [2,3,4,1] [2,4,1,3] [2,4,3,1]
C1 C2 C3 C4 C5 C6
[3,1,2,4] [3,1,4,2] [3,2,1,4] [3,2,4,1] [3,4,1,2] [3,4,2,1]
D1 D2 D3 D4 D5 D6
[4,1,2,3] [4,1,3,2] [4,2,1,3] [4,2,3,1] [4,3,1,2] [4,3,2,1]

3.3.2

1	1	2	3	4	5	6	7	8	9	10	11	12
R-6	t	9	0	1	2	e	7	8	5	4	3	6
RI-e	7	8	5	4	3	6	t	9	0	1	2	e
P-6	6	3	4	5	8	7	e	2	1	0	9	t
I-e	e	2	1	0	9	t	6	3	4	5	8	7
2												
RI-3	e	0	9	8	7	t	2	1	4	5	6	3
P-4	4	1	2	3	6	5	9	0	e	t	7	8
I-3	3	6	5	4	1	2	t	7	8	9	0	e
R-4	8	7	t	e	0	9	5	6	3	2	1	4
3												
P-4	4	1	2	3	6	5	9	0	e	t	7	8
R-4	8	7	t	e	0	9	5	6	3	2	1	4
I-3	3	6	5	4	1	2	t	7	8	9	0	e
RI-3	e	0	9	8	7	t	2	1	4	5	6	3
4												
I-5	5	8	7	6	3	4	0	9	t	e	2	1
R-6	t	9	0	1	2	e	7	8	5	4	3	6
RI-5	1	2	e	t	9	0	4	3	6	7	8	5
P-6	6	3	4	5	8	7	e	2	1	0	9	t
5												
P-8	8	5	6	7	t	9	1	4	3	2	e	0
I-1	1	4	3	2	e	0	8	5	6	7	t	9
R-8	0	e	2	3	4	1	9	t	7	6	5	8
RI-1	9	t	7	6	5	8	0	e	2	3	4	1
6												
I-7	7	t	9	8	5	6	2	e	0	1	4	3
RI-7	3	4	1	0	e	2	6	5	8	9	t	7
P-2	2	e	0	1	4	3	9	t	7	6	5	8
R-2	8	5	6	7	t	9	3	4	1	0	e	2

27	1	2	3	4	5	6	7	8	9	10	11	12
P-5	5	2	3	4	7	6	t	1	0	e	8	9
I-t	t	1	0	e	8	9	5	2	3	4	7	6
R-5	9	8	e	0	1	t	6	7	4	3	2	5
RI-t	6	7	4	3	2	5	9	8	e	0	1	t
26												
I-8	8	e	t	9	6	7	3	0	1	2	5	4
RI-8	4	5	2	1	0	3	7	6	9	t	e	8
P-3	3	0	1	2	5	4	t	e	8	7	6	9
R-3	9	6	7	8	e	t	4	5	2	1	0	3
25												
R-7	e	t	1	2	3	0	8	9	6	5	4	7
I-6	6	9	8	7	4	5	1	t	e	0	3	2
P-7	7	4	5	6	9	8	0	3	2	1	t	e
RI-6	2	3	0	e	t	1	5	4	7	8	9	6
24												
RI-6	2	3	0	e	t	1	5	4	7	8	9	6
R-1	5	4	7	8	9	6	2	3	0	e	t	1
I-6	6	9	8	7	4	5	1	t	e	0	3	2
P-1	1	t	e	0	3	2	6	9	8	7	4	5
23												
R-3	7	6	9	t	e	8	4	5	2	1	0	3
I-2	2	5	4	3	0	1	9	6	7	8	e	t
P-3	3	0	1	2	5	4	8	e	t	9	6	7
RI-2	t	e	8	7	6	9	1	0	3	4	5	2
22												
RI-4	0	1	t	9	8	e	3	2	5	6	7	4
I-4	4	7	6	5	2	3	e	8	9	t	1	0
R-5	9	8	e	0	1	t	6	7	4	3	2	5
P-5	5	2	3	4	7	6	t	1	0	e	8	9

3.3.3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19/16
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37
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13/16
25/32
11/16
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9/16
17/32
20
32
15/32
29/64
42
64
28/64
27/64
26/64
47
64
24/64
22/64
31
64
20/64
2/8

3.3.4

A		Splits
3,4,5	1	20/19
39 SQ	2	21/18
	3	22/17
	4	23/16
	5	24/15
	6	25/14

B		Splits
6,7,8	1	19/18
37 DSQ	2	20/17
	3	21/16
	4	22/15
	5	23/14
	6	24/13

C		Splits
13,14,15	1	22/20
42 HDSQ	2	23/19
	3	24/18
	4	25/17
	5	26/16
	6	27/15

D		Splits
18,19,20	1	16/15
31 HDSQ	2	17/14
	3	18/13
	4	19/12
	5	20/11
	6	21/10

E		Splits
24,25,26	1	10/9
19 DSQ	2	11/8
	3	12/7
	4	13/6
	5	14/5
	6	15/4

F		Splits
27,28,29	1	33/32
65 HDSQ	2	34/31
	3	35/30
	4	36/29
	5	37/28
	6	38/27

G		Splits
32,33,34	1	25/24
49 DSQ	2	26/23
	3	27/22
	4	28/21
	5	29/20
	6	30/19

H		Splits
35,36,37	1	36/35
71 DSQ	2	37/34
	3	38/33
	4	39/32
	5	40/31
	6	41/30

I		Splits
40,41,42	1	21/20
41 SQ	2	22/19
	3	23/18
	4	24/17
	5	25/16
	6	26/15

Objects

5.1

e				
1	**9/4**	144	48	33.33%
2	**37/16**	148	49	33.11%
3	**19/8**	152	50	32.89%
4	**18/8**	144	47	32.64%
5	**10/4**	160	52	32.50%

t				
1	**17/8**	136	44	32.35%
2	**35/16**	140	45	32.14%
3	**8/4**	128	41	32.03%
4	**36/16**	144	46	31.94%
5	**20/8**	160	51	31.88%

9				
1	**33/16**	132	42	31.82%
2	**34/16**	136	43	31.62%
3	**21/8**	168	53	31.55%
4	**11/4**	176	55	31.25%
5	**16/8**	128	40	31.25%

8				
1	**15/8**	120	37	30.83%
2	**22/8**	176	54	30.68%
3	**31/16**	124	38	30.65%
4	**32/16**	128	39	30.47%
5	**23/8**	184	56	30.43%

7				
1	**7/4**	112	34	30.36%
2	**12/4**	192	58	30.21%
3	**29/16**	116	35	30.17%
4	**30/16**	120	36	30%
5	**24/8**	192	57	29.69%

6				
1	**49/32**	98	29	29.59%
2	**25/8**	200	59	29.50%
3	**14/8**	112	33	29.46%
4	**6/4**	96	28	29.17%
5	**13/4**	208	60	28.85%

5				
1	**26/16**	104	30	28.85%
2	**27/16**	108	31	28.70%
3	**48/32**	96	27	28.13%
4	**47/32**	94	26	27.66%
5	**46/32**	92	25	27.17%

4				
1	**45/32**	90	24	26.67%
2	**28/16**	112	32	26.23%
3	**44/32**	88	23	26.14%
4	**43/32**	86	22	25.58%
5	**42/32**	84	21	25%

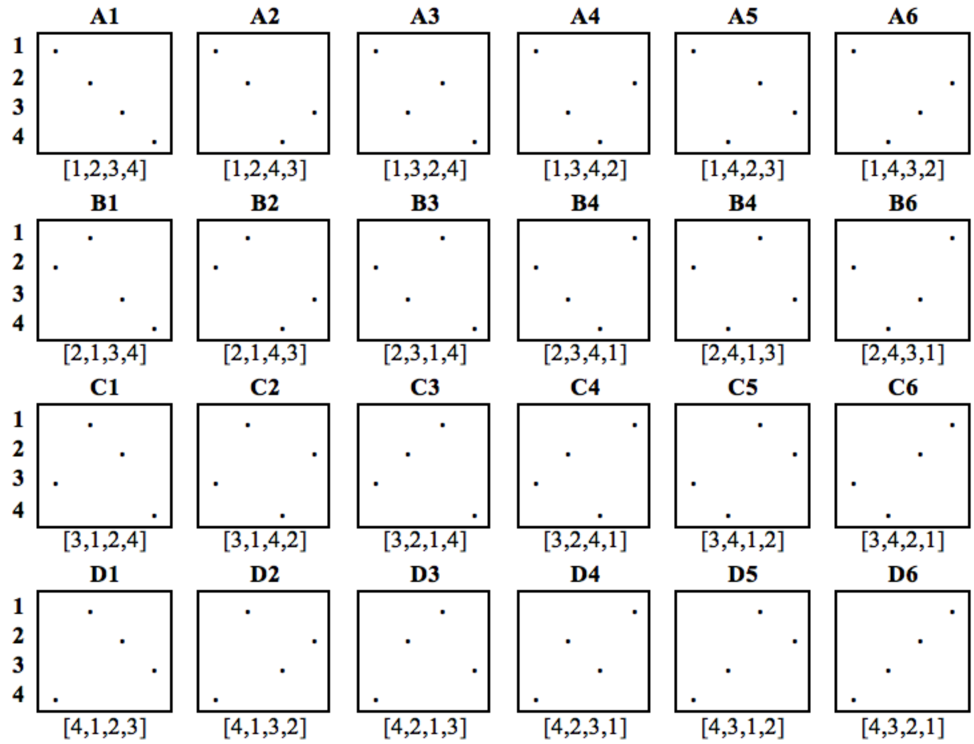
3				
1	**41/32**	82	20	24.39%
2	**5/4**	80	19	23.75%
3	**4/4**	64	15	23.44%
4	**61/64**	61	14	22.95%
5	**40/32**	80	18	22.50%

2				
1	**39/32**	78	17	21.79%
2	**60/64**	60	13	21.67%
3	**38/32**	76	16	21.05%
4	**59/64**	*59*	12	20.34%
5	**58/64**	*58*	11	18.97%

1				
1	**57/64**	*57*	10	17.54%
2	**56/64**	*56*	9	16.07%
3	**55/64**	*55*	8	14.54%
4	**54/64**	*54*	7	12.96%
5	**53/64**	*53*	6	11.32%

0				
1	**52/64**	*52*	5	9.62%
2	**51/64**	*51*	4	7.84%
3	**50/64**	*50*	3	6%
4	**3/4**	48	2	4.17%
5	**2/4**	32	1	3.13%

5.2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A2
A3
A4
A5
A6
1
2
3
4
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[1,2,4,3]
[1,3,2,4]
[1,3,4,2]
[1,4,2,3]
[1,4,3,2]
B1
B2
B3
B4
B4
B6
[2,1,3,4]
[2,1,4,3]
[2,3,1,4]
[2,3,4,1]
[2,4,1,3]
[2,4,3,1]
C1
C2
C3
C4
C5
C6
[3,1,2,4]
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[3,2,1,4]
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D1
D2
D3
D4
D5
D6
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[4,2,1,3]
[4,2,3,1]
[4,3,1,2]
[4,3,2,1]

Objects 2

7.1

Bar	T-Sig	From Set	Gesture	No. of	Impulses	No. of pc	No. of Tups	Plus/Minus	Tuplet	%
1	2\4	4	4P	3	12	12	2	Plus	27\14	192.86
									28\15	186.67
3	3\4	5	2DS	6	12	24	2	Plus	27\15	180
									25\14	178.57
7	5\4	6b	2DS +1G	9	18	36	2	Plus	28\16	175
									24\14	171.43
2	4\4	6a	4P+1G	9	36	36	2	Plus	25\15	166.67
									24\15	160
6	6\4	7	2P+1DS+1G	12	36	48	3	Plus	25\16	156.25
									28\18	155.56
									25\18	138.89
10	10\4	9b	2DS+2G	18	36	72	3	Plus/Minus	27\20	135
									21\16	131.25
									16\28	57.14
4	7\4	8a	2P+1DS	15	45	60	3	Minus	14\24	58.33
									16\27	59.26
									15\25	60
5	9\4	9a	2P+1DS+2G	18	54	72	4	Minus	15\24	62.5
									16\25	64
									18\28	64.29
									14\20	70
8	8\4	8b	4P+2G	15	60	60	4	Minus	18\25	72
									20\27	74.07
									16\21	76.19
									21\25	84
11	11\4	t	4P+4G	21	84	84	4	Minus	25\28	89.29
									18\20	90
									25\27	92.59
									14\15	93.33
9	12\4	e	4P+3G	24	96	96	4	Minus	15\16	93.75
									20\21	95.24
									24\25	96
									27\28	96.43

7.2

4P	[1,3,4,2]	4	**4P+1G**	[2,3,1,4]	9	**4P+3G**	[3,2,4,1]	16
4P	[2,4,3,1]	12	**4P+1G**	[4,3,1,2]	23	**4P+3G**	[1,4,2,3]	5
4P	[1,2,4,3]	2	**4P+1G**	[3,4,1,2]	17	**4P+3G**	[2,4,1,3]	11
4P+4G	[3,4,2,1]	18	**4P+1G**	[4,2,3,1]	22	**4P+3G**	[4,2,1,3]	21
4P+4G	[4,3,2,1]	24	**4P+1G**	[2,4,1,3]	11	**4P+3G**	[2,1,3,4]	7
4P+4G	[2,1,4,3]	8	**4P+1G**	[4,2,1,3]	21	**4P+3G**	[4,3,1,2]	23
4P+4G	[4,2,3,1]	22	**4P+1G**	[3,1,2,4]	13	**4P+3G**	[2,4,3,1]	12
4P+4G	[3,2,4,1]	16	**4P+1G**	[4,1,2,3]	19	**4P+3G**	[1,4,3,2]	6
4P+4G	[4,1,2,3]	19	**4P+1G**	[2,3,4,1]	10	**4P+3G**	[2,3,4,1]	10
4P+4G	[2,3,4,1]	10				**4P+3G**	[4,3,2,1]	24
4P+4G	[1,4,2,3]	5	**4P+2G**	[4,3,2,1]	24	**4P+3G**	[2,1,4,3]	8
4P+4G	[2,4,1,3]	11	**4P+2G**	[3,4,2,1]	18	**4P+3G**	[1,3,2,4]	3
			4P+2G	[1,4,2,3]	5			
4P+4G	[3,1,4,2]	14	**4P+2G**	[4,1,3,2]	20	**4P+3G**	[4,2,3,1]	22
4P+4G	[4,1,3,2]	20	**4P+2G**	[2,1,3,4]	7	**4P+3G**	[3,4,1,2]	17
4P+4G	[3,2,1,4]	15	**4P+2G**	[1,2,3,4]	1	**4P+3G**	[1,2,3,4]	1
4P+4G	[1,4,3,2]	6	**4P+2G**	[3,2,1,4]	15	**4P+3G**	[3,2,1,4]	15
4P+4G	[2,3,1,4]	9	**4P+2G**	[1,4,3,2]	6	**4P+3G**	[4,1,2,3]	19
4P+4G	[1,3,2,4]	3	**4P+2G**	[2,4,3,1]	12	**4P+3G**	[3,1,2,4]	13
4P+4G	[3,4,1,2]	17	**4P+2G**	[1,3,4,2]	4	**4P+3G**	[1,2,4,3]	2
4P+4G	[1,2,3,4]	1	**4P+2G**	[3,1,4,2]	14	**4P+3G**	[3,4,2,1]	18
4P+4G	[2,1,3,4]	7	**4P+2G**	[1,3,2,4]	3	**4P+3G**	[1,3,4,2]	4
4P+4G	[4,3,1,2]	23	**4P+2G**	[2,1,4,3]	8	**4P+3G**	[3,1,4,2]	14
4P+4G	[3,1,2,4]	13	**4P+2G**	[1,2,4,3]	2	**4P+3G**	[4,1,3,2]	20
4P+4G	[4,2,1,3]	21	**4P+2G**	[3,2,4,1]	16	**4P+3G**	[2,3,1,4]	9

7.3

<table>
<tr><th colspan="11">Trio Assignments</th></tr>
<tr><th>Bar</th><th>Gesture</th><th>Trio</th><th>4P-G</th><th>Bar</th><th>Gesture</th><th>Trio</th><th>4P-G</th><th>Gesture</th><th>Trio</th><th>4P-G</th></tr>
<tr><td rowspan="6">6</td><td>1</td><td>4</td><td rowspan="4">4312</td><td rowspan="12">9</td><td>1</td><td>3</td><td>[241]3</td><td>13</td><td>4</td><td rowspan="4">4231</td></tr>
<tr><td>2</td><td>3</td><td>2</td><td>1</td><td rowspan="4">1234</td><td>14</td><td>2</td></tr>
<tr><td>3</td><td>1</td><td>3</td><td>2</td><td>15</td><td>3</td></tr>
<tr><td>4</td><td>2</td><td>4</td><td>3</td><td>16</td><td>1</td></tr>
<tr><td>5</td><td>3</td><td rowspan="4">34/12</td><td>5</td><td>4</td><td>17</td><td>2</td><td rowspan="4">2143</td></tr>
<tr><td>6</td><td>4</td><td>6</td><td>3</td><td rowspan="3">[4]321</td><td>18</td><td>1</td></tr>
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<tr><td>8</td><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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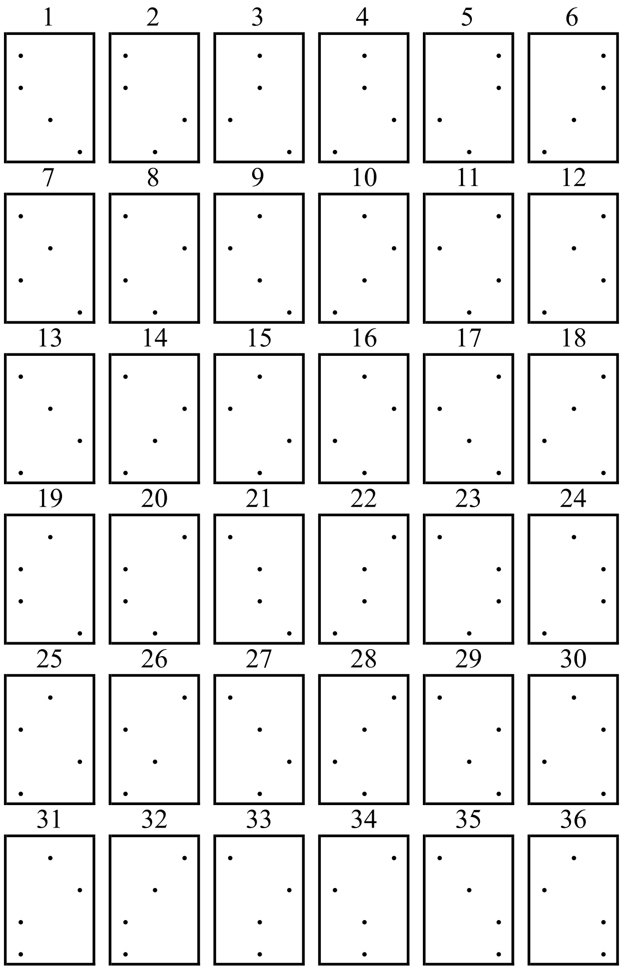
7.4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33
34
35
36

7.5

Bar	Gesture	1DS+2P	Bar	Gesture	1DS+2P+1G	Bar	Gesture	1DS+2P+2G
4	1	2	6	1	6	5	1	26
	2	15		2	20		2	17
	3	21		3	11		3	31
	4	10		4	8		4	24
	5	30		5	19		5	9
	6	32		6	35		6	36
	7	4		7	25		7	25
	8	14		8	13		8	18
	9	29		9	12		9	3
	10	34		10	2		10	8
	11	19		11	18		11	23
	12	12		12	29		12	33
	13	1					13	5
	14	28					14	7
	15	13					15	27
							16	16
							17	22
							18	35

Objects 3.1

9.1

Q = 144	**Dist.**	**1**	**2**	**3**	**4**	**X**
\4	**1**	**X**	(+1) 2	1	1	1
\8	**1**	1	**X**	(+1) 2	1	1
\16	**2**	2	2	**X**	(+1) 3	2
\32	**1**	1	1	(+1) 2	**X**	(+1) 2
\64	**1**	(+1) 2	1	1	1	**X**
	P-c = 6					
Q = 108	**Dist.**	**1**	**2**	**3**	**X**	**4**
\4	**2**	**X**	(+2) 4	2	2	(+1) 3
\8	**3**	(+1) 4	**X**	(+1) 4	3	3
\16	**2**	2	(+1) 3	**X**	(+2) 4	2
\32	**3**	3	3	(+1) 4	**X**	(+1) 4
\64	**2**	(+1) 3	2	2	(+1) 3	**X**
	P-c = 12					
Q = 90	**Dist.**	**1**	**2**	**X**	**3**	**4**
\4	**3**	**X**	(+2) 5	3	3	(+1) 4
\8	**3**	(+1) 4	**X**	(+2) 5	3	3
\16	**3**	3	(+1) 4	**X**	(+2) 5	3
\32	**3**	3	3	(+1) 4	**X**	(+2) 5
\64	**3**	(+2) 5	3	3	(+1) 4	**X**
	P-c = 15					
Q = 72	**Dist.**	**1**	**X**	**2**	**3**	**4**
\4	**4**	**X**	(+2) 6	4	4	(+2) 6
\8	**3**	(+2) 5	**X**	(+2) 5	3	3
\16	**4**	4	(+1) 5	**X**	(+2) 6	4
\32	**3**	3	3	(+2) 5	**X**	(+2) 5
\64	**4**	(+2) 6	4	4	(+1) 5	**X**
	P-c = 18					
Q = 36	**Dist.**	**X**	**1**	**2**	**3**	**4**
\4	**4**	**X**	(+4) 8	4	4	(+2) 6
\8	**6**	(+2) 8	**X**	(+2) 8	6	6
\16	**4**	4	(+2) 6	**X**	(+4) 8	4
\32	**6**	6	6	(+2) 8	**X**	(+2) 8
\64	**4**	(+2) 6	4	4	(+2) 6	**X**
	P-c = 24					

9.2

Q = 144

6	3	2	1	1	1	2	3
3	2	1	3	4	2	3	1
2	1	3	2	5	3	1	2
3	2	1	3	4	2	3	1
2	1	3	2	5	3	1	2
6	3	2	1	1	1	2	3
2	1	3	2	5	3	1	2
6	3	2	1	1	1	2	3
3	2	1	3	4	2	3	1

Q = 108

1	1	2	3	6	3	2	1
4	2	3	1	3	2	1	3
5	3	1	2	2	1	3	2
4	2	3	1	3	2	1	3
5	3	1	2	2	1	3	2
1	1	2	3	6	3	2	1
5	3	1	2	2	1	3	2
1	1	2	3	6	3	2	1
4	2	3	1	3	2	1	3

Q = 90

3	2	1	3	4	2	3	1
2	1	3	2	5	3	1	2
6	3	2	1	1	1	2	3
2	1	3	2	5	3	1	2
6	3	2	1	1	1	2	3
3	2	1	3	4	2	3	1
6	3	2	1	1	1	2	3
3	2	1	3	4	2	3	1
2	1	3	2	5	3	1	2

Q = 72

2	1	3	2	5	3	1	2
6	3	2	1	1	1	2	3
3	2	1	3	4	2	3	1
6	3	2	1	1	1	2	3
3	2	1	3	4	2	3	1
2	1	3	2	5	3	1	2
3	2	1	3	4	2	3	1
2	1	3	2	5	3	1	2
6	3	2	1	1	1	2	3

Q = 36

5	3	1	2	2	1	3	2
1	1	2	3	6	3	2	1
4	2	3	1	3	2	1	3
1	1	2	3	6	3	2	1
4	2	3	1	3	2	1	3
5	3	1	2	2	1	3	2
4	2	3	1	3	2	1	3
5	3	1	2	2	1	3	2
1	1	2	3	6	3	2	1

9.3

Bars 1...20					Bars 21...40					Bars 41...60					Bars 61...80				
5	3	1	4	2	1	4	2	5	3	4	2	5	3	1	3	1	4	2	5
1	4	2	5	3	5	3	1	4	2	3	1	4	2	5	4	2	5	3	1
2	5	3	1	4	2	5	3	1	4	2	5	3	1	4	2	5	3	1	4
3	1	4	2	5	4	2	5	3	1	1	4	2	5	3	5	3	1	4	2
4	2	5	3	1	3	1	4	2	5	5	3	1	4	2	1	4	2	5	3

9.4

1	2	3	4	[1,2,4,3]	[1,2,3]
4	3	2	1	[3,4,2,1]	[1,2,4]
2	1	4	3	[3,2,1,4]	[1,2,5]
3	4	1	2	[2,1,3,4]	[1,2,6]
				[4,3,1,2]	[1,3,4]

4	3	2	1	[4,3,1,2]	[1,3,5]
1	2	3	4	[2,1,3,4]	[1,3,6]
3	4	1	2	[2,3,4,1]	[1,4,5]
2	1	4	3	[3,4,2,1]	[1,4,6]
				[1,2,4,3]	[1,5,6]

2	1	4	3	[2,1,3,4]	[2,3,4]
3	4	1	2	[4,3,1,2]	[2,3,5]
1	2	3	4	[4,1,2,3]	[2,3,6]
4	3	2	1	[1,2,4,3]	[2,4,5]
				[3,4,2,1]	[2,4,6]

3	4	1	2	[3,4,2,1]	[2,5,6]
2	1	4	3	[1,2,4,3]	[3,4,5]
4	3	2	1	[1,4,3,2]	[3,4,6]
1	2	3	4	[4,3,1,2]	[3,5,6]
				[2,1,3,4]	[4,5,6]

9.5

Bars 1…20

1				Ent.			
1	**1**	**2**	**3**	**6**	**3**	**2**	**1**
4	2	3	1	3	2	1	3
5	3	1	2	2	1	3	2
3	**2**	**1**	**3**	**4**	**2**	**3**	**1**
2	1	3	2	5	3	1	2
6	3	2	1	1	1	2	3

Bars 21…40

2				Ent.			
2	**1**	**3**	**2**	**5**	**3**	**1**	**2**
6	3	2	1	1	1	2	3
3	2	1	3	4	2	3	1
5	**3**	**1**	**2**	**2**	**1**	**3**	**2**
1	1	2	3	6	3	2	1
4	2	3	1	3	2	1	3

Bars 41…60

5				Ent.			
5	**3**	**1**	**2**	**2**	**1**	**3**	**2**
1	1	2	3	6	3	2	1
4	2	3	1	3	2	1	3
2	**1**	**3**	**2**	**5**	**3**	**1**	**2**
6	3	2	1	1	1	2	3
3	2	1	3	4	2	3	1

Bars 61…80

6				Ent.			
6	**3**	**2**	**1**	**1**	**1**	**2**	**3**
3	2	1	3	4	2	3	1
2	1	3	2	5	3	1	2
4	**2**	**3**	**1**	**3**	**2**	**1**	**3**
5	3	1	2	2	1	3	2
1	1	2	3	6	3	2	1

9.6

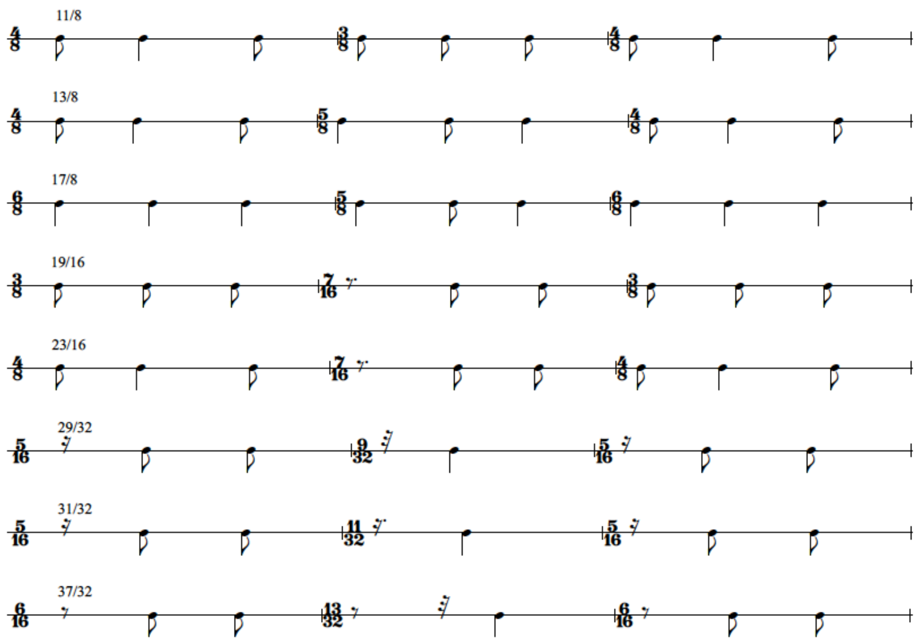
1	[2,3,6]	**4**				
2	[1,3,4]	**4**				
3	[1,3,5]	**4**				
4	[3,5,6]	**4**				
5	[1,4,6]	**3**	1.2	1	2	5
6	[3,4,5]	**1**				
7	[2,3,4]	**2**	3.3	3	4	6
8	[1,2,5]	**3**	3.3	4	5	6
9	[1,2,3]	**1**				
10	[1,3,6]	**2**	3.3	3	5	6
11	[2,4,5]	**1**				
12	[4,5,6]	**2**	2.1	2	4	5
13	[3,4,6]	**1**				
14	[1,5,6]	**1**				
15	[1,2,6]	**2**	3.2	2	4	6
16	[2,3,5]	**4**				
17	[1,2,4]	**3**	1.1	1	3	5
18	[2,4,6]	**3**	1.1	1	2	3
19	[2,5,6]	**3**	1.1	1	2	3
20	[1,4,5]	**2**	2.3	1	5	6

Objects 4

11.1

Paragraph 1		Wrd.Ptns.	P-c content
the	th - e	2	6
univocal	u - n - i - v - o - c - a - l	8	24
inspired	i - n - s - p - i - re - d	7	21
coterie	c - o - t - er - ie	5	15
Sisyphean	S - i - s - y - ph - e - an	7	21
improbable	i - m - p - r - o - b - a - ble	8	24
Paragraph 2			
abides	a - b - i - des	4	12
culinary	c - u - l - i - n - a - r - y	8	24
accent	a - c - c - e - n - t	6	18
vowel	v - o - w - e - l	5	15
include	i - n - c - l - u - de	6	18
substantive	S - u - b - s - ta - n - ti - ve	8	24
Paragraph 3			
French	F - re - n - ch	4	12
tribute	t - r - i - b - u - te	6	18
only	o - n - l - y	4	12
translation	t - ra - n - s - l - a - t - ion	8	24
like	li - ke	2	6
make	m - a - ke	3	9
Paragraph 4			
required	r - e - q - ui - re - d	6	18
encouragement	en - c - our - a - ge - m - en - t	8	24
Bernstein	B - er - n - s - t - ei - n	7	21
Johnston	J - oh - n - s - to - n	6	18
Kim	K - i - m	3	9
car	c - ar	2	6

11.2



11.3

P-0	0	1	4	5	3	2	e	t	7	6	8	9
R-0	9	8	6	7	t	e	2	3	5	4	1	0
RI-e	2	3	5	4	1	0	9	8	6	7	t	e
I-e	e	t	7	6	8	9	0	1	4	5	3	2

1-3

0	1	4
9	8	6
2	3	5
e	t	7

10-12

6	8	9
4	1	0
7	t	e
5	3	2

2-4

1	4	5
8	6	7
3	5	4
t	7	6

9-11

7	6	8
5	4	1
6	7	t
4	5	3

3-5

4	5	3
6	7	t
5	4	1
7	6	8

8-10

t	7	6
3	5	4
8	6	7
1	4	5

4-6

5	3	2
7	t	e
4	1	0
6	8	9

7-9

e	t	7
2	3	5
9	8	6
0	1	4

11.4

	A				B				C				D			
	1				2				3				4			
1	1	2	3	4	2	1	4	3	3	4	1	2	4	3	2	1
	4	3	2	1	3	4	1	2	2	1	4	3	1	2	3	4
	2	1	4	3	1	2	3	4	4	3	2	1	3	4	1	2
	3	4	1	2	4	3	2	1	1	2	3	4	2	1	4	3
	1				2				4				3			
2	1	2	4	3	2	1	3	4	4	3	1	2	3	4	2	1
	3	4	2	1	4	3	1	2	2	1	3	4	1	2	4	3
	2	1	3	4	1	2	4	3	3	4	2	1	4	3	1	2
	4	3	1	2	3	4	2	1	1	2	4	3	2	1	3	4
	1				3				2				4			
3	1	3	2	4	3	1	4	2	2	4	1	3	4	2	3	1
	4	2	3	1	2	4	1	3	3	1	4	2	1	3	2	4
	3	1	4	2	1	3	2	4	4	2	3	1	2	4	1	3
	2	4	1	3	4	2	3	1	1	3	2	4	3	1	4	2
	1				3				4				2			
4	1	3	4	2	3	1	2	4	4	2	1	3	2	4	3	1
	2	4	3	1	4	2	1	3	3	1	2	4	1	3	4	2
	3	1	2	4	1	3	4	2	2	4	3	1	4	2	1	3
	4	2	1	3	2	4	3	1	1	3	4	2	3	1	2	4
	1				4				2				3			
5	1	4	2	3	4	1	3	2	2	3	1	4	3	2	4	1
	3	2	4	1	2	3	1	4	4	1	3	2	1	4	2	3
	4	1	3	2	1	4	2	3	3	2	4	1	2	3	1	4
	2	3	1	4	3	2	4	1	1	4	2	3	4	1	3	2
	1				4				3				2			
6	1	4	3	2	4	1	2	3	3	2	1	4	2	3	4	1
	2	3	4	1	3	2	1	4	4	1	2	3	1	4	3	2
	4	1	2	3	1	4	3	2	2	3	4	1	3	2	1	4
	3	2	1	4	2	3	4	1	1	4	3	2	4	1	2	3

11.5

Paragraph 1

E 6

1	4	3	2
2	3	4	1
4	1	2	3
3	2	1	4

U 5

1	4	2	3
3	2	4	1
4	1	3	2
2	3	1	4

N 2

1	2	4	3
3	4	2	1
2	1	3	4
4	3	1	2

O 1

1	2	3	4
4	3	2	1
2	1	4	3
3	4	1	2

I 3

1	3	2	4
4	2	3	1
3	1	4	2
2	4	1	3

A 4

1	3	4	2
2	4	3	1
3	1	2	4
4	2	1	3

Paragraph 2

E 3

3	1	4	2
2	4	1	3
1	3	2	4
4	2	3	1

U 4

3	1	2	4
4	2	1	3
1	3	4	2
2	4	3	1

N 6

4	1	2	3
3	2	1	4
1	4	3	2
2	3	4	1

O 5

4	1	3	2
2	3	1	4
1	4	2	3
3	2	4	1

I 2

2	1	3	4
4	3	1	2
1	2	4	3
3	4	2	1

A 1

2	1	4	3
3	4	1	2
1	2	3	4
4	3	2	1

Paragraph 3

E 4

4	2	1	3
3	1	2	4
2	4	3	1
1	3	4	2

U 3

2	4	1	3
3	1	4	2
4	2	3	1
1	3	2	4

N 1

3	4	1	2
2	1	4	3
4	3	2	1
1	2	3	4

O 2

4	3	1	2
2	1	3	4
3	4	2	1
1	2	4	3

I 5

2	3	1	4
4	1	3	2
3	2	4	1
1	4	2	3

A 6

3	2	1	4
4	1	2	3
2	3	4	1
1	4	3	2

Paragraph 4

E 1

4	3	2	1
1	2	3	4
3	4	1	2
2	1	4	3

U 2

3	4	2	1
1	2	4	3
4	3	1	2
2	1	3	4

N 5

3	2	4	1
1	4	2	3
2	3	1	4
4	1	3	2

O 6

2	3	4	1
1	4	3	2
3	2	1	4
4	1	2	3

I 4

2	4	3	1
1	3	4	2
4	2	1	3
3	1	2	4

A 3

4	2	3	1
1	3	2	4
2	4	1	3
3	1	4	2

11.6

Paragraph 1	**1**	Solo	4	Db
	2	Duet	2	[1,3] – Bcl,Vib
	5	Duet	2	[2,4] – Hn,Db
	6	Trio	[1,2,3]	Bcl,Hn,Vib
	4	Solo	3	Vib
	3	Trio	[1,2,4]	Bcl,Hn,Db
Paragraph 2	**4**	Solo	2	Hn
	3	Trio	[1,3,4]	Bcl,Vib,Db
	1	Solo	1	Bcl
	2	Duet	3	[2,3] – Hn,Vib
	5	Duet	3	[1,4] – Bcl,Db
	6	Trio	[2,3,4]	Hn,Vib,Db
Paragraph 3	**3**	Trio	[1,3,4]	Bcl,Vib,Db
	4	Solo	2	Hn
	6	Trio	[2,3,4]	Hn,Vib,Db
	5	Duet	3	[1,4] – Bcl,Db
	2	Duet	3	[2,3] – Hn,Vib
	1	Solo	1	Bcl
Paragraph 4	**6**	Trio	[1,2,3]	Bcl,Hn,Vib
	5	Duet	1	[3,4] – Vib,Db
	2	Duet	1	[1,2] – Bcl,Hn
	1	Solo	4	Db
	3	Trio	[1,2,4]	Bcl,Hn,Db
	4	Solo	3	Vib

Objects 5

13.1

2 - [2,1,4,3]

2	1	4	3
3	4	1	2
1	2	3	4
4	3	2	1

Parallax

4 - [1,2,3,4]

1	2	3	4
4	3	2	1
2	1	4	3
3	4	1	2

Belvedere

5 - [2,4,3,1]

2	4	3	1
1	3	4	2
4	2	1	3
3	1	2	4

Gingivitis

3 - [4,3,2,1]

4	3	2	1
1	2	3	4
3	4	1	2
2	1	4	3

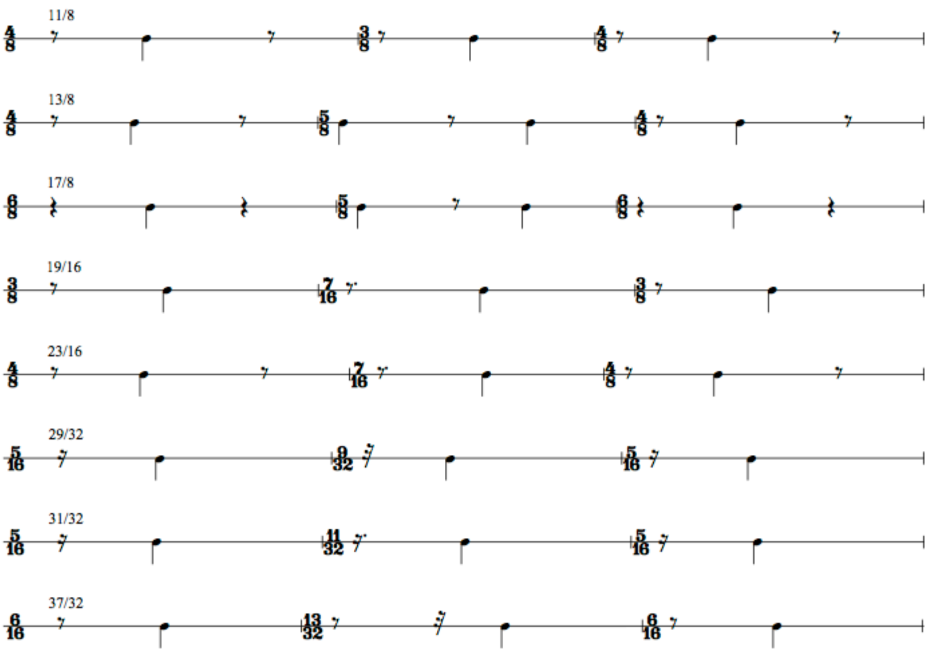
Monochord

1 - [3,4,1,2]

3	4	1	2
2	1	4	3
4	3	2	1
1	2	3	4

Tumulus

13.2



13.3

iDist						
1	2,3,4,5	1,2	1.1	3,4,5	1.1
2	1,3,4,5	1,3	1.2	2,4,5	1.2
3	1,2,4,5	1,4	2.1	2,3,5	2.1
4	1,2,3,5	1,5	2.2	2,3,4	2.2
5	1,2,3,4	2,3	3.1	1,4,5	3.1
		2,4	3.2	1,3,5	3.2
		2,5	4.1	1,3,4	4.1
		3,4	4.2	1,2,5	4.2
		3,5	5.1	1,2,4	5.1
		4,5	5.2	1,2,3	5.2

iDur	
2,3,5,7	**E**
3,5,7,11	**D**
5,7,11,13	**C**
7,11,13,17	**B**
11,13,17,19	**A**

13.4

	Bars	**4-Pg**	**5-Pg**	**Outcome**	**3-Pg iDist**	**3-Pg iDur**
A - [4,1,2,3]	1-6	4,1	2	4 - 2	[1,3,4,5]	17,13,11,7
	7-12	2,3	4	2 - 4.3	[2,5]	17,7
E - [3,2,1,4]	1-6	3,2	5	3 - 5.2	[1,2,3]	11,7,5
	7-12	1,4	3	1 - 3	[3]	5
I - [3,4,2,1]	1-6	3,4	1	3 - 1.4	[2,4,5]	7,3,2
	7-12	N/A	N/A	N/A	[1,3]	7,3
O - [2,3,4,1]	1-6	N/A	N/A	N/A	[1,2,4,5]	13,11,7,5
	7-12	N/A	N/A	N/A	[4,5]	7,5
U - [1,4,3,2]	1-6	N/A	N/A	N/A	[1,3,4]	19,13,11
	7-12	N/A	N/A	N/A	[2]	17

13.5

P-0	0	1	4	5	3	2	e	t	7	6	8	9
R-0	9	8	6	7	t	e	2	3	5	4	1	0
RI-e	2	3	5	4	1	0	9	8	6	7	t	e
I-e	e	t	7	6	8	9	0	1	4	5	3	2

	1-3			**10-12**		
1	0	1	4	6	8	9
	9	8	6	4	1	0
	2	3	5	7	t	e
	e	t	7	5	3	2

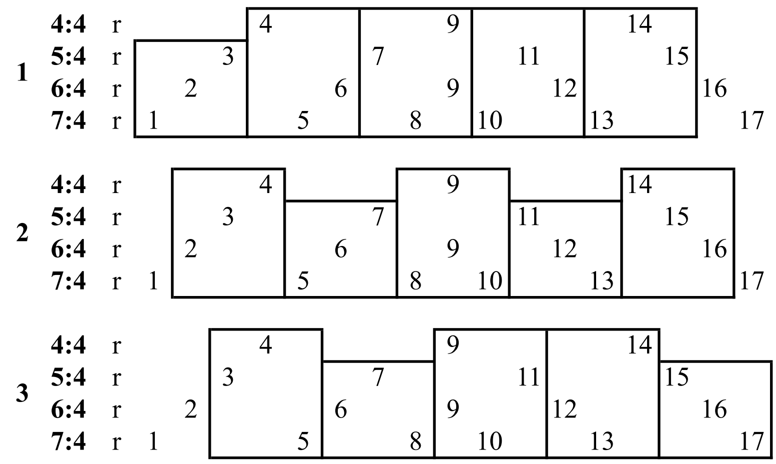
	2-4			**9-11**		
2	1	4	5	7	6	8
	8	6	7	5	4	1
	3	5	4	6	7	t
	t	7	6	4	5	3

	3-5			**8-10**		
3	4	5	3	t	7	6
	6	7	t	3	5	4
	5	4	1	8	6	7
	7	6	8	1	4	5

	4-6			**7-9**		
4	5	3	2	e	t	7
	7	t	e	2	3	5
	4	1	0	9	8	6
	6	8	9	0	1	4

15. Objects 6.1-6.3

15.1



15.2

	4:4	1				5					10					**15**			
1	**5:4**	1			**4**				8				12				16		
4, 15	**6:4**	1		3				7			10			13				17	
	7:4	1	2				6			9		11			14				18

	4:4	1				**5**					10					15			
2	**5:4**	1			4				8				12				16		
5, 14	**6:4**	1		3				7			10			13				17	
	7:4	1	2				6			9		11			**14**				18

	4:4	1				5					10					15			
3	**5:4**	1			4				8				12				16		
6, 13	**6:4**	1		3				7			10			**13**				17	
	7:4	1	2				**6**			9		11			14				18

	4:4	1				5					10					15			
4	**5:4**	1			4				8				**12**				16		
7, 12	**6:4**	1		3				**7**			10			13				17	
	7:4	1	2				6			9		11			14				18

	4:4	1				5					10					15			
5	**5:4**	1			4				**8**				12				16		
8, 11	**6:4**	1		3				7			10			13				17	
	7:4	1	2				6			9		**11**			14				18

	4:4	1				5					**10**					15			
6	**5:4**	1			4				8				12				16		
9, 10	**6:4**	1		3				7			**10**			13				17	
	7:4	1	2				6			**9**		11			14				18

16. *Objects 7*

16.1

Section 1		**Section 2**		**Section 3**		**Section 4**		**Section 5**		**Section 6**	
1	1F3R	**1**	1F3R	**1**	1F3R	**6**	3F3R	**6**	3F3R	**6**	3F3R
3	2F2R	**5**	3F2R	**4**	3F1R	**3**	2F2R	**2**	2F3R	**4**	3F1R
5	3F2R	**4**	3F1R	**5**	3F2R	**2**	2F3R	**3**	2F2R	**2**	2F3R
2	2F3R	**3**	2F2R	**2**	2F3R	**5**	3F2R	**4**	3F1R	**5**	3F2R
4	3F1R	**2**	2F3R	**3**	2F2R	**4**	3F1R	**5**	3F2R	**3**	2F2R
6	3F3R	**6**	3F3R	**6**	3F3R	**1**	1F3R	**1**	1F3R	**1**	1F3R

16.2

1F3R	**1**	1,2,3	3W	**3F1R**	**1**	1,4,7	
	2	4,5,6	3B		**2**	2,5,8	
	3	7,8,9	3S		**3**	3,6,9	

2F3R	**1**	1,2,6	2W1B	**1**	3,4,5	2B1W	**1**	3,7,8	2S1W
	2	1,3,5	2W1B	**2**	4,2,6	2B1W	**2**	2,7,9	2S1W
	3	2,3,4	2W1B	**3**	1,5,6	2B1W	**3**	1,8,9	2S1W
	1	1,2,9	2W1S	**1**	4,5,9	2B1S	**1**	6,7,8	2S1B
	2	1,3,8	2W1S	**2**	4,8,6	2B1S	**2**	5,7,9	2S1B
	3	2,3,7	2W1S	**3**	7,5,6	2B1S	**3**	4,8,9	2S1B

2F2R	**1**	1,2,4	2W1B	**1**	1,4,5	2B1W	**1**	1,7,8	2S1W
	2	1,2,5	2W1B	**2**	2,4,5	2B1W	**2**	2,7,8	2S1W
	3	1,3,4	2W1B	**3**	1,4,6	2B1W	**3**	1,7,9	2S1W
	4	1,3,6	2W1B	**4**	3,4,6	2B1W	**4**	3,7,9	2S1W
	5	2,3,5	2W1B	**5**	2,5,6	2B1W	**5**	2,8,9	2S1W
	6	2,3,6	2W1B	**6**	3,5,6	2B1W	**6**	3,8,9	2S1W
	1	1,2,7	2W1S	**1**	4,5,7	2B1S	**1**	4,7,8	2S1B
	2	1,2,8	2W1S	**2**	4,5,8	2B1S	**2**	5,7,8	2S1B
	3	1,3,7	2W1S	**3**	4,6,7	2B1S	**3**	4,7,9	2S1B
	4	1,3,9	2W1S	**4**	4,6,9	2B1S	**4**	6,7,9	2S1B
	5	2,3,8	2W1S	**5**	5,6,8	2B1S	**5**	5,8,9	2S1B
	6	2,3,9	2W1S	**6**	5,6,9	2B1S	**6**	6,8,9	2S1B

3F3R	**1**	1,5,9	1,2,3	**4**	2,6,7	2,3,1
	2	1,6,8	1,3,2	**5**	3,4,8	3,1,2
	3	2,4,9	2,1,3	**6**	3,5,7	3,2,1

3F2R	**1**	1,4,8	1,1,2	**1**	1,4,9	1,1,3	**1**	2,5,9	2,2,3
	2	1,5,7	1,2,1	**2**	1,6,7	1,3,1	**2**	2,6,8	2,3,2
	3	1,5,8	1,2,2	**3**	1,6,9	1,3,3	**3**	2,6,9	2,3,3
	Ranges 1 and 2			**Ranges 1 and 3**			**Ranges 2 and 3**		
	1	2,4,7	2,1,1	**1**	3,4,7	3,1,1	**1**	3,5,8	3,2,2
	2	2,4,8	2,1,2	**2**	3,4,9	3,1,3	**2**	3,5,9	3,2,3
	3	2,5,7	2,2,1	**3**	3,6,7	3,3,1	**3**	3,6,8	3,3,2

16.3

	1	**Ranges 1/2**				**2**	**Ranges 1/3**				**3**	**Ranges 2/3**			
	1	W1	B1	S2	1,4,8	**1**	W1	B1	S3	1,4,9	**1**	W2	B2	S3	2,5,9
[1,4,5]	**2**	W1	B2	S1	1,5,7	**2**	W1	B3	S1	1,6,7	**2**	W2	B3	S2	2,6,8
	3	W1	B2	S2	1,5,8	**3**	W1	B3	S3	1,6,9	**3**	W2	B3	S3	2,6,9
	1	W2	B1	S1	2,4,7	**1**	W3	B1	S1	3,4,7	**1**	W3	B2	S2	3,5,8
[2,3,6]	**2**	W2	B1	S2	2,4,8	**2**	W3	B1	S3	3,4,9	**2**	W3	B2	S3	3,5,9
	3	W2	B2	S1	2,5,7	**3**	W3	B3	S1	3,6,7	**3**	W3	B3	S2	3,6,8

16.4

Section 1			3-Pgs	4-Pgs	P-cs
	2	5	2	1	10
2	1	4	3	0	9
	3	6	1	2	11
	3	12	2	3	18
4	1	10	4	1	16
	2	11	3	2	17
	1	1	2	0	6
1	3	3	0	2	8
	2	2	1	1	7
	2	8	2	2	14
3	3	9	1	3	15
	1	7	3	1	13
	3	15	4	3	24
5	2	14	3	3	21
	1	13	4	2	20

Section 2			3-Pgs	4-Pgs	P-cs
	1	1	2	0	6
1	2	2	1	1	7
	3	3	0	2	8
	2	11	3	2	17
4	3	12	2	3	18
	1	10	4	1	16
	2	8	2	2	14
3	1	7	3	1	13
	3	9	1	3	15
	1	4	3	0	9
2	3	6	1	2	11
	2	5	2	1	10
	3	15	4	3	24
5	2	14	3	3	21
	1	13	4	2	20

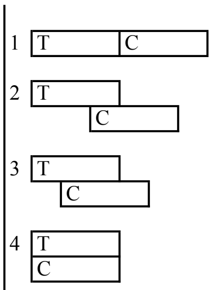
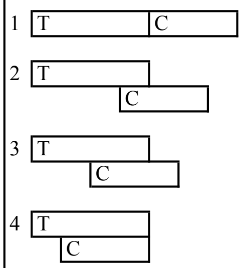
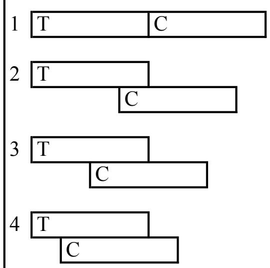
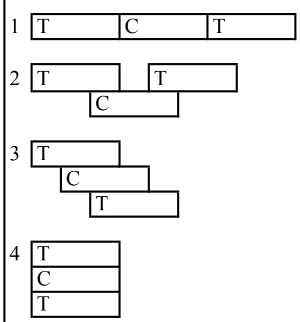
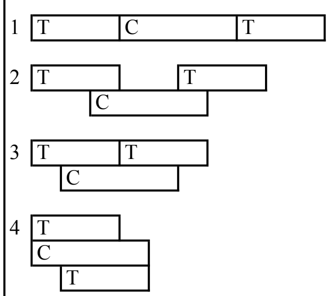
Section 3			3-Pgs	4-Pgs	P-cs
	1	1	2	0	6
1	2	2	1	1	7
	3	3	0	2	8
	2	8	2	2	14
3	3	9	1	3	15
	1	4	3	0	9
	3	12	2	3	18
4	1	7	3	1	13
	2	8	2	2	14
	1	4	3	0	9
2	3	6	1	2	11
	2	5	2	1	10
	3	15	4	3	24
5	2	14	3	3	21
	1	13	4	2	20

Section 4			3-Pgs	4-Pgs	P-cs
	3	15	4	3	24
5	2	14	3	3	21
	1	13	4	2	20
	2	8	2	2	14
3	1	7	3	1	13
	3	9	1	3	15
	1	4	3	0	9
2	3	6	1	2	11
	2	5	2	1	10
	3	12	2	3	18
4	1	7	3	1	13
	2	8	2	2	14
	1	1	2	0	6
1	2	2	1	1	7
	3	3	0	2	8

Section 5			3-Pgs	4-Pgs	P-cs
	3	15	4	3	24
5	2	14	3	3	21
	1	13	4	2	20
	2	5	2	1	10
2	1	4	3	0	9
	3	6	1	2	11
	1	7	3	1	13
3	3	9	1	3	15
	2	8	2	2	14
	3	12	2	3	18
4	1	10	4	1	16
	2	11	3	2	17
	1	1	2	0	6
1	2	2	1	1	7
	3	3	0	2	8

Section 6			3-Pgs	4-Pgs	P-cs
	2	11	3	2	17
4	3	12	2	3	18
	1	10	4	1	16
	1	4	3	0	9
2	3	6	1	2	11
	2	5	2	1	10
	3	15	4	3	24
5	1	13	4	2	20
	2	14	3	3	21
	2	8	2	2	14
3	1	7	3	1	13
	3	9	1	3	15
	1	1	2	0	6
1	2	2	1	1	7
	3	3	0	2	8

16.5

	3-Pg	4-Pg	Trio	Compliment	
1	2	0	1 x 3-Pg	1 x 3-Pg	
2	1	1	1 x 4-Pg	1 x 3-Pg	
3	0	2	1 x 4-Pg	1 x 4-Pg	
4	3	0	2 x 3-Pgs	1 x 3-Pg	
5	2	1	2 x 3-Pgs	1 x 4-Pg	

16.6

r = root
c = comp.

1 (1-3, 10-12)

r	r	r	c	c	c	c	c	c	r	r	r	**P-0**	0	1	4	5	3	2	e	t	7	6	8	9
r	r	r	c	c	c	c	c	c	r	r	r	**R-0**	9	8	6	7	t	e	2	3	5	4	1	0
r	r	r	c	c	c	c	c	c	r	r	r	**RI-e**	2	3	5	4	1	0	9	8	6	7	t	e
r	r	r	c	c	c	c	c	c	r	r	r	**I-e**	e	t	7	6	8	9	0	1	4	5	3	2

2 (2-4, 9-11)

c	r	r	r	c	c	c	c	r	r	r	c	**P-0**	0	1	4	5	3	2	e	t	7	6	8	9
c	r	r	r	c	c	c	c	r	r	r	c	**R-0**	9	8	6	7	t	e	2	3	5	4	1	0
c	r	r	r	c	c	c	c	r	r	r	c	**RI-e**	2	3	5	4	1	0	9	8	6	7	t	e
c	r	r	r	c	c	c	c	r	r	r	c	**I-e**	e	t	7	6	8	9	0	1	4	5	3	2

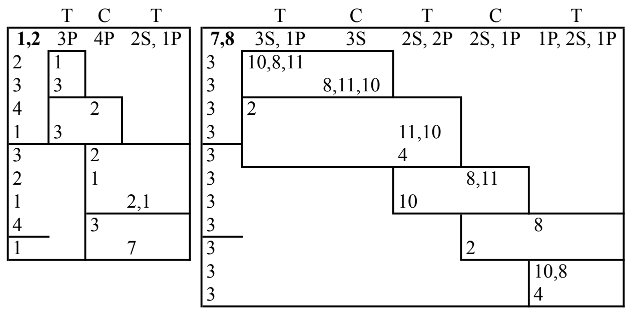
3 (3-5, 8-10)

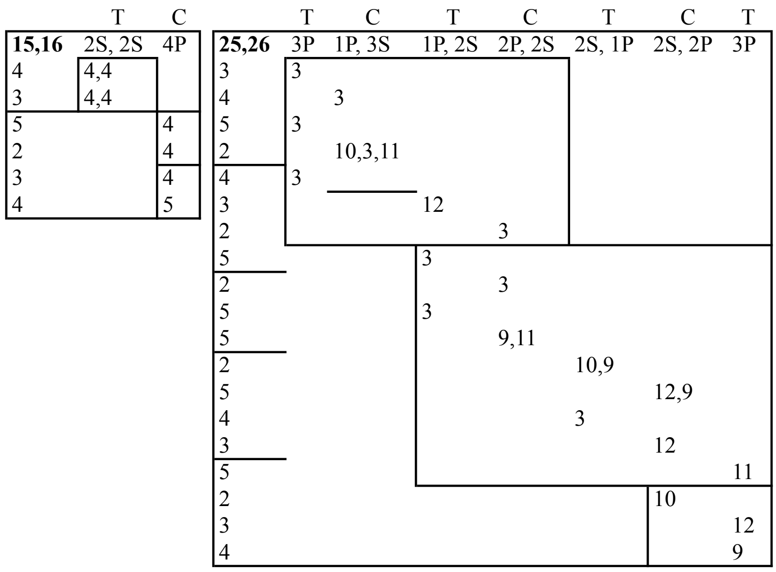
c	c	r	r	r	c	c	r	r	r	c	c	**P-0**	0	1	4	5	3	2	e	t	7	6	8	9
c	c	r	r	r	c	c	r	r	r	c	c	**R-0**	9	8	6	7	t	e	2	3	5	4	1	0
c	c	r	r	r	c	c	r	r	r	c	c	**RI-e**	2	3	5	4	1	0	9	8	6	7	t	e
c	c	r	r	r	c	c	r	r	r	c	c	**I-e**	e	t	7	6	8	9	0	1	4	5	3	2

4 (4-6, 7-9)

c	c	c	r	r	r	r	r	r	c	c	c	**P-0**	0	1	4	5	3	2	e	t	7	6	8	9
c	c	c	r	r	r	r	r	r	c	c	c	**R-0**	9	8	6	7	t	e	2	3	5	4	1	0
c	c	c	r	r	r	r	r	r	c	c	c	**RI-e**	2	3	5	4	1	0	9	8	6	7	t	e
c	c	c	r	r	r	r	r	r	c	c	c	**I-e**	e	t	7	6	8	9	0	1	4	5	3	2

16.7





	T	C	T	C	T	C
27,28	1P, 2S, 1P	1P, 2S	2S, 2S	2S, 1P	2S, 2S	3P
6	9					
6	11,10					
6		4				
6			9,10			
6		9,11				
6				3,4		
6					3,4	
6	3					
6			9,11			
6						4
6				10		
6						4
6					3,4	
6						3

	T	C	T	T	C	T
29,30	3P	4S	1P, 2S	2S, 1P	4S	3P
3	10					
2	9					
3	12					
2		9,12,1,11				
2			1			
3			10,12			
2				1,1		
3				9		
2					10,1,11,1	
3						1
2						1
3						1

16.8

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