THE CONSTRUCTION OF CONSTRICTED SOUNDWORLDS THROUGH LIMITED MATERIALS, CYCLIC PROCESSES, INTERFERENCE AND EXTENDED TUNINGS

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Abstract

The portfolio of music and accompanying thesis examines the construction of constricted soundworlds. The portfolio creates these soundworlds through two approaches. The first approach explores harmonic unity over an extended duration by using a combination of limited materials and extended harmonic language influenced by abstract visual art. The second approach employs the repetition of a melodic row, which is then extended by the use of compositional techniques including cyclic processes and interference. The thesis investigates my approach to the compositional techniques of the portfolio, explaining in detail different facets of limited materials, extended tuning systems and visual art. I draw on examples from the portfolio and from wider contextual resources that incorporate similar compositional techniques.

Chapter 1: Limited Materials

The use of limited materials is the main characteristic of my compositional approach. I define limited materials as the restriction of a musical parameter, using only a small proportion of the element's potential materials. These limited musical parameters are then combined. In this chapter I will discuss the restriction of three musical parameters: pitch, register and rhythmic complexity.

My approach towards limited materials came through an interest in sparse sound worlds and the ways which small amounts of materials can be maintained over a prolonged period of time. Much of my exposure to these materials came through the works of minimalist composers such as John Adams and La Monte Young.

Adams' *Phrygian Gates* (1977) was the first piece that really exposed me to the idea of limited materials. *Phrygian* Gates uses a repetitive cell that is transposed between different degrees of the Phrygian and Lydian modes. I was particularly interested in the coherence between two independent strands of materials and the fluidity of the transpositions between different modes. As my approach to these materials matured I decided that other elements of the piece, such as the rhythmic complexity and the reliance upon process, diminished elements that drew me towards limited materials. The most prominent of these ideas were the organic properties that the use of limited materials can create. These organic properties are the elements that manifest over longer durations when the listener is confronted with sparse musical content.

La Monte Young's *Composition 1960 #7* (1960) is created from the two pitches B and F# with only one performance direction: "to be held for a long time." After a prolonged period of listening these organic elements began to appear as Jeremy Grimshaw describes when he heard a performance of the piece in 2001:

> Immersed in the vibration of the sustained interval, I eventually could not help but notice the brief moments of faint beating brought on by the slightest change in intonation (and cut short by subtle fingerboard corrections), or the tiniest irregularities in bowstroke, or the upper harmonics…[1]

When developing my approach I employed those organic elements that were the unspecified side-effects of the materials in *Composition 1960 #7* and sustained tone music in general, and decided which elements I could control and implement in my own music.

[1] Grimshaw J., (2011) *Draw a straight line and follow it*. New York: Oxford Press. 49

As a result, my approach to limited materials is based on two creative principles: first, sparse sound worlds that focus on the combination of my three main limited parameters to create a set of chords that form one large-scale coherent sound over an extended duration; second, through the repetition of a limited set of pitches with the addition of a musical technique that extends the different parameters of the row.

1. Pitch

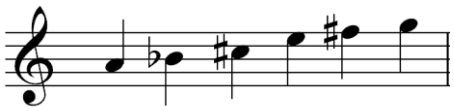
I limit pitch material through the horizontal repetition of short melodic rows and through limited vertical interval collections.

1.a. Pitch – horizontal

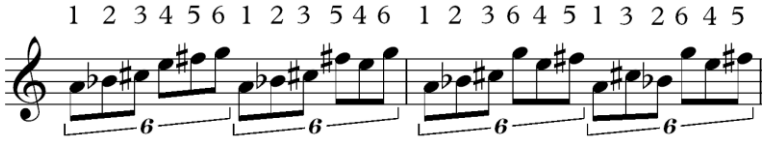
Portittor and *Okanami* employ a melodic row that uses repetition as a function that constantly recycles the row's basic materials. These rows are then exposed to two different techniques that I use to expand the repetitive elements of the materials. The main interest created from such repetitive materials is the relationship that one forms with certain characteristics of the material such as an interval or pitch. As both pieces develop the materials are displaced, but when one hears these characteristics in a different context they are immediately drawn in.

Portittor uses a six-pitch row and applies a cyclic process to change elements of the row's material. The process I use is a permutating sequence that results in the row never using an exact repetition of the six pitches.

Example 1: Six-pitch row used in *Portittor.*



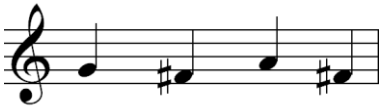
Example 2: Right hand from *Portittor* bars 29-30, showing the original row then three permutations of the row.



The six-pitch row is put through a permutation generator that produced hundreds of different permutations of the sequence. This results in each pitch appearing in every position of the row. However, the six pitches are never used in the same sequence (Example 2). Due to the large number of sequences that result from mapping every permutation, as well as the planned duration, I decided to choose intuitively which sequences I would combine to create the large-scale melody. I also began with smaller iterations of the row using four-note (bars 1-5) and five-note sequences (bars 6-28). Applying these permutations to the row creates the continual repetition of pitch, but the slight change in each sequence affects the listener's perception. When listening to dense repetitive material, one becomes drawn to specific pitches or intervals that return in different positions of the pitch rows, making one question the size of the row and the degree of repetition that is heard. I find this particularly interesting. This idea is amplified by the fact that the accompaniment is primarily rhythmically independent to the melody. This affects the listener's perception because the pitch of the accompanying material is largely derived from the six-note row but displaced to lower octaves and used in more triadic materials.

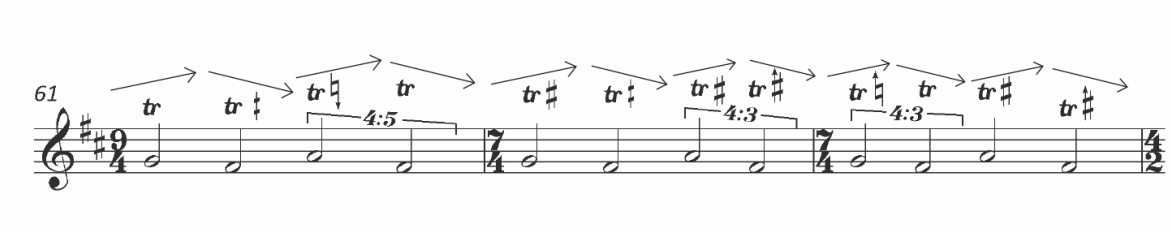
Okanami uses an exact repetition of its four-note row with extended saxophone techniques used to expand the sonic content of the row. The extended techniques that I employ create an interference with the listener's perception of the row, altering the characteristics that make the row by expanding and distorting the parameters of pitch, timbre, duration and dynamics.

Example 3: Four-note row used in *Okanami*.



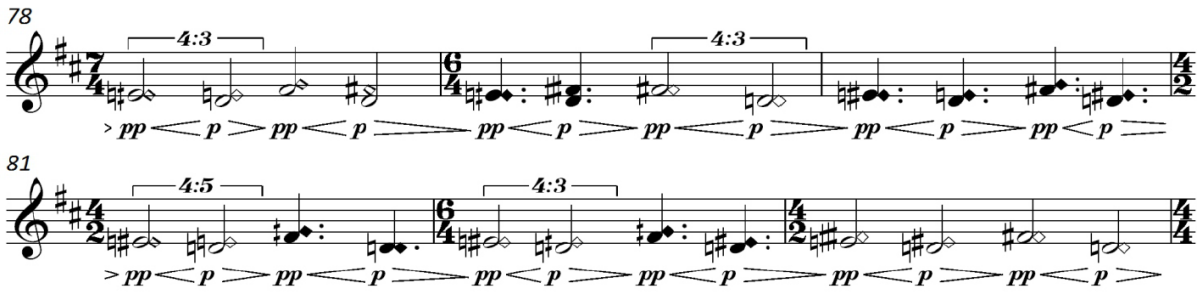
As the pitch materials change through the different sections, the presence of the original row is continually questioned as the basic pitch is distorted by the introduction of different timbres from extended techniques that interfere with the production of pitch. The pitch row is maintained in the new materials by maintaining parts of the row such as pitch, or the contour of the row. Example 4 shows how aspects of pitch from the note rows stay intact. The materials are created through the use of microtonal trills and the loosening and tightening of the embouchure, resulting in the sonic materials that deviate from the four-note row in unpredictable ways. The original pitches are still used but masked by the rapid fluctuations between the trilled pitches and the transition between different embouchures, changing the timbre from fluctuations between the trilled pitches when the embouchure is tight to the loosened embouchure, removing much of the pitch content and replacing it with the sound of key clicks.

Example 4: *Okanami, b*ars 61-63, indicating microtonal trills and embouchure adjustments over repeating row



Another example of how different aspects of the four-note row are maintained is in section 6 (bars 78-83). In this section, only the intervallic contour remains intact while the other aspects are changed. The saxophonist plays a pitch conventionally while also singing a different pitch at the same time. The sonic result of this technique creates interference with the saxophone's timbre and, due to the character of such close intervallic materials, a second level of interference is created through oscillations between the two pitches.

Example 5: Section 6 of *Okanami,* bar 78-83, with simultaneous singing and playing



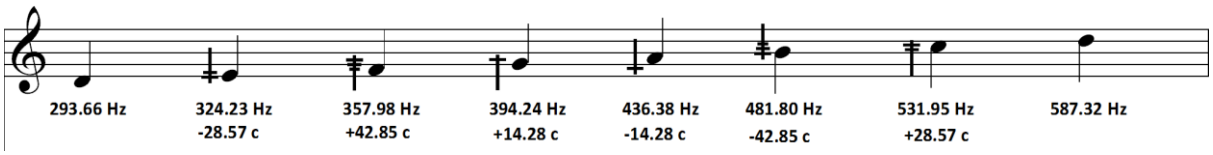
1.b. Pitch – vertical

The second way I use limited pitch material is harmonically, using a limited set of intervals to build the harmonies in *Aequo* and *Concordia*.

Aequo is written for solo violin and electronics with the pitch content restricted to 10 pitches. These pitches are created from two octaves of a seven-tone equal tempered tuning system. The tuning system is based around the frequency of 293.66 hertz. The seven-tone equal tempered tuning system uses seven pitches spaced equally 171.43 cents apart. Due to the large spacing between pitches and the fact that the frequencies are outside any pre-established microtonal accidental systems, I decided to create accidentals specific to this system.

I use three symbols. The first (†) is the basis on which the other two are formed. It represents a frequency 14.28 cents higher in pitch to that of 12-tone equal temperament. The other two symbols use the same principles with extra lines added to deviations of twice as much as the original symbol, 28.57 cents (†), or treble, 42.85 (†) cents. The symmetrical relationship between pitches in the system results in the same deviation above and below different pitches; in this case I have inverted the symbol to represent the drop in pitch.

Example 6: Seven-tone equal tempered scale used in *Aequo*

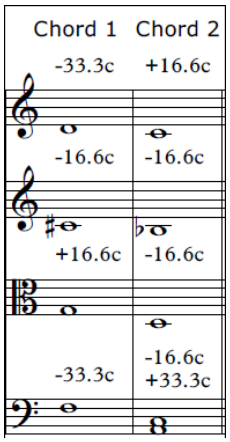


Aequo is made up of seven sections and uses electronics to create the harmonic materials that form the parameters for each section. The violin then completes the different harmonies by using glissandi to move between different pitches from the tuning system.

Concordia, for string quartet, employs drones that use pitch content created from a 72-tone equal tempered tuning system, creating chords that are influenced by tertian style harmonies. The 72-tone equal temperament is an extension of the 12-tone equal temperament system, subdividing each semitone into six pitches. There is a high degree of repetition within the pitch material throughout the different chords, with pitches distributed to different degrees of each chord. As a result of the intuitive development of the pitch material and the small deviations between pitches

that 72-tone equal temperament produces, instead of using one defining pitch from a subset within a semitone in every chord I decided to use the pitch from these subsets that intuitively sounded best. Example 7 shows these slight changes in pitch, with the D in violin 1 having a cent deviation of -33.3 in the first chord but then a deviation of only -16.6 when used in the viola in the second chord.

Example 7: Use of two different pitches of a semitone subset in different chords



Even with these deviations, I still categorise the use of any pitch within the subset of the semitone as repetition. By using the harmonic content in this way I create chords that combine vertical pitches with a clarity between their intervallic relationships that results in harmonic unity, joining together different pitches seamlessly to create a new identity of one coherent musical object. This idea forms the principle characteristics for both *Concordia* and *Aequo*. Creating harmonic unity allows me to make sound worlds that apply other techniques such as narrow registers and limited rhythmic complexity.

My approach to limited pitch material is similar in some ways to the works of Giacinto Scelsi. Scelsi's *Quattro Pezzi* (1959), for example, is made up of four works, each based on a single pitch: F, B, B and Ab. As Tristan Murail writes,

> For Scelsi, the principle object of composition then becomes what he calls the 'depth' of sound. It is primarily a question of working with timbre, taken in the broadest sense: the global timbre of the orchestra as a whole. The composer thus concerned with dynamics, densities, registers, internal dynamism and the timbral variation and micro-variations of each instrument.[2]

I was particularly drawn to Murail's description – 'the "depth" of sound' – an objective I wanted for my own materials as well. My approach to creating this differs to Scelsi's due to the sparse content

[2] Murail, T. (2005) Scelsi, De-composer, *Contemporary Music Review*, 24:2-3, 173-180, 177-78

of my sound-worlds and the chordal approach to harmony. Still, I created this 'depth' of sound by applying the parameters Scelsi uses in different ways. The first is internal dynamism. Instead of relating this to the timbre of individual pitches, I implemented it as a principle of my harmonic material, creating a coherence not only between vertical pitch arrangement but also through the interaction of different chords. This dynamism is expressed through the fluid mechanism I use to change pitches in *Concordia*, with no fixed changes between pitches, instead setting up a transitional period created through the performer's discretion. For me, other aspects of Scelsi's approach to this 'depth' of sound negated my goals, primarily the use of a wide register. My approach to the 'depth' of sound is formed by condensing a limited amount of pitch materials in a small registral space, forming one coherent sound over a collection of many smaller sounds, as is evident in *Quattro Pezzi*.

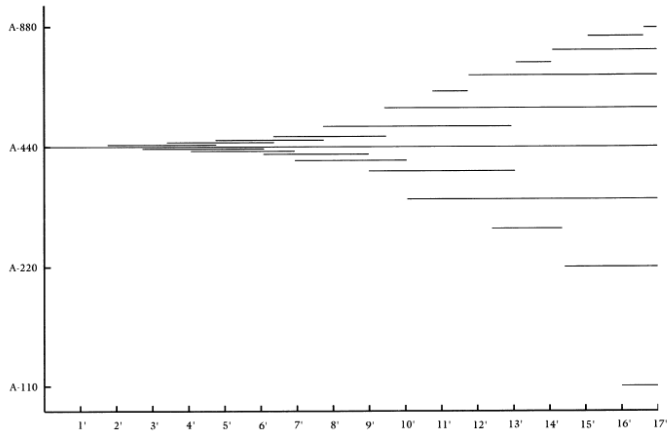
Across the portfolio, I approached pitch with two separate methods so that I could explore different types of sound-worlds using a number of limited materials. I decided that *Concordia* and *Aequo* would explore longer durations and a sparser sound world while *Portittor* and *Okanami* would focus on the repetition of a melodic cell. Other elements of the creation of these two pieces also influenced my decision. In *Portittor* I struggled because of the piano's limit to 12-tone equal temperament, a tuning system I find uninteresting when creating harmonic material in a limited setting. Also, the relatively short duration that a piano can sustain a sound before it begins to decay was another factor that stopped me from using harmonic unity. Instead, I decided that other techniques, such as keeping a confined register space, could remain a part of my approach while implementing the cyclic process. This was an approach I have used in earlier works. The decision to change my approach to pitch in *Okanami* was because I found the variety of timbres available through extended techniques on the soprano saxophone particularly interesting. This variety of timbre, however, is a contrast to the sonic materials I use when creating my harmonically orientated works. I therefore decided to create a piece that would still limit pitch, but instead of using a wider range of pitches vertically over a longer period of time, I used only four pitches but repeated them continuously creating a repetitive melodic cell. This allowed me to explore extended techniques by exposing the same melodic cell to a number of techniques and creating a transitional connection between timbres.

2. Register

I confine register to a narrow space. This brings attention to pitch relationships in the pieces that focus on harmonic unification. The constricted space emphasises harmonic materials as they are in such a confined space, thus creating a concentrated set of pitches. Wider ranges between intervals create less concentrated intervallic relationships and affect the ability to create the coherence of one sound that harmonic unification generates.

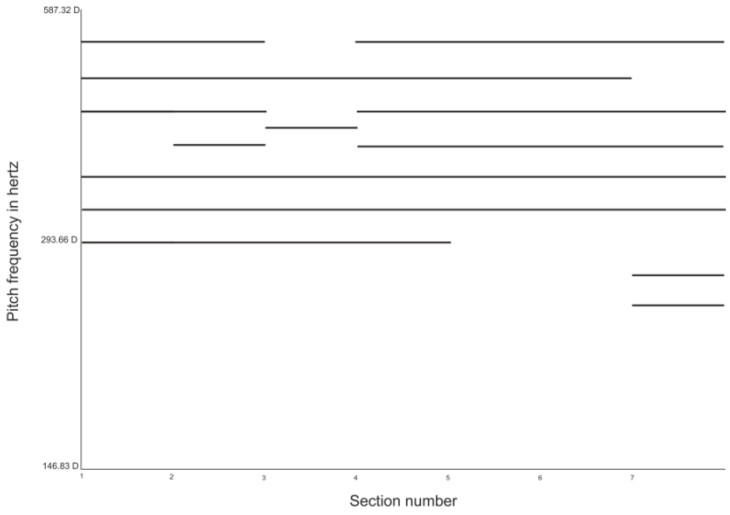
This method of using a narrow register is also used by James Tenney in *Critical Band* (1988). Other than one pitch in the last minute of the piece, Tenney keeps the pitch material confined to two octaves for the 17-minute duration, producing a harmonically rich sound-world in a small harmonic space.

Example 8: Placement of pitch material in *Critical Band*[3]



[3] Gilmore, B. (1995). 'Changing the Metaphor: Ratio models of musical pitch in the work of Harry Partch, Ben Johnston and James Tenney'. *Perspectives of New Music,* 458-503

Example 9: Placement of the pitch material of *Aequo* in relation to register



In *Aequo* I confine my pitch material to span of 963.58 hertz, using 10 pitches over the 15-minute duration. Using such a confined harmonic space is a technique I use in conjunction with the tuning system to keep the pitch material concentrated. Having pitch in such a confined environment limits the amount of possible intervallic relationships and removes harmonies wider than an octave. This encourages the listener to begin to focus on the recurring intervallic material when it returns in different contexts throughout.

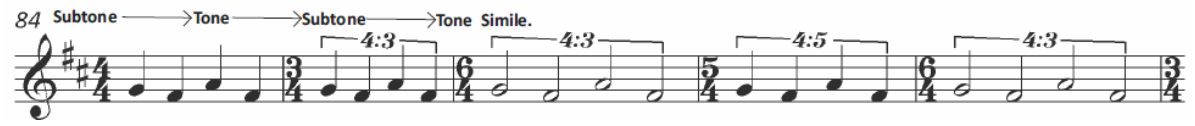
Another aspect of registral limits in my music is tessitura, which is typically restricted to the mid-range of the instruments I use. This limitation is for two reasons. First, I wanted a timbre that could keep a near continuous tone production, with as few fluctuations as possible. Using the middle range produces this without having to take into consideration other principles such as dynamic constraints in the registral extremes of the instruments. Second, the complexity of tuning systems I have applied when using string instruments creates difficulties in the higher positions on the strings due to the narrowing of the space between pitches higher up the fingerboard. As I employ tunings systems that have such small deviations between pitches it would become very difficult to keep these pitches in tune in the higher ranges.

3. Rhythmic Simplicity

I use rhythmic simplicity in two ways depending on how I have created the pitch material. When I have used pitch melodically I typically keep each pitch's duration within the row equal, except for a few exceptions in *Okanami*. Instead, I create rhythmic interest through other approaches. In

Okanami this interest is produced by changing the duration of each bar, compressing and expanding the material.

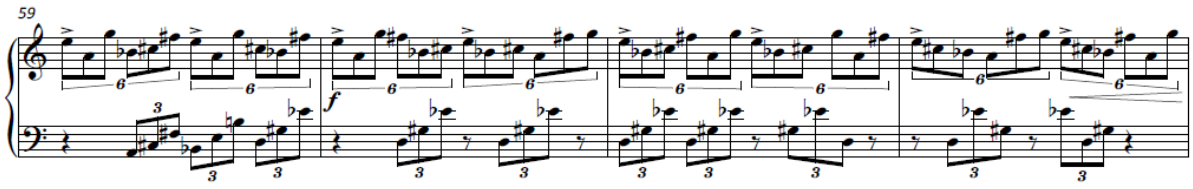
Example 10: Compression and expansion of the duration of the four-note row, *Okanami* bars 84-88



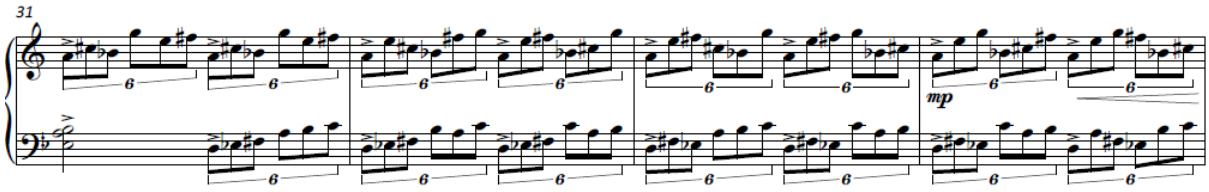
This effect is used on a bar-by-bar basis, created by changing time signatures and applying tuplets so that the duration of the four pitches that form the repetitive row are equal. As example 10 shows, in bar 84 the time signature is 4/4 with a tempo of 60 BPM, meaning the duration of each pitch in the bar is one second. In the next bar the row is compressed using a shorter bar duration of only three seconds, but still keeping the four pitch's individual durations equal by using tuplets resulting in a reduction in duration of each pitch to three-quarters of a second. This method of changing the duration of the row allows me to produce a variety of rhythmic content on a bar-by-bar basis while keeping the row's equal identity intact.

In *Portittor* I keep the durations of the pitch rows used in the right hand equal. As the row expands I keep the duration of the bar the same, instead shortening the individual duration of each pitch using tuplets to keep them equal. I create interest by adding a degree of rhythmic complexity, which is unprecedented in my works. I decided to do this as I intuitively felt that I needed to produce aspects of instability within the rhythmic material of the left hand in order to build in points of unison with the right hand. This enables me to use unison to exaggerate specific points of the cyclic series.

Example 11: Rhythmic complexity in the left hand, *Portittor* bars 59-62



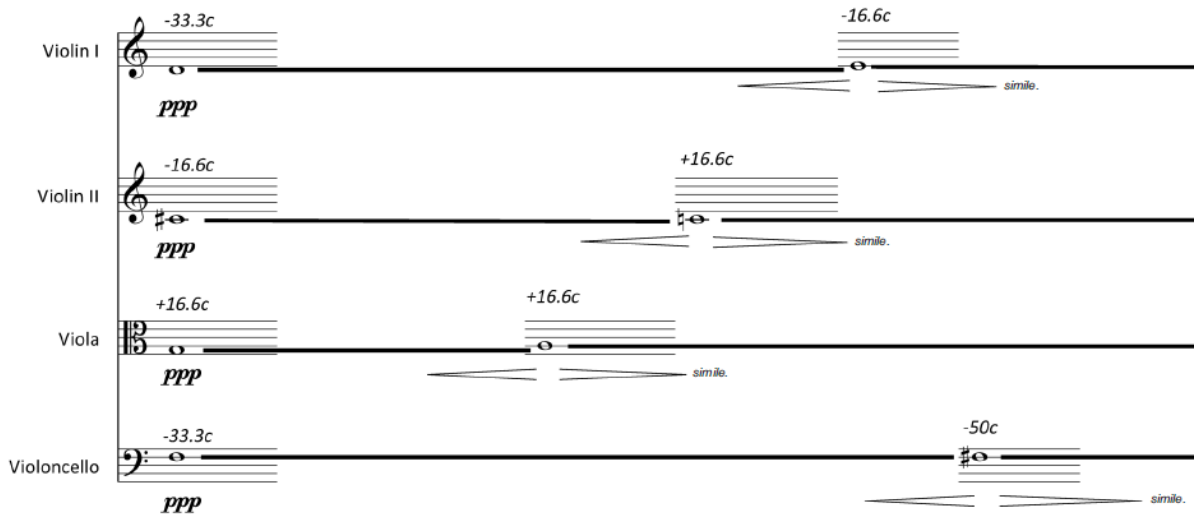
Example 12: Exaggeration of six-note row by left and right hand unison, *Portittor* bars 31-34



The left hand of bar 60-62 (Example 11) shows the rhythmic complexity I use, with the second triplet of the first two bars and the first triplet of bar 63 syncopated a quaver after the row in the right hand has already begun. This creates instability between the two strands of music before the resolution with the triplet at the end of bar 62, returning to a homogenous texture with the right hand before a new section begins at bar 64. Example 12 shows the left hand in rhythmic unison with the note row. Even though the pitch material is different the unison still works as a structural pillar, returning the listener's focus towards the note row's cyclic process before the left hand returns to its individual materials.

The second approach to rhythmic limitations is through the use of drones. This occurs when my pitch materials are focused on the harmonic relationships between pitches. I use static rhythmic structures so that the sound-worlds are centred on achieving harmonic unification. My use of drones is different depending on what I am trying to achieve. In *Concordia* the pitch material applied to the drones is static, with no change in the frequency of the drone. The transitions between harmonies are instead created through gradual change. New drones are offset between the four instruments, resulting in transition points that create a fluid state of harmonic colour as drones from the pre-existing chord and the new chord become intertwined for a small period of time before the new chord is fully established.

Example 13: Transitional stages of *Concordia* demonstrating interaction of materials from two chords



When creating *Concordia* I drew on aspects of Richard Glover's work, specifically his approach to sustained tones. His article, 'The Experience of Sustained Tone Music', presented at the ICMPC-ESCOM conference at Aristotle University of Thessaloniki in 2012, particularly intrigued me because of his thoughts on the temporality of sustained tones.

> Moments of instability, with parametric changes occurring, take up more memory space than stable moments of low information.
>
> ↓
>
> Duration experienced during instability is perceived as being shorter, but remembered as being longer
>
> ↓
>
> Sections of stability are perceived as longer durations, but remembered as shorter.[4]

This flow chart made me consider the degree to which instability affected the harmonic material within *Concordia*, and resulted in slightly shortening the durations of the transitional material that caused instability. The durations of the static harmonies are elongated so that they are perceived for longer periods of time. The stability of the chords at these points is the important musical

[4] Glover, R., (2012) 'The experience of sustained tone music'. In ICMPC-ESCOM 2012 Joint Conference, 23-28 July 2012, Aristotle University of Thessaloniki.

object; the transitional areas are secondary and are only there to necessitate a fluid change between the harmonic materials.

Unlike *Concordia*, the fluid nature of the harmonic material achieved in the transitional sections creates a technique I wished to focus on in *Aequo*. This resulted in using some aspects of the drones in a different way. The nature of the electronics' drones is the same as *Concordia* except that the transitions between chords are created through the fading in and out of dynamics. The fluidity is instead created by a violin glissando moving between pitches. Although pitch may be in an almost constant state of flux, there is still one continuous sound played by the violin. As a result, the violin's altered drone still conforms to the characteristics that I use to create the harmonic material in the electronics.

The drone music of Phill Niblock, specifically *Five More String Quartets* (1993), is a piece that has influenced my approach to extended duration and harmony. The materials of the piece create a homogenous sound that maintains a constant texture. The instruments of the string quartet are amplified individually, allowing for the creation of multi-tracking, which is used to create oscillations between pitches.[5] The similar instrumentation and the static elements of his pitch material employed over an extended duration are what originally drew me to the work. Immediately, his use of multi-tracking was an obvious contrast to my own work, resulting in an approach that drew the audience to the small fluctuations in pitch instead of focussing on the ensemble's overall sound. However, in the last five minutes the materials form two short periods of harmonic material that combine to create one coherent sound. It is these periods of Niblock's work that are most similar to the sound-world that I use, except I employ the idea over longer durations with a wider variety of different chords.

I was also influenced by the combination of an extended duration on a homogenous texture employing a limited set of pitches. I found that my experience changed the longer I listened; the sound became more intensive as the piece developed. I was mainly intrigued about the points where I was most deeply focused, losing my perspective on singular aspects such as dynamic levels and density instead hearing only a musical object. This occurs even with continual fluctuations in pitch. I was particularly excited about the sounds that would occur in a similar setting, but with sustained tones.

[5] Glover, R., 'Phill Niblock: Identity through instability'. *MusikTexte*, 132.

Chapter 2: Extended Equal Temperament

Introduction

My approach towards pitch in *Concordia and Aequo* is created using extended tuning systems. (I consider an extended tuning system as anything except 12-tone equal temperament.) The sound-worlds of the two pieces explore a set of chords that are combined to form one large-scale coherent sound in a sparse setting. Due to the small amount of pitch material I planned to use, harmony would create much of the piece's sonic content. As a result I wanted to employ tuning systems that explored an expanded harmonic language. My preliminary research explored a wide range of composers' applications of extended tuning systems. The first composer I researched was Harry Partch.

> Partch's music uses an expandable source scale of pure intervals, described in terms of frequency ratios, against a fundamental or 1/1 (in his system this theoretical 1/1 is always taken as G, regardless of the actual 'tonic' of a given passage of music). In his earliest extant theoretical writings, he frequently changed his mind about the number of pitches in the octave that the source scale should be considered to contain; 29, 55 and 37 tones in the octave were all possibilities at different times. By the early 1940s he had settled for theoretical purposes on the 43-tone scale that he analyses in great detail in *Genesis of a Music.* All of these scales are in fact subsets of the theoretically infinite set of pitch resources that can be derived from the small set of generative intervals Partch chose to work with: besides the octave (2/1) these are 3/2, 5/4, 7/4, 9/8 and 11/8. (The set of intervals can be thought of analogously to the proportions 8:9:10:11:12:14 in the harmonic series, though Partch himself conceived of them not in terms of partials but of string proportions.).[6]

After further research I decided that I could not implement Partch's tuning systems. This is because of the complexity of the tuning system and the system's devaluing of the tonic and octave in its harmonic language. In my work, the octave and tonic form reference points that help to integrate and create coherence between chords.

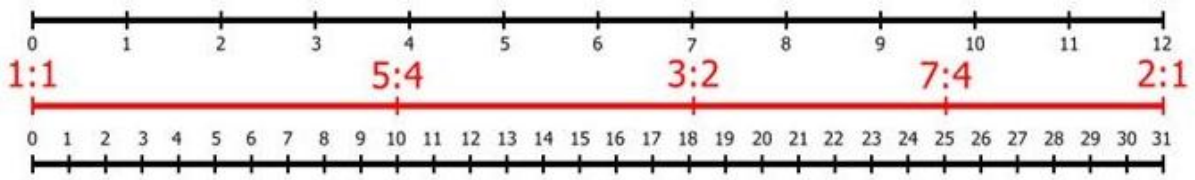
Another difficulty in much of Partch's work is the application of alternative tuning systems to pre-established instruments. His works require instruments to be adapted or completely new instruments to be invented to use the systems. One aspect of Partch's approach to extended tuning systems I have decided to apply is the precise notation of pitch. This is achieved in his works through the combination of ratios and conventional notation.

Instead of these more complex systems, I reverted to researching extensions of the conventional 12-tone equal temperament system and in particular Adriaan Fokker, who worked with extended

[6] Gilmore, B. (2003) 'The Climate of Harry Partch', *Contemporary Music Review*. 22 (1-2) 18

31-tone equal temperament. The extension to the system now incorporated pure intervals as well as tempered pitches. Pure intervals are created when multiple pitches vibrate at the same frequency as an interval from the harmonic series.[7] Example 14 shows the relationship of pure intervals to 12-tone and 31-tone equal temperaments, with 31-tone more capable of employing the pure intervals (in red). The extension of equal tempered pitches plus the system's ability to employ pure intervals captivated me as it generates a wide degree of harmonic colour.

Example 14: 12-tone equal temperament vs. 31-equal tone temperament [8]



This research of extended tuning systems resulted in my approach incorporating extended equal temperament systems that can be employed on pre-existing classical instruments, with specific pitch notations.

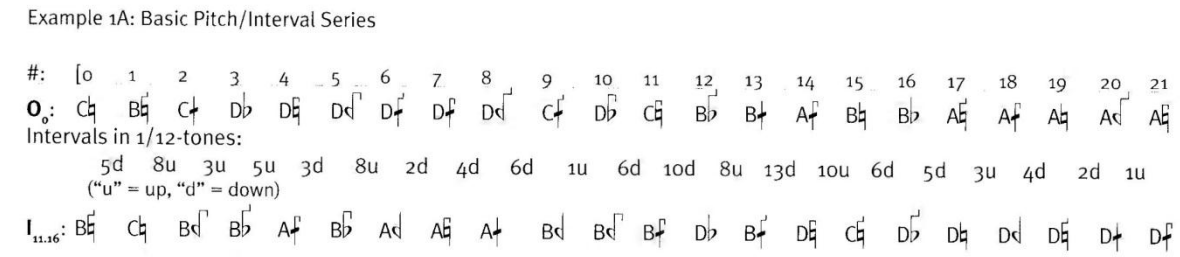
1. Pitch Material

The use of extended equal temperament tunings systems applies a cyclic element similar to techniques I use in other areas of my compositional approach. I am particularly drawn to equally tempered scales that repeat at the octave with divisions other than twelve. This is an important factor as I regard the octave as a tonal anchor through which the tuning systems I use form their harmonic identities. The choice to use extended equal temperament instead of other systems with octave divisions is due to the equidistant division between pitches. This equality between pitches is the main reason that I chose equal temperament instead of other tunings systems such as meantone temperaments. Meantone temperaments result in the thirds being much closer to pure intervals. However the system has to compensate for the creation of these pure intervals with smaller intervals being unequally spaced and the fifth, which is tempered differently, sounding unrelated to the other materials.[9]

[7] Duffin, R. W. (2007) *How Equal Temperament Ruined Harmony (and Why You Should Care)* New York: Norton, 32
[8] Huygens-Fokker Foundation (n.d) *Theory*: *31-tone a unique experience* Available at: http://www.huygens-fokker.org/microtonality/theory.html [Accessed 1 August 2013]
[9] Duffin, 39

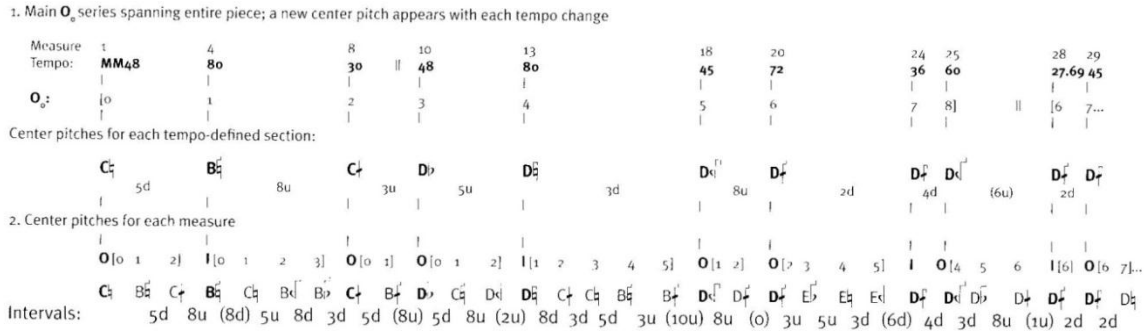
Composer Franklin Cox also works with extended equal temperaments in his work *Recoil f*or solo cello (1994). Cox describes his use of 72-tone equal temperament as 'combining an explicit denaturing of rational (i.e., 12ET) pitch relationships through extreme microtonality—i.e., 72ET (i.e., six microtones per half step) in *Recoil* and the string trio *Spuren*—with a highly rational and patterned intervallic organization.'[10] This is achieved in *Recoil* through the creation of an initial pitch series and its inversion (Example 15), from which Cox derives all his pitch materials.

Example 15: Basic pitch series of *Recoil,* by Franklin Cox[11]



This pitch series is used on different levels of *Recoil.* Example 16 shows how the series is used in the first 30 bars as a centre pitch for each tempo-defined section. The centre pitch acts as a tonal centre for each section, becoming a pillar anchoring the piece to the large-scale structure. Each section's pitch space is then filled by different segments of the basic row.

Example 16: Pitch structure of *Recoil* bars 1-30[12]



In *Recoil* this idea of centre pitches is applied to a more complex structure than the sectional structure I use in *Aequo*, but my approach is similar to Cox's. Instead of using one centre pitch I

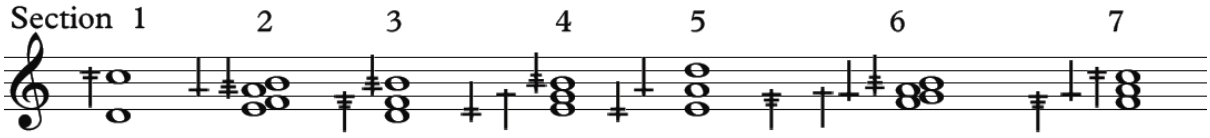
[10] Cox, F., 'Recoil, for Solo Cello: Background and Analysis' *Facets of the Second Modernity*, ed. Cox, Mahnkopf and Schurig - Hofheim: Wolke Verlag, 67
[11] Cox, F., 'Recoil, for Solo Cello: Background and Analysis', 76

[12]Cox, F., 'Recoil, for Solo Cello: Background and Analysis', 80

use a central harmony, which is played by the electronics. The violinist then changes each section's harmonic content by shifting between different pitches.

The contrast between our uses of extended equal temperaments also results in a difference in sonic outcomes. Cox describes the results of his use of extended equal temperament on the listener: 'One is literally swimming in a sea of tones too small to be consistently perceived as entities, but which are clearly organized in a coherent fashion.'[13] This approach to extended equal temperament acts as a coloristic device to blur the listener's ability to perceive pitch. When I use 72-tone extended equal temperament in *Concordia* my aim is for the extension of 12-tone equal temperament to create intervallic materials, closer to pure intervals while still keeping equidistant spacing between horizontal pitches.

Example 17: Harmonic centres of each section in *Aequo*



2. Instrumentation

The final reason for using extended equal temperament is the ability to easily apply the tuning system to conventional classical instruments, in contrast to other tuning systems that require the adaptation of pre-existing musical instruments or the creation of new ones. Both of my works that employ extended temperaments are easily performed on string instruments.

Concordia requires no changes from normal tuning approaches. *Aequo* requires a few modifications to the violin's normal tunings to adapt to the seven-tone equal tempered tuning system. In *Aequo*, I specifically base the scale I use around the violin's open D string, tuned to its conventional frequency of 293.66 hertz, centred in the middle of the violin's registral capability. The other three strings are retuned, requiring a new syntax to use the tuning system. The spaces between pitches are much wider than the conventional tuning system, meaning the violinist must form new relationships between pitches and their positions on the fingerboard. The *scordatura* system allows the violinist to use the open strings as reference points to find the correct position for the same pitch in different octaves on the other strings. Using the octave as a reference point means that

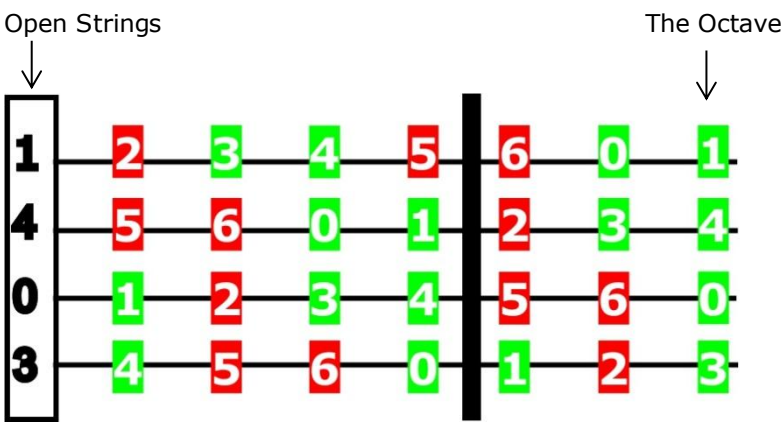
[13] Cox, F., 'Recoil, for Solo Cello: Background and Analysis', 97

the violinist can easily map out four of the seven pitches of the scale in any position on the fingerboard. The other three pitches—F, B and C—should be mapped using the interval of a fifth. The equal elements of the tuning system result in pitches being exactly parallel to the pitch, a fifth above or below. This idea is effective because each parallel finger position has at least one pitch that can use the open string as a reference point.

Example 18: Physical relationship of pitches in *Aequo's* 7-tone equal temperament on a violin fingerboard

■ = Pitch found through octave displacement

■ = Pitch found through the use of a fifth



0	D
1	E
2	F
3	G
4	A
5	B
6	C

A different approach to the retuning of string instruments is used in the *Symphony for Open Strings* (1978) by Louis Andriessen. The piece uses the full range of chromatic pitches over four octaves and shares them between 12 players, with each player only using the retuned pitches of the open strings. This approach to the retuning of the strings creates limitations on the sound-world. As a result of these limitations, Andriessen uses hocketing to produce the harmonic material.

> In modern composers' works hocket-like effects are the result of concern with texture or colour, while non-Western 'hocketing' generally results either from the necessity of allocating portions of a melody or of a complex sound pattern (as in the gamelan music of Bali) to more than one instrument because of limitations of range, or from the social partiality for rapid and colourful antiphonal interchange.'[14]

[14]Sanders H., E. "Hocket." *Grove Music Online*. *Oxford Music Online*. Oxford University Press, accessed July 31, 2013, http://www.oxfordmusiconline.com/subscriber/article/grove/music/13115

Hocketing creates a democratic relationship between the instruments with no leader and no distinction between melody and accompaniment in the large-scale material[15]. The democratic relationship Andriessen uses is also an important aspect of *Concordia* because of the objectives of its sound-world and my own approach towards the instrumentation: it is a non-hierarchical approach, with no controlling presence within the musical materials or the ensemble. Democracy is important because of the freedom that I give to the performers to create fluid transitions between chords, with no specific point to change, putting it at the performer's discretion. The ensemble is forced to interact on a deeper level in order for these transitions to remain fluid and also on a larger-scale in order to create the principles of harmonic unity and the idea of one coherent musical object.

Because of the level of constriction I have employed within *Concordia* and *Aequo*, harmony has become the main focus within my sound-worlds. I use extended tuning systems because I decided that conventional 12-tone equal temperament could not provide materials interesting enough to engage with an audience for the extended durations I planned to use. Another factor that drew me towards the introduction of extended tuning systems was the introduction of intervals from the harmonic series. The pureness that is created between pitches was an obvious similarity to the objectives of harmonic unity. The ability to use these pure intervals in equal tempered tuning systems is also important as I wanted to use tuning systems that are based on simple theoretical principles that would allow for transpositions between different keys.

[15]Trochimczyk, M. (2002) *The music of Louis Andriessen* London: Routledge, 147

Chapter 3: Influences from Visual Art

Several of the works in my portfolio draw on influences from visual art in one of two ways: first, to create a sonic representation of a picture that forms a large-scale aspect of my compositional approach, as in *Okanami,* and second, as a visual analogy of the sound-world, as in *Concordia*. Visual art has always influenced my works, with analogies of pictures by artists such as Bridget Riley helping to define early compositions, with varying degrees of success. The best analogy to art came in *Pulses* (2011), an evolving sound-world created from the continual expansion and contraction of two quartertone sequences sandwiched between two chordal strands of music, employing polyrhythms between four strands. I related these ideas to aspects of Turkish rugs, specifically the repetitive patterns and the slight inconsistencies in the patterns that occur when the rugs are created.

Example 19: Turkish Rug[16]

More recently I have been drawn to abstract art of Mark Rothko.

> The blurring of demarcations dislodges the rectangles, causing them to hover in and out, but it also turns the surface of each of his pictures into an allover field, creating an effect of oneness. Enhancing this effect is the spread of the rectangles across the canvas, terminating near the framing edges, declaring the wholeness of work. At the same time, the field is continuous and open suggesting an extension into infinity.[17]

[16] http://www.icollector.com/Heriz-Design-Turkish-Rug-Carpet-18406_i8506188 [Accessed 1 August 2013]
[17] Sandler, I. (1996) '*Mark Rothko'* Mark Rothko 1903-1970 no.ed London: Tate Gallery Publishing

This analysis by Irving Sandler defines many of the ideas I see in my approach: the 'wholeness of the picture' matches the large-scale structure of *Concordia*, and 'the spread of the rectangles' connects to the chordal progression I employ.

1. *The Great Wave* by Hokusai

Example 20: Hokusai's *The Great Wave* (1830)[18]

This picture was used as an inspiration for the materials used in *Okanami*. It helped me draw ideas relating to many aspects of my compositional approach including timbre, dynamic content and duration. The most important aspect of the picture that I wanted to portray was the shapes and sizes that form a variety of waves. I achieved this by first creating a musical idea—the recurring four-note row discussed above—that would represent the waves. The contraction and expansion of the row represents the differences in shape and size. In the next stage of creation I identified the different visual elements that combine to form the picture. After identifying a range of components I assigned a timbre or sonic idea that I felt related to visual stimulus. I then applied these components to form the different sections that form *Okanami*. These sections are connected by a large-scale palindromic structure. Symmetry is used for the large-scale structure so that ideas can be reused over large distances with other materials in between, while still keeping structural integrity.

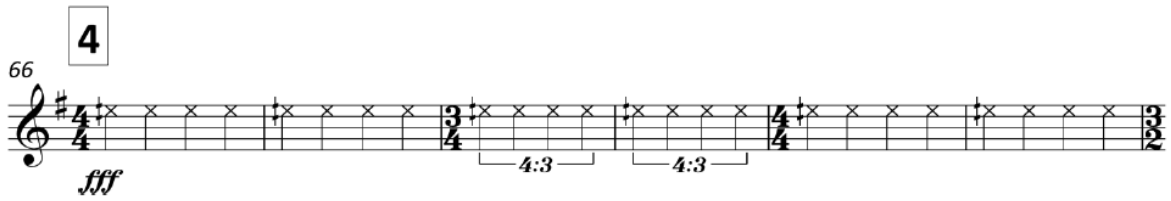
[18] http://www.slow-life.co.uk/hokusai-the-japanese-hockney/ [Accessed: 1 August 2013]

Example 21: *Okanami's* large-scale structure

1	2	3	4	3	2	1
Section 1 Bar 1-35	Section 2 Bar 36-59	Section 3 Bar 60-64	Section 4 Bar 65-72	Section 5 Bar 73-77	Section 6 Bar 78-83	Section 7 Bar 84-105
Four-pitch series continuously repeated with a gradual transition between normal tone and subtones.	Dominated by toneless material controlled by the performer's use of mouth shapes and vowels. Four-pitch series distorted.	Return to a more pitched sound world; however, unlike Sections 1 & 7, constant state of flux within the pitch through glissando created by mouth.	Abrasive repetition of a single pitch, which contrasts with the other material of the piece through the loudness of its dynamic and change to a higher register.	Same as Section 3	Relates to Section 2 However interference with pitch created by singing and playing close intervals making critical band oscillations.	Same as Section 1

The most obvious aspect I imitate is the large wave in the top left hand corner. I create this idea in section four (Example 22) by directing the saxophonist to produce the loudest, most abrasive timbre available by biting the reed. This creates a variety of uncontrolled overtones. By using this timbre I portray the power and size of the wave. The production of overtones allows the more subtle aspects in the detail of Hokusai's painting, such as the wash of the wave and the spray, that is shown to be heard.

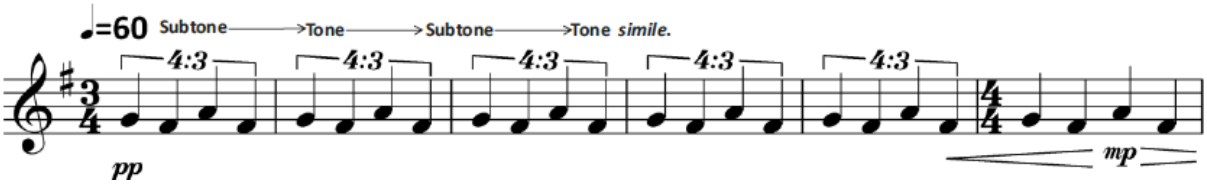
Example 22: Section four of *Okanami,* Bars 66-71



The transitions between normal tones and subtones in sections one and seven (Example 23) are portrayals of a different kind of wave that I identified in the painting. Here I focus on the bottom right of the painting and Hokusai's representation of the cycle between the end of one wave and the beginning of a new one. It seemed that this aspect lacked clarity, with no real distinction between the different waves. I applied this idea to music by cycling between normal tones and subtones at a *pianissimo* dynamic, resulting in a loss of clarity in the four-note row used to

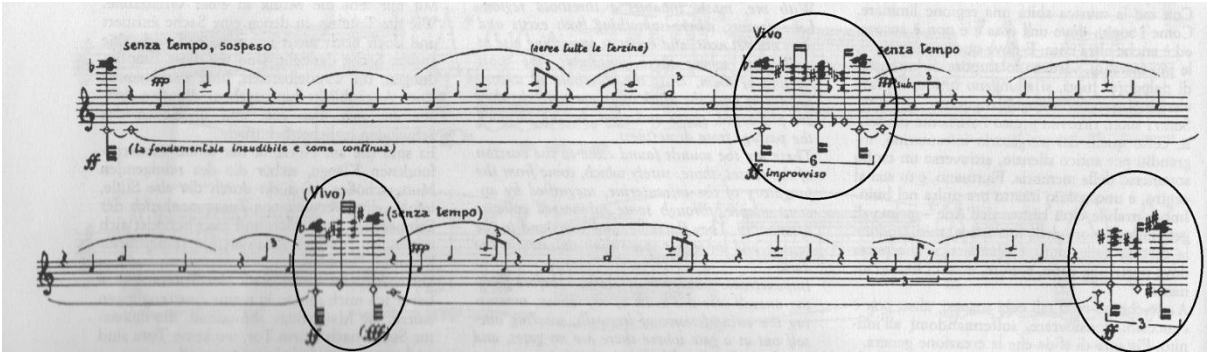
represent the wave. This outcome is amplified by the freedom given to the performer in the decision to transition between the different tone productions.

Example 23: The use of subtones in *Okanami* section one, bars 1-6



The variety of timbres that I use is inspired by the works of Salvatore Sciarrino and his production of an array of timbral colour. I was drawn to Sciarrino initially through Paul Griffiths' discussion of the composer's 'allusions to Mediterranean mythology as mediated by literature and visual art'[19] and also by the visual metaphors he uses, for example 'quiet rumblings may suggest distant thunder, or gunfire.'[20] An example of these visual metaphors occurs in the opening materials of *Hermes* (1984), a piece described by Griffiths as 'musicalized breath.'[21] The metaphor is created through a contrast between arpeggiated fifths at *ppp* dynamic level and short interjections of loud, dissonant materials that form the 'thunder' or 'gunfire'. (Example 24)

Example 24: Opening two lines of *Hermes,* visual metaphor circled



Visual metaphors are the objective when creating a sonic representation. The employment of different timbres is used to show different parts of the picture. My approach differs to that of Sciarrino in *Hermes* as he uses materials that use characteristics that relate to a variety of visual stimuli from different contexts, whereas my approach uses one visual image as the stimulus for all my materials. The characteristics of his materials also evoke much greater visual comparisons, similar to that which occur when 'mickey mousing' is used within film scores. My approach to

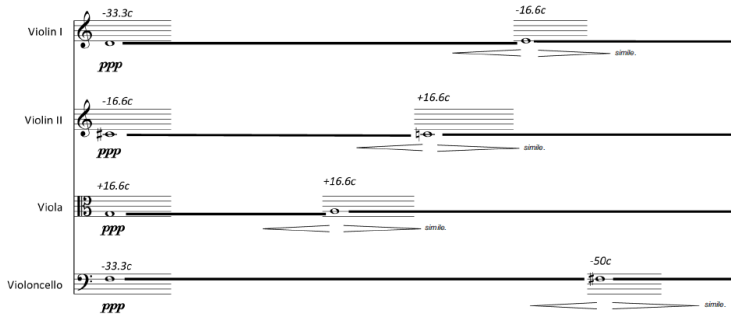
[19] Griffiths, P. (2010) *Modern Music and After*. 3rd ed. New York: Oxford University Press, 296
[20] Griffiths, *Modern Music and After*, 296
[21] Griffiths, *Modern Music and After*, 295

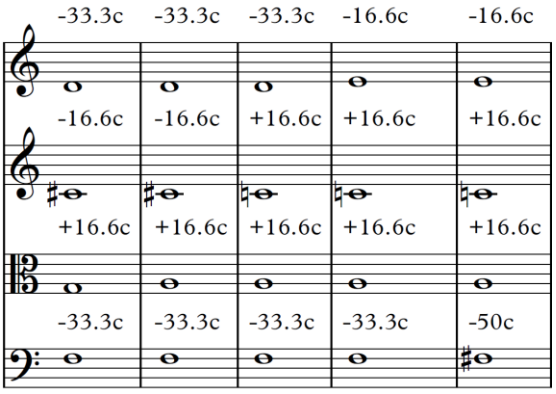
visual influences affects me more abstractly, with my analogies and descriptions being particularly personal and open to a number of interpretations.

2. Mark Rothko

Mark Rothko's work affected me in a completely different way to Hokusai's painting. While Hokusai was used as a reference, helping me to form a musical approach, the works of Rothko helped me clarify an objective that I had been trying to achieve in my compositional approach. This idea was the harmonic unification that forms the basis of *Concordia* and *Aequo*. After I had finished *Concordia* I found it hard to clarify my approach to harmony and the way the sonic results of the transitional sections could still be described as a unified sonic idea.

Example 25: Transitional aspects of *Concordia* in the score and transcription of the chords created in the transition.





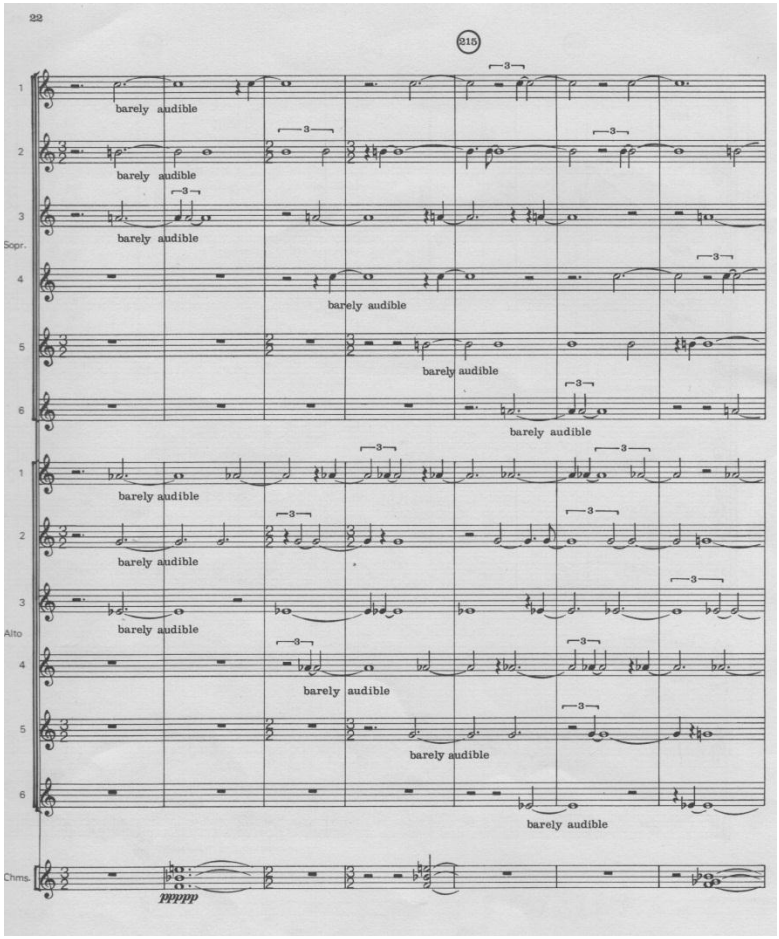
Rothko's abstract paintings of the 1950s (Examples 27-29) helped me clarify how the transitional aspects affected my other objectives, in particular as a result of the way Rothko forms the relationship between different objects that come together to create the large-scale structure of his paintings. The merging of different shapes results in a fluidity of colour, with objects overlapping

to form a variety of colours while still keeping a coherent large-scale structure. This fluid approach was something I saw when comparing Rothko's paintings to the transitional aspects of *Concordia.* From this comparison I decided that it is possible to create a unified sound and still have fluid harmonic material. I now saw the clusters of harmonic material almost as the basic colours of the paintings and the transitional areas as the variety of new colours that came from the overlapping ideas within Rothko's work.

Rothko's abstract work is explored by another composer, Morton Feldman, in his work *Rothko Chapel* (1973). The relation to abstract art is only explored for a short period from bars 211-242, using 'a single choral chord, sustained for about three minutes, punctuated by chime chords.'[22] Similar to my approach in *Concordia*, Feldman uses sustained pitch material to represent the idea of the large-scale colours of Rothko's paintings. My approach to visual stimuli differs from Feldman's through the approach to abstraction and fluctuations in colour. Abstraction is realised in my compositional approach through the transition between chordal harmonies. Due to the relatively short duration Feldman explores abstraction, roughly three minutes, he must create the effect differently. A chord is shared between the sopranos and altos of the chorus, with each section split into six parts. Each part is given one pitch to sing for the entire section. Feldman then creates the principle of abstraction through two approaches, first by changing the density of the material with each section having short durations of silence at different points throughout creating small fluctuations in the sound-world, and second through the voices' continual retaking of their pitch, creating a different kind of fluctuation (Example 26). These two approaches create continual, barely perceptible changes to harmonic colour, a particularly effective approach to abstraction in such a short period.

[22] Johnson, S., 'Rothko Chapel and Rothko's Chapel', *Perspectives of New Music*, Vol. 32, No. 2 (Summer, 1994), pp. 6-53, 15

Example 26: Excerpt of Feldman's approach to abstraction in *Rothko Chapel*, bars 211-217



Example 27: *Green White and Yellow on Yellow* (1951)[23]

[23] Phillps, G. (2005) *Seeing Mark Rothko.* Los Angeles: Getty Research Institute, 125

Example 28: *Number 7* (1951)[24]

Example 29: *Red, Orange, Tan and Purple* (1954)[25]

[24]Phillps, G. (2005) *Seeing Mark Rothko.* Los Angeles: Getty Research Institute, page. 127

[25]Phillps, G. (2005) *Seeing Mark Rothko.* Los Angeles: Getty Research Institute, page. 132

Conclusion

In this thesis I have shown that all four pieces that comprise my portfolio are primarily created from limited pitch materials. My approaches to these materials are split into 2 categories.

1. The soundworlds in *Aequo* and *Concordia* explore the idea of harmonic unity. The parameters that make up these sound worlds are extended tuning systems, coherence of multiple pitches and the combination of limitations to a number of musical parameters including register and rhythmic complexity. These limitations are used as mechanisms to form the other principles that create unity within the work as well as forming the large-scale structural aspects, primarily the extended durations used.

2. A repetitive melodic row in *Okanami* and *Portittor* forms the large-scale materials. These pieces use techniques designed to extend the limited pitch materials while still keeping the basic elements such as contour and intervallic relationships intact. A cyclic process in *Portittor* results in a continual permutation of the cell with no exact repetition of the six-note row**.** *Okanami* uses extended techniques of the saxophone, primarily through air production**.**

The two strands are drawn together by my large-scale methodology. I decide upon instrumentation and duration, and then set out fixed parameters that do not change throughout a piece. These are usually fixed register, fixed dynamics and fixed tempos, and, in the case of the second strand, fixed pitch. Once these are decided I add the basic materials that create the 'colour' in my works. In the first strand these are the extended tuning systems from which pitches for the chords are derived. The second strand's 'colour' is created from the techniques designed to extend the row's material. The next level of composition is much more intuitive, what I would describe as the experimental stage of creation where I created a palette of musical colour that would then be refined to form my musical materials.

After this experimental stage I evaluate the materials that I have created, which usually number in the dozens. I move them from their individual abstraction into a coherent musical structure**.** I usually classify these materials as either musical objects or transitional materials**.** At this point visual analogies and references become an integral part of my methodology, helping define coherent structure for my pieces.

The final level of my methodology is the addition of transitional materials between musical objects. This is arguably the most important aspect of my approach as it takes the ideas from the experimental section and transforms them from a collection of musical ideas into a coherent sound-world. At this point I define my musical objects as different sections that are placed linearly; in the first strand this is the order of the harmonic materials, and in the second the different materials that extend the row. These objects are then merged by the addition of the transitional materials that in my portfolio are exclusively the result of the integration of two musical objects. These transitions were again created from an intuitive approach, with the decision primarily based on the sounding results.

Bibliography

Written Sources

Adams, J. (n.d) *Phrygian Gates*. Available at: http://www.earbox.com/piano-solo-or-duet/phrygian-gates [Accessed 1 August 2013]

Bousted, D., (2003) 'An empirical study of quarter-tone intonation' *Contemporary Music Review*. 22 (1-2) pp.53-85

Cox, F. 'Recoil, for Solo Cello: Background and Analysis' *Facets of the Second Modernity*, ed. Cox, Mahnkopf and Schurig - Hofheim: Wolke Verlag

Duffin, R. W. (2007) *Why equal temperament ruined harmony: and why we should care.* (London: W.W Norton)

Fox, C. (2003) 'Temperaments, Tonalities and Microtonalities: an Introduction' *Contemporary Music Review*. 22 (1-2) pp.1-2

Fox, C. and Osmond-Smith, D., 'Giacinto Scelsi'. *Oxford Music Online*

Garland, P. (1984) *Sounding 13: the music of James Tenney.* Sante Fe: Sounding Press

Gilmore, B. (1995). 'Changing the Metaphor: Ratio models of musical pitch in the work of Harry Partch, Ben Johnston and James Tenney'. *Perspectives of New Music*, 33,458-503

Gilmore, B. (2003) 'The Climate of Harry Partch' *Contemporary Music Review*. 22 (1-2) pp.15-33

Gilmore, B. (1998) *Harry Partch: A biography.* New Haven: Yale University Press

Glover, R. (2012) 'The Experience of sustained tone music'. In ICMPC-ESCOM 2012 Joint Conference, 23-28 July 2012, Aristotle University of Thessaloniki

Glover, R. 'Phill Niblock: Identity through instability'. *MusikTexte*, 132. ISSN 0178-8884

Griffiths, P. (2010) *Modern Music and After*. 3rd ed. New York: Oxford University Press

Grimshaw, J. (2011) *Draw a straight line and follow it*. New York: Oxford University Press.

Harvey, P. (1995) *Saxophone*. London: Kahn & Averill

Hillier, P. (1997) *Arvo Pärt* Oxford: Oxford University Press

Huygens-Fokker Foundation (n.d) 'Theory: 31-tone a unique experience'. http://www.huygens-fokker.org/microtonality/theory.html [Accessed 1 August 2013]

Isacoff, S. (2002) *Temperament.* London: Faber

Johnson, S. 'Rothko Chapel and Rothko's Chapel' *Perspectives of New Music*, Vol. 32, No. 2 (Summer, 1994), pp. 6-53, 15

Lieberman, F. and Miller L. E. (1998) *Lou Harrison: A Composing World.* Oxford: Oxford University Press

N.A (1996) *Mark Rothko. 1903-1970* London: Tate Gallery Publishing

Maycock, R. (2002) *Glass A Portrait.* London: Sanctuary

Murail, T. (2005) 'Scelsi, De-composer' *Contemporary Music Review*, 24:2-3, 173-180

Partch, H. (1974) *Genesis of a music: an account of a creative work, it roots and its fulfilments.* 2nd ed. New York: De Capo Press

Phillps, G. (2005) *Seeing Mark Rothko.* Los Angeles: Getty Research Institute

Read. G. (1990) *20th-Century Microtonal Notation*. London: Greenwood Press

Sanders H. E. "Hocket." *Grove Music Online*. *Oxford Music Online*. Oxford University Press, accessed July 31, 2013, http://www.oxfordmusiconline.com/subscriber/article/grove/music/13115

Saunders, J. ed. (2009) *The Ashgate Research Companion to Experimental Music.* Surrey: Ashgate Publishing Ltd

Teodorescu-Ciocanea, L., (2003) 'Timbre versus Spectralism' , *Contemporary Music Review*. 22 (1-2) pp. 87-104

Tenney, J. (1988) *A History of 'Consonance' and 'Dissonance'.* New York: Excelsior Music

Trochimczyk, M. (2002) *The music of Louis Andriessen.* London: Routledge

Weiss, M. (2010) *The techniques of saxophone playing.* Kassel: Barenreiter

Wolf, J. D. (2003) 'Alternative tunings, alternative tonalities', *Contemporary Music Review*. 22 (1-2) pp.3-14

Scores

Adams, J. (1983) *Phrygian Gates: for piano.* New York: Associated Music Publishers

Adams, J. (1989) *Shaker Loops: for string orchestra.* (1982 revision) New York: Associated Music Publishers

Adams, J. (2006) *Violin concerto: for violin and orchestra.* New York: Boosey and Hawkes

Andriessen, L. (1977) *Hoketus: for two groups of five instruments*. Amsterdam: Donemus

Andriessen, L. (1978) *Symphony for open strings*. New York: Boosey and Hawkes

Cox, F. (1994) *Recoil for solo cello*. Baltimore: Smith publications

Feldman, M. (1973) *Rothko Chapel.* New York: Universal Edition

Feldman, M. *Solo Piano Works 1950-64.* Straebel, V. Ed. New York: Peters

Ferneyhough, B., (2000) *String Trio.* London: Peters

Finnissy, M., (1984) *Andimironnai: for violoncello solo.* London: United Music Publishers

Glass P. (2000) *String quartet no.4: 'buczak'.* London: Chester

Harrison L. (1998) *Selected keyboard and chamber music: 1937-1994*. Kassel, R. ed. Madison: A-R editions

Ives, C., (1968) *Three quarter-tone pieces: 2 Pianos – 4 hands.* London: Peters

Lucier, A., (1987) *Crossings for small orchestra with slow sweep pure wave oscillator.* Kiel: Material Press

Lucier, A., (1984) *In memoriam John Higgins: Clarinet in A and slow sweep pure wave oscillator.* Kiel: Material Press

Lucier, A., (1996) *Q: for violin, clarinet, cello, trombone and double bass.* Kiel: Material Press

Lucier, A., (1991) *Navigations for Strings.* Kiel: Material Press

Part, A. (1980) *Tabula Rasa.* Wien: Universal Editions

Partch, H. (2000) *Barstow: eight hitchhiker inscriptions from a highway railing at Barstow, California (1968 version).* Kassel, R. ed. Madison: A-R editions

Reich, S. (1995) *City life: for ensemble.* New York: Boosey & Hawkes

Reich, S. (1988) *Different trains: for string quartet and pre-recorded performance tape.* New York: Boosey & Hawkes

Scelsi, G., (1983) *Quartetto no.4* Paris: Salabert

Scelsi, G., (1983) *Quartetto no.3* Paris: Salabert

Scelsi, G., (1959) *Quattro pezzi su una nota sola* Paris: Salabert

Sciarrino, S. (1990) *L'opera per Flauto.* Milan: Ricordi

Tenney, J. (1988) *Critical band.* Lebanon: Frog Peak Music

Tenney, J. (2000) *Harmonium #7: for any 12 or more sustaining instruments.* Lebanon: Frog Peak Music

Tenney, J. (1994) *In a large, open space: [for] any 12 or more sustaining instruments.* Lebanon: Frog Peak Music

Tenney, J. (1995) *Spectrum 1: for 7 instruments.* Lebanon: Frog Peak Music

Tenney, J. (1995) *Spectrum 4: for 8 instruments.* Lebanon: Frog Peak Music

Discography

Adams, J. and Rzewski, F., (2006) *Piano Works.* Arciuli, E. Italy: Stradivarius. STR 33735

Andriessen, L. (2007) *MELODIE & Symphonie VOOR LOSSE SNAREN* Netherlands: Attacca

Andriessen, L. (1991) *De Staat.* Schonberg Ensemble U.S.A: Nonesuch

Andriessen, L. (1994) *De Stijl.* U.S.A: Nonesuch

Cox, F. (2010) *The New Cello, Volume 1. American Composers.* U.S.A: Centaur

Harrison, L. (2002) *Complete harpsichord works: music for the tack piano and fortepiano in historic and experimental tunings.* U.S.A: New Alboin

Harrison, L. (2006) *Lou Harrison: in memory.* U.S.A: Hellion Records

Lucier, A. (1990) *I am sitting in a room: for voice on tape.* U.S.A: Lovely Music

Lucier, A. (1990) *Crossings.* U.S.A: Lovely Music

Lucier, A. (2003) *Navigations for strings* U.S.A: Mode

Feldman, M. *Rothko Chapel; Why patterns?* U.S.A: New Albion

Ives, C. (2006) *Quarter-tone pieces.* Switzerland: Hat[now]Art

Niblock, P. (1993) *Music of Phill Niblock*. Soldier string quartet. U.S.A: Experimental Intermedia

Part, A. (1984) *Tabula rasa; Frates; Cantus in memory of Benjamin Britten.* Germany: ECM

Reich, S. (2005) *Different Trains.* Smith string quartet. Arts Music

Reich, S. (2002) *City life.* Nextime Ensemble. U.K:Signum

Sciarrino, S. (2002) *L'opera per Flauto vol.1* Caroli, M. Italy: Stradivarius

Sciarrino, S. (2002) *L'opera per Flauto vol.2* Caroli, M. Italy: Stradivarius

Sciarrino, S. (2008) *Orchestral Works.* Austria: Kairos

Scelsi, G. (2007) *Scelsi, G: The orchestra works 2*. Vienna Radio Symphony Orchestra. U.S.A: Mode

Scelsi, G. (2010) *Scelsi: Chamber works.* Germany: Edition RZ

Tenney, J. (2009) *Spectrum Pieces*. The Barton Workshop. U.S.A: New World Records

Tenney, J. (2004) *James Tenney: postal pieces*. The Barton Workshop. U.S.A: New World Records

Tenney, J. (1991) *On edge*. Relache Ensemble. U.S.A: Mode

Young L, M. (2000) *Inside the dream syndicate: Vol.1*. John Cale. 74W