Chapter Three

THE STYX

General

The Styx was written for a project organised by a student organisation at the Sydney Conservatorium called the Sydney Eclectic Composers Society. The project was known as the *Kammerklang* project, and involved the organisation of a large student ensemble and also included the well-known Australian percussionist Claire Edwardes. The work uses a large chamber ensemble consisting of flute, oboe, clarinet, bassoon, horn, violin I and II, viola, cello and contrabass. The string parts (excluding the contrabass) can also be enlarged to 2 or 3 players for each part if desired. A concertante percussion part, composed for Ms Edwardes, provides a foreground focus for the work. The title refers to the *River Styx*, which formed the division between earth and the underworld in ancient Greek mythology known as *Hades*. *The Styx* is therefore influenced by some of the features and imagery of this mythological river.

The pitch material for *The Styx* is based on harmonic spectra of nine fundamentals. The numbers nine and five are used extensively throughout the work as they have a strong affiliation with the river. The River Styx was the main river of Hades and had four other tributary rivers, thus resulting in the use of the number five when added together.[1] The ancient Greek gods were also made to swear binding oaths by the river and if these were not fulfilled they had to drink from the waters of the Styx and lost their voices for a period of nine years.[2] These numbers form the basis for deriving the

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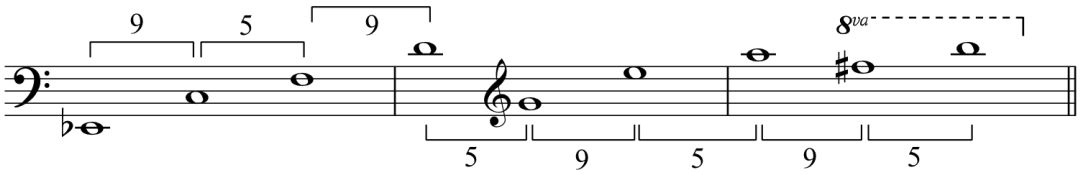
1 Paget, R.F. (1967), "In the Footsteps of Orpheus", London: Hale, p.42

2 Antoni, S. "Styx" Entry, Brill's New Pauly Online Encyclopedia of the Ancient World, www.brillonline.nl (accessed November 2010).

work's fundamentals, as well as much of the work's rhythm. The fundamentals begin with Eb (known as *Es* in German and *S* being the first letter in Styx), with the other fundamentals decided by using the semitone intervals of nine and five, as shown in **Example 3.1**. The work is divided into three sections, with the pitch material of these based largely on three of these fundamentals each.



Example 3.1. Fundamentals used in *The Styx*.

The Styx only incorporates basic uses of microtones and microtonal effects, given that the ensemble was originally made up of non-professional performers. These techniques include inflections where the wind and string players detune an equal tempered pitch up or down slightly, but no particular microtonal interval is specified. There are also quartertones added to chords in the second and third sections of the work. These effects are used for various reasons depending on the section, but largely add a spectral sound to the harmony that is appropriate to the ancient Greek subject matter. Although spectral harmony is not related to the ancient Greek musical world, the microtonal effects assist to provide a similar ancient-world rawness to the piece.

Section I: bar 1-56

Section I uses spectra of the first three fundamentals Eb, C and F. The texture incorporates arpeggios of various spectral partials up to the twentieth harmonic. In the first section the textures are very blurry and hazy due to the use of different cross rhythms beginning with 3 over 2. This is representative of the first section's main emphasis, which is to depict the enigmatic nature and sense of the unknown of the River Styx. After being taken across the river by Charon, the Ferryman, the souls of the ancient Greeks were then judged and sent either to Elysium (Heaven), the punishment hall of Tartarus (Hell) or to the Meadow of Asphodel (a type of Purgatory).[3] The Styx also formed the division between the land of the living and the land of the dead, and was rumoured to possess many unnatural properties. To represent this division, after the initial statement of the three opening spectra between bars 1-6, there is a constant juxtaposition of harmonic spectra and sub-harmonic spectra with a rhythmic length of nine and five crotchets respectively. This occurs for all three fundamentals, with each sub-harmonic spectrum using the corresponding partials of its corresponding harmonic spectrum.

In each sequence (of approximately 11-12 bars each) the fundamentals are used with several occurrences of silence, resonance or an insert of short contrasting pizzicato material. The order of these inserts and the order that the fundamentals appear is permutated. Metamorphosis techniques are also used to transform the textures such as using parts out of syncronisation to further blur the texture such as at bar 30. The most important change though, is the transformation in register. This is similar to *The German Hills,* and involves the transposition of various partials down one or two

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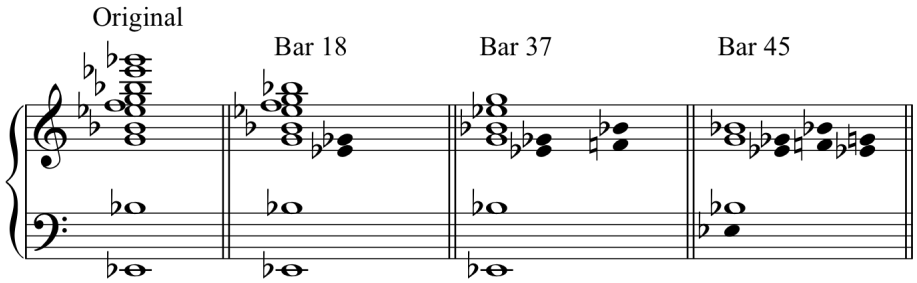
[3] Paget, R.F. (1967), p.43-5

octaves to create inharmonic spectra. The same process is also used for the sub-harmonic spectra, so that by the end of the process at bar 53, both spectra types are very similar. **Example 3.2** shows how the parts in the harmonic spectra for the fundamental Eb are changed over time.



Pitches with filled noteheads indicate transposed voices

Example 3.2. Transposition of parts for fundamental Eb: Section I.

At bar 30, other changes are also added, such as changes of rhythm where quaver tuplets of seven are used over tuplets of five. Many of these rhythmic groupings also cross barlines, adding more haziness to the texture by blurring the meter. The rhythm is then changed again at rehearsal mark B, where semiquavers are used over triplets and later quaver septuplets. From bar 30 is also where spectra lengths are changed. Up to this point, the material in each harmonic spectrum was always nine crotchets in length and the sub-harmonic five. These values begin to be swapped, beginning at the end of bar 33, where the harmonic C spectrum is changed to five crotchets and the sub-harmonic spectrum nine.

The change at bar 30 also signifies the point where microtonal techniques become more widespread in *The Styx*. There is an upward microtonal bend beginning in this bar present in the clarinet. This occurs using the pitch Bb, with the fundamental at this point F, thus making the Bb the eleventh partial. The same technique is also used

in the contrabass for the proceeding sub-harmonic texture, only in a downward direction. This occurs with the pitch A, adding the thirteenth sub-harmonic partial with F the fundamental once more. These partials are both microtonal, provide a spectral element to the harmony and also add further blurriness to the texture by adding dissonance. These inflections also provide another foreground focus in-between various solo percussion material where they predominantly occur.

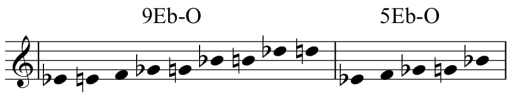
The percussion soloist's material begins very sparse, focussing mostly on metallic instruments such as triangle and gongs. Other instruments are soon incorporated, especially cowbells and tom tom drums. The cowbells particularly add an "out-of-tune" element to the work that indirectly relates to the spectral harmony and subject matter. The percussion material in this section also adds to the blurriness by incorporating rapid patterns over a variety of different non-homogenous instruments and using various cross rhythms. The percussion also gradually takes a more active role over section I that is linked to an increase in tension. This works with the techniques used in the orchestra, such as the microtonal inflections that begin to appear simultaneously and become more frequent and numerous. This continues to the beginning of section II at rehearsal mark C.

Section II: bar 57-108

The emphasis of the work's second and middle section is directed towards representing the unnatural powers the ancient Greeks believed the River Styx possessed and the darker aspects of Hades. It was believed that the river could make

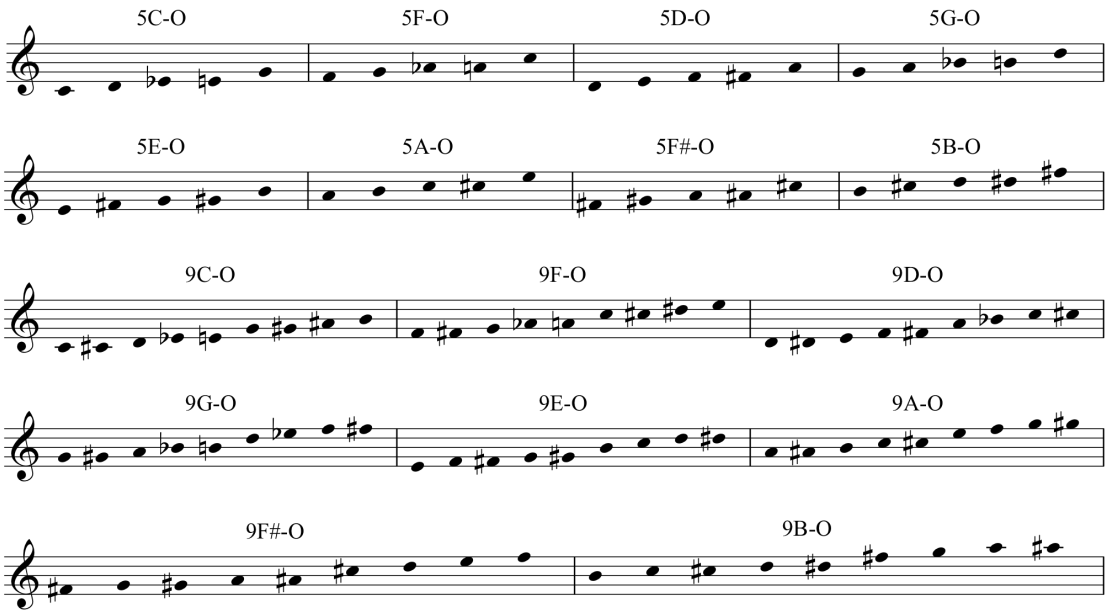
one immortal or invulnerable, or more disturbingly, be poisonous or dangerous[4] such as its ability to remove one's voice. Many cruel punishments awaited the unrighteous upon arrival in Hades, and the three-headed dog *Cerberus* greeted all new arrivals on the bank of the Styx, ready to tear to pieces any souls attempting to make their way back across the river.[5] These disturbing powers are the influence for the more brutal and primal textures in the second section, which has a contrasting character to the first. The fluid nature of section I is replaced by a more stagnant, less rhythmically regular texture with more space.

For section II, I derived a series of nine and five-note chords using the pitches found in the initial Eb harmonic spectrum, as well as chords that use all partials included in the three spectra of the entire first section (excluding partial 11, which is a quartertone). These two chords are shown in **Example 3.3** and are labelled 5Eb-O and 9Eb-O. These two chords are transposed onto each of the other fundamentals used in the work and in addition to this, those chords are also inverted. This provides a large body of pitch material to utilise throughout the second and third sections. The transpositions and inversions of these two chords are shown in **Examples 3.4** and **3.5**.

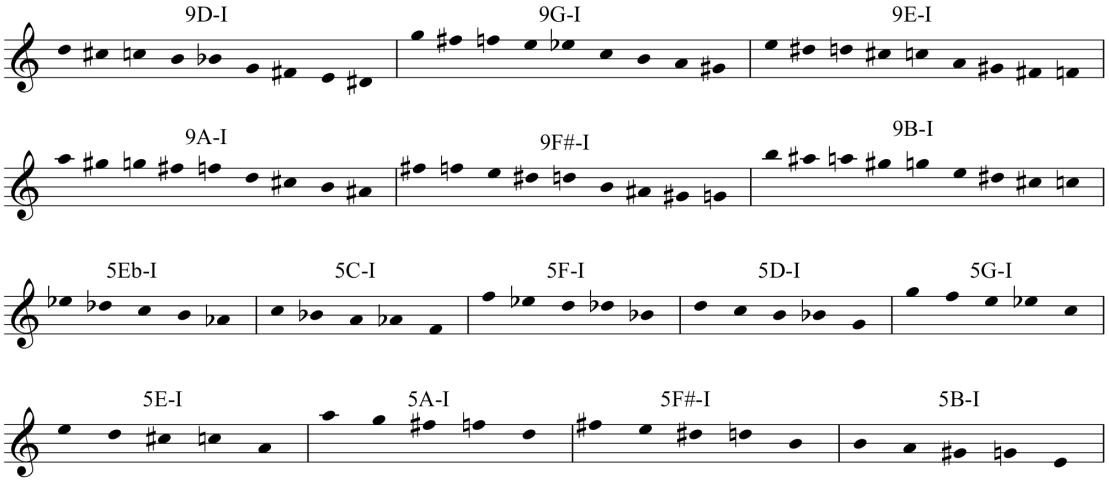


Example 3.3. Original derived nine and five-note chords in *The Styx*.

[4] Antoni, S. www.brillonline.nl. Paget, R.F. (1967), p. 89-91.
[5] Paget, R.F. (1967), p. 42.



Example 3.4. Transposed nine and five-note chords in *The Styx.*



Example 3.5. Inverted nine and five-note chords in *The Styx.*

The first occurrence of these chords is during the bridge between sections I and II beginning in the second half of bar 53 to bar 56. The nine-note chords of 9Eb-O, 9F-O and 9C-O are used in a texture of arpeggios as in the first section. This changes though, as these denser chords become more aggressive while a ritardando affects a momentary slowing of momentum. The texture then changes completely, as a brutal

repeated chord gesture is introduced with primal sounding, syncopated tom tom material in the solo percussion. This gesture uses chord 9D-O for nine crotchet beats followed by 9G-O for five crotchet beats. This aggressive texture uses two of the second section's fundamentals (which are D, G and E) and is followed by a silent general pause to represent the Styx's ability to remove one's voice.

The percussion is the main driving force of the repeated chordal gesture, with the syncopated tom toms and bass drum encapsulating the extreme brutality that was often evident in the ancient world. The syncopation also provides the rhythmic direction for the gesture and is later included in the orchestral parts to develop the texture and add to this effect.

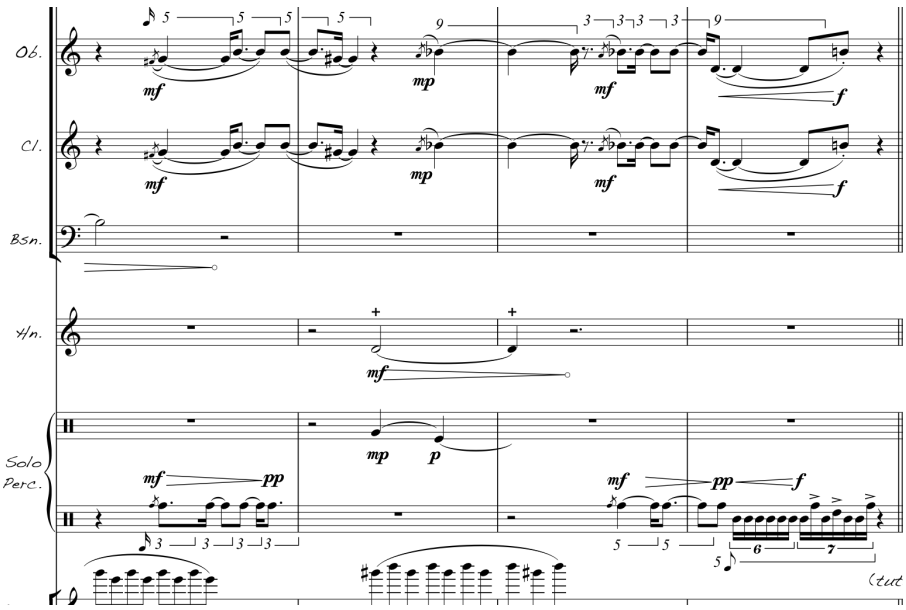
The first general pause is followed by a short unmeasured section beginning at rehearsal mark D with wind section chords using 5B-O, 5Eb-O and 5C-O. The main emphasis is on the 5Eb-O chord as it is the first fundamental of the work. The wind chords in this section are followed by the inversions of the three chords in the winds by the strings in a call-and-response (canon) texture. There is then a short percussion cadenza, the facilitation of which is the main function of the unmeasured sections. This cadenza (and other cadenzas added later) is added to remove any natural flow and the percussion material is often sporadic and exists in its own time. Other rhythmically free percussion cadenzas also appear throughout section II using similar material with the strings and winds continuing to incorporate the other five-note chords in the order of the work's fundamentals.

At rehearsal mark G the order of nine and five crotchets is swapped in the repeated chordal gesture and uses chords 9D-O and 9E-O. There is also syncopation added in the string and wind parts as well as quartertones. The quartertones are added to both chords and pertain to the 7^{th} and 13^{th} partials of the fundamentals. B quartertone sharp and A three-quartertone sharp in the oboe and bassoon appear with 9D-O while C quartertone sharp and D quartertone flat appear in the first violin and cello for the 9E-O chord. The tuning of these partials is not precise to make them easier to perform and they also appear out of the correct register. The quartertones included however, further brutalise the repeated chordal gesture and add a different aural quality to the harmony. Due to the registral placement of the quartertones often into lower parts the chords are very raw and uncomfortable, approximating a very primal sound relevant to expressing the darker aspects of the River Styx.

This repeated gesture is developed by immediately adding another occurrence using the inverted chords 9D-I and 9G-I. This is rhythmically developed by the substitution of a 15/16 bar to replace the 5/4 bar and also includes quartertones. The 15/16 bar is divided into five dotted quavers, meaning it still relates to the 5/4 bar only with a diminished sub-division. The quartertones added also relate to partials 7 and 13, only the sub-harmonic versions for chords 9D-I and 9G-I. Quartertones are also added to subsequent occurrences at bars 95 and 106, which also add seventh and thirteenth harmonic and sub-harmonic partials and similar rhythmic developments.

A primal-sounding melody is added to the texture in the second section in the oboe and clarinet and first appears between bar 89-93. The contrabass adds two of the section's fundamentals (E and G) simultaneously as an accompaniment to the

oboe/clarinet melody. The pitches used in the melody are from chords 5E-O and 5G-O, thus relating to the fundamentals in the contrabass. In between the phrases of the oboe/clarinet melody, arpeggiated material occurs related to the opening of the work. The percussion soloist accompanies the oboe and clarinet between bar 89-93, and in other subsequent melodic sections using rhythms based on durations of three and five. The rhythm for the oboe and clarinet is also predominantly based on durations of three and five, but also occasionally nine. These figures all relate back to those used previously in the work. **Example 3.6** outlines the rhythms in the soloist percussion and oboe/clarinet melody.



Example 3.6. Oboe, clarinet and percussion parts at bars 90-3.

Section III: bar 109-63

The third and final section of *The Styx* begins at rehearsal mark I after a brief climax found at the end of section II. This third section represents the demonisation that the River Styx and Hades seems to have suffered over the centuries as the pagan religions

of the ancient world were gradually replaced by other faiths such as Christianity.[6] In addition Section III is aggressive compared to the second section, even war-like. This is especially true of the soloist percussion part, which predominantly uses aggressive war-like bass drum material. This effect is particularly representative of the river's demonisation, where Hades is often referred to as Hell and the Styx therefore would be a feature of Hell.[7]

Two different material types alternate during section III. The first is a texture of chords using the five-note harmonies from the unmeasured divisions of the second section immediately preceded by fast demisemiquaver flourishes. As with the middle section, there is a call-and-response texture (canon) between the string and wind parts, only with the inverted chords appearing in the winds. The war-like bass drum material appears simultaneously with these imitative gestures and is again the main driving force. The second texture is the continuation of the primal melodic lines from section II, only the flute is added to thicken the sound of the melodies further. Microtonal bends are also included to add further intensity and an out-of-tune quality to the melodies. These microtones correspond to the fifth or third partial, such as the C# in bar 118 that is detuned down over the fundamental A approximating a justly tuned third and the C# in bar 123 detuned upwards over the fundamental F# approximating a justly tuned fifth.

Quartertones and microtonal effects are also used to recolour the harmonies used in the aforementioned canon chordal/flourish gesture. These begin from bar 127 to

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6 Paget, R.F. (1967), p. 15, p. 62, p. 80.

7 Youngblood, R.F; Bruce, F.F. & Harrison, R.K. (1995), "Hades Entry" New Illustrated Bible Dictionary, Nelson's Nashville

recolour and add intensity to the re-used chords 5E-O and 5E-I by adding justly tuned fifths and thirds. These microtonal intervals are also added to the proceeding string chords between bars 129-30 by including the quartertonal pitches of D quartertone sharp and F three-quartertone sharp in chord 5B-O. D three-quartertone sharp and G quartertone sharp are added in the bassoon and horn, and appear as sub-harmonic partials in the chord 5B-I. This re-colouring coupled with the war-like bass drum assists to depict the demonisation of the Styx.

Quartertones are also added to the nine-note chords used at rehearsal mark K. This section is the climax of the work and uses the same texture as the chordal/flourish gesture only all parts are in rhythmic unison for the flourishes and the beginning of each chord. The nine-note chords are found in the sustained textures and use different effects such as fluttertongue, tremolos and various string bowings to add different tone colours. These chords are all either nine or five overall crotchets in length and begin with chord 9A-O in bar 137 followed by 9B-O, 9F#-O, 9F#-I, 9A-I and 9B-I. Quartertones are added to each of these chords relating to partials 7 and 13 for each fundamental used, as was also the case in section II for the repeated chordal gesture. This again adds an aurally uncomfortable quality to the chords and assists the increase in tension for the climax by adding further intensity to the chords. The percussion also adds to this tension and extreme rawness by using frantic material predominantly in the tom toms as well as the continuation of the war-like bass drum gesture to the climax at bar 149. These gestures sometimes appear simultaneously with the orchestra supporting their gestures, but sometimes also appear independently of the orchestra. **Appendix V** shows the climactic section at rehearsal mark K with the chords used marked.

Emerging out of this climax is a single suspended strike to the triangle, which signifies a return to the opening calmer texture of the work and a brief coda using the fundamentals of the last section A, F# and B. This coda gradually thins in texture and fades into the distance, much like the memory of the River Styx.

Conclusion

The microtones in *The Styx* are used predominantly to suggest a primal quality in the harmony of the work reminiscent of an ancient musical world. The quartertones and microtonal effects add to the sense of mystery of the work's opening section as well as a foreground focus for these spectral textures. They also add unpleasantness and intensity to the climactic gestures of the second and third sections and add a primal quality to the melodic passages. This is supported by the imprecise pitch quality of the tone colours utilised in the percussion, whose instruments add an out-of-tune effect to the textures. These effects assist to paint the imagery associated with the River Styx and all relate to the work's theme; which is to represent a mythological feature of the pagan underworld and a river that was beyond the understanding for many of the ancient world and middle ages.

Chapter Four

ZODIAC TURBULENCE

General

Zodiac Turbulence was written upon an invitation from the director of the Sydney Conservatorium Modern Music Ensemble, Mr. Daryl Pratt. Work began on the piece in late 2009 and was completed in early 2010. Due to my interest in science and history, the influence on this work is the ancient Babylonian and Greek celestial coordinate system known as the *Zodiac*. The Zodiac is essentially an ancient form of calendar and divided the year into seasons using the knowledge of science and astronomy of the time. It is the basis of the modern day calendar and also uses twelve divisions. These divisions map the path of the sun and stars across the *heavens*, or what we would describe as the horizon. It is still used today in astrology and was also used in the ancient world, as it is now, to predict the future by mapping the position of the moon and naked-eye planets such as Venus and Mars.[1]

As the Zodiac was originally devised as a means to understand and divide the heavens of the ancient world, I decided to create a work based on this concept and the understanding we now have in this area. We now know the heavens to in fact not be Earth central but rather constitute an extended space in which Earth is positioned along with other objects. In such a space, each object has the potential to influence many others in a variety of ways. This can take the form of turbulence, which can exist on many levels, such as gravitational pressures to which one of the satellites of Jupiter named *Io* is subjected. Io is so close to Jupiter that its gravity causes constant

[1] Hübner, W & Hunger, H. "Zodiac" Entry, Brill's New Pauly Online Encyclopedia of the Ancient World, www.brillonline.nl (accessed December 2010).

and violent volcanic activity on Io. Solar winds (Gamma Rays/X-Rays etc.) emitted from stars are another type and are so destructive they can strip away a planet's atmosphere. Black holes, where a star implodes creating a vortex so intense all matter within its grasp is sucked into a spinning mass of singularity. The ultimate turbulence is the constant relentless expansion of the universe, which is not a violent form of turbulence, but the slow creeping away into infinity may ultimately result in the destruction of the universe.[2]

Turbulence then is the basic conceptual and musical inspiration for *Zodiac Turbulence*, and while the work is not programmatic, several of the images (gravitational turbulence, solar winds etc.) outlined serve as an imaginative basis for the exploration of various timbres and textures in this piece. Firstly, there is turbulence inflicted on the Equal Tempered Tuning System, which, along with the Zodiac also possesses twelve divisions. This turbulence is caused by the inclusion of microtones thus expanding harmonic possibilities and disrupting the consistency of the twelve-tone scale. The various timbres of *Zodiac Turbulence* are also subjected to various processes that cause turbulence and tension. Some examples of these processes include the rhythmic expansion of the gestures in section **II** that relate to the expansion of the universe. The alternation of two spectra in section **III** resulting in constant emerging and fading represents gravitational pulling, while the glissandi and rapid scales in section **IV** simulate images of matter bouncing around the universe.

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[2] Fraser, G; Lillestol, E & Sellevåg, I. (1995) "The Search for Infinity", Facts on File NY, p. 96-7 & p. 112-23.

Structurally, *Zodiac Turbulence* is divided into twelve sections labeled in the score with Roman Numerals. The structure is also palindromic, but the retrograde is not exact as some sections are only related by the process used or by texture. This is done to achieve structural contrast as an exact reversal may have proven to be predictable. All twelve chromatic pitches are used as fundamentals arranged intuitively with each section alternating between two of these. The second half uses the inversion of the first twelve fundamentals. **Table 1** outlines the bar numbers and fundamentals of each section. The table is also divided to outline the palindromic form.

Section	Bar Numbers	Fundamentals
I	1-26	Ab and G
II	27-67	B and A
III	68-92	C and Bb
IV	93-113	E and D#
V	114-34	D and F#
VI	135-62	F and Db
VII	163-89	G# and A
VIII	190-210	F and G
IX	211-39	E and F#
X	240-65	C and Db
XI	266-91	D and Bb
XII	292-320	B and D#

Table 1. Bar numbers and fundamentals for each section.

Section I: bar 1-26

The first section of *Zodiac Turbulence* acts as an introduction and begins with very high partials of the fundamentals Ab and G. The opening texture has a very bell-like sound and focuses on the crotales and piano with artificial harmonics in the strings doubling these pitches. There is an emphasis on intervals such as major and minor-sevenths and tritones in the harmony, at first melodically but later harmonically. As this section progresses other lower partials emerge, played on the other instruments of

the ensemble, including various microtonal pitches. The piano also takes more of a foreground role as this section develops, which becomes more prevalent at later points of the work.

Rhythmically, much of the material in this and later sections is based on the numbers 12 and 8 or numbers related to these. 12 represents the 12 divisions of the Zodiac while 8 refers to the 8 arc degrees of the Zodiac above the horizon used to track the moon and the naked-eye planets known as wandering stars. Therefore to begin with, each repetition of the two spectra is twelve crotchets overall in length and possesses four events or pitches. These events are sometimes single pitches, sometimes chords and are mostly emphasised by the piano. The overall length and events change over time, as the length is diminished to 10 crotchets and later 8 while the number of events increases to 6 then 8 and finally 12.

Section **I** is used to establish the mood of the work, as well as to introduce some of the main harmonic elements. One of these is the importance of the major and minor-seventh and tritone intervals to the melodic material of the piano. It also introduces the listener to the microtonal elements and timbres that permeate the entire work.

Section II: bar 27-67

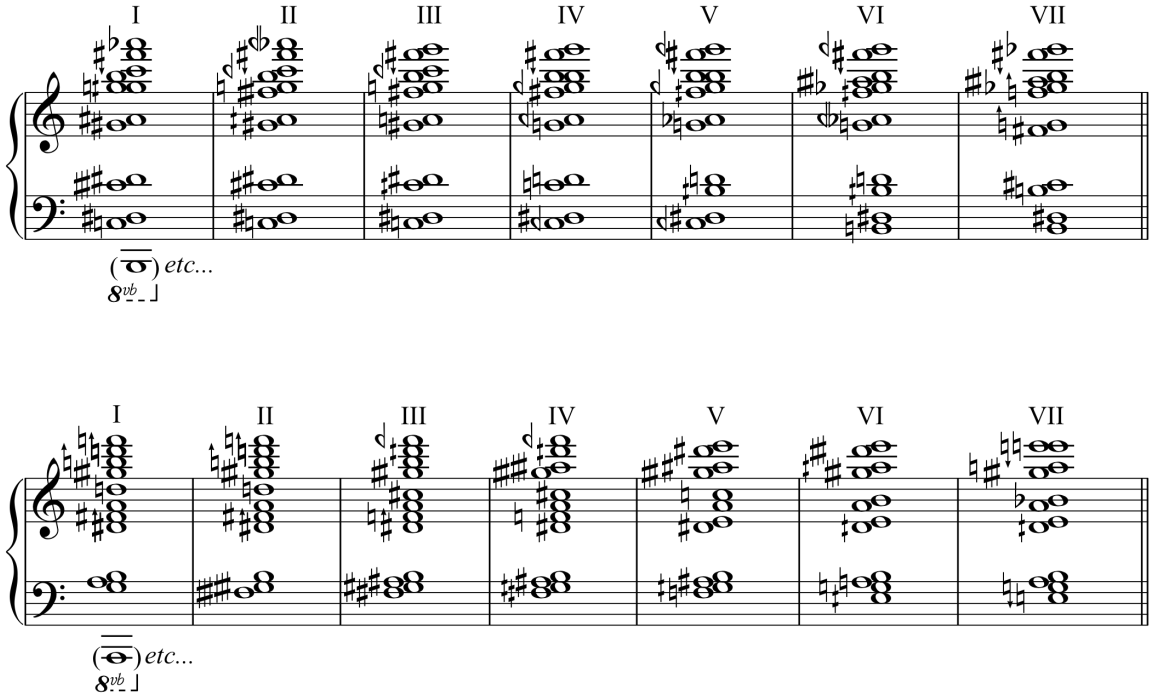
This section initiates the first process used to inflict turbulence upon the work's tone colours. This process involves a transition where the partials from Section **I** are gradually retuned over the course of Section **II** into harmonic spectra using the fundamentals of B and A. Most of these partials are retuned up or down in quartertone steps until the new partial of either the B or A spectrum is reached. There

are however some partials that exist in both spectra of Sections **I** and **II**. These remain unchanged during the transition and act as reference points for both performer and listener. This transition results in the spectrum for the Ab fundamental (from Section **I**) morphing into the spectrum for the B fundamental. Meanwhile, the G spectrum (also from Section **I**) morphs into the spectrum using A as the fundamental. As this metamorphosis unfolds, very turbulent inharmonic spectra result. This turbulence is gradually resolved as the harmonic and more stable spectra using B and A as the fundamentals are reached at bar 60. This is also the point where the transition process comes to an end.

The harmonic spectra of Section **II** reached at bar 60 also use partials that closely relate to the numbers 12 and 8. The spectrum using B as the fundamental has partials 4, 8 and 12 present plus the next partial up from each of these. It also includes 24, 32, and 48 plus the next partial down from each of these. The A spectrum uses partials 6, 8 and 16 plus the next partial up from each as well as 12, 32 and 48 plus the next partial down from each.

The texture used in Section **II** consists of feather-beamed decelerandi that are arranged predominantly in pairs, but on occasion groups of three. These pairs and groups are constantly permutated for contrast as is the order of each instrument. Rhythmically, each repetition of this gesture gradually expands. At the beginning of this section the duration of each spectrum is one 4/4 bar in length with each pair/group overlapping closely. Gradually, the ratio of overlapping is reduced, while the length of the decelerandi is also lengthened. By the end of the process at bar 60

each spectrum is 4 bars in length with almost no overlapping. The spectra and transition process for Section **II** is outlined below in **Example 4.1**.



Example 4.1. Transition process of Section II.

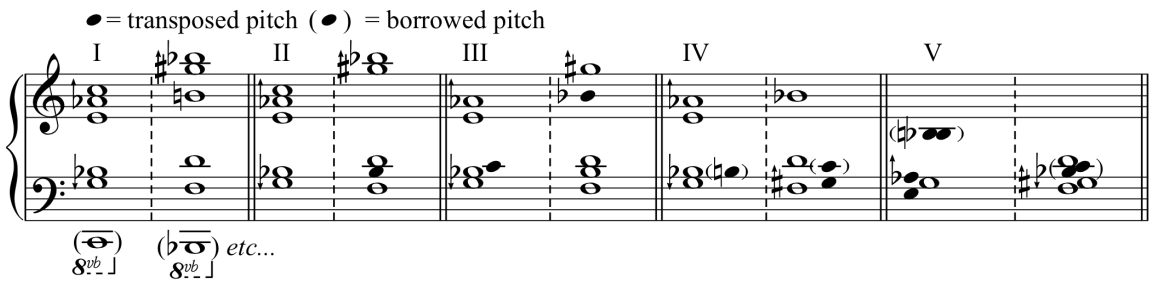
Section III: bar 68-92

This section contains a sustained texture that is very different from the bouncing decelerandi used in Section **II**. Towards the end of the second section some pairs and groups include sustained pitches to assist the transition from the decelerando texture to the sustained texture of Section **III**. The main feature of the third section is the alternation between two harmonic spectra using the fundamentals C and Bb. This alternation is achieved by the two spectra constantly emerging and fading in sequence from foreground to background. The constant crescendi and decrescendi cause tension at the crossover points where one spectrum is still fading and the other emerging. The overall length of the crescendi and decrescendi begins as 8 crotchets,

and then is diminished to 6, 4, 3 and finally 2. These numbers again relate to 12 and 8.

There is also a process used to again add turbulence to the tone colours of Section **III**. As stated previously, the two spectra of C and Bb begin as harmonic spectra. Each version of these two spectra (five overall) also corresponds to the various crescendo and decrescendo lengths (8, 6, 4, 3, 2). These five versions of each spectrum gradually include partials that are transposed down one octave (occasionally down two octaves), which is a very simple technique that gradually adds more inharmonicity to the spectra as the pitches are grouped closer together. A darker quality is also added as the process unfolds.

In addition to transposing partials downward, the final two versions of these spectra also swap pitches. With the fourth versions appearing at bar 86, the C spectrum borrows the pitch B from the Bb spectrum. This pitch now appears with the C spectrum throughout the remainder of Section **III**. The Bb spectrum meanwhile borrows the pitch C from the C spectrum. Then at bar 89 for the fifth and final versions, the C spectrum borrows Bb, while the Bb spectrum borrows the microtonal pitch Bb 1/8th tone flat. This very simple process adds tension to the texture over time and is outlined in **Example 4.2**. The piano part, as in the first section adds a melodic element to the sustained texture and signposts the various changes to the spectra mentioned as well as providing the fundamentals. This signposting is done by adding more activity in the piano just before the spectral changes. The piano material is also related to Section **I** and emphasises the same intervals. Refer to **Appendix VI** for a score excerpt of this section.



Example 4.2. Transition process of Section III.

Section IV: bar 93-113

The fourth section of *Zodiac Turbulence* again has a very different, very active texture that uses overlapping glissandi and rapid scales beginning in the low register and leading to higher spectral partials. These glissandi and rapid scales are executed by the cello, viola, bass clarinet, trombone and piano and are followed by repeated staccato pitches in the other instruments. The first and last pitches of the glissandi and scales outline various partials of each spectrum. The repeated staccato pitches are also spectral partials immediately above and below partials that are again related to the numbers 12 and 8. For example, partials 15 and 17 (above and below 16 etc). The two fundamentals used are E and D#, with the E spectrum using partials 7, 9, 15, 17, 23, 25, 31 and 33 in the repeated staccato texture. The D# spectrum meanwhile uses partials 7, 9, 11, 13, 17, 19, 47 and 49. The rapid scales and glissandi occur between lower partials where the intervals are wider apart.

As in Section **III**, these partials are gradually transposed down by one or two octaves over the course of each occurrence of these two spectra. There are four occurrences overall of each, with this process again leading to an increase in inharmonicity and tension. It also leads to some of the rapid scales and glissandi changing to a downward direction.

The rhythmic length of each spectrum begins as twelve crotchets overall in length, with each repeat being reduced by one-twelfth. This manifests as a reduction of one crotchet for each repeat, and hastens the build-up of turbulence. This section is also significant as it is the first climactic point and the dynamic level is predominantly ***f***. The brass instruments are also used without mutes for the first of only three occasions, thus assisting the work's first small climax. This tension is sustained through to the beginning of Section **V**.

Section V: bar 114-34

The contrasting texture for Section **V** consists of overlapping arpeggios of partials using the fundamentals D and F#. These arpeggios are arranged predominantly in pairs and use various cross rhythms beginning with faster versions that become slower over time. Each instrument is assigned to a particular spectrum, with the trumpet, violin II, clarinet and flute realising pitches from the D spectrum while the violin I, viola and oboe the F# spectrum. The piano uses arpeggios from both spectra and is the only instrument to do so. It also provides the fundamentals with the cello and trombone. The combinations of arpeggios are constantly permutated during the five repetitions of each spectrum, with different instrumental colours often emerging and/or fading from the texture.

The rhythmic length of each spectrum's occurrence is gradually increased over the course of Section **V**. This is very similar to Section **II**, with the spectra beginning as one 5/4 bar each at bar 114, and augmenting to four 4/4 bars each by the end of the process at bar 127. The overlapping of the arpeggios is also similar to Section **II**,

which begin very close together but slowly begin to occur further apart as the process unfolds. The length of each arpeggio also increases from three crotchets in length to six crotchets by bar 127. Overall this results in the tension built-up during Section **IV** being relaxed very quickly.

Although the overlapping parts are similar to those in section **II**, the process used to achieve the timbral metamorphosis in Section **V** is different. The main difference is that the spectra in Section **V** begin inharmonic and transform into harmonic spectra to correlate with the decrease in tension. The arpeggios are transposed down from their original positions in the inharmonic spectra versions, as in Sections **III** and **IV**, but due to the inharmonic spectra appearing first, the arpeggios begin in lower registers than normal and are transposed up to their natural positions as the process unfolds. The partials present again use 12 and 8 as well as related numbers. Another partial up or down from these, normally a third or an interval close to a third (sometimes microtonal) is also used to arpeggiate between.

Sections VI and VII: bar 135-89

The middle of *Zodiac Turbulence* constitutes the pivot point for the palindromic form and Sections **VI** and **VII** is where this occurs. This means that in terms of the process and rhythmic length used, Section **VII** is an exact reversal of section **VI**. These middle two sections show the palindrome in the most obvious manner; there are however, still some differences. The major difference is the two pairs of spectra for each section. Section **VI** uses harmonic spectra of the fundamentals F and Db while the seventh section uses sub-harmonic spectra with the fundamentals G# and A. Not

only are the intervals different, providing different harmonic changes, but the contrast between the harmonic and sub-harmonic spectra is also quite considerable.

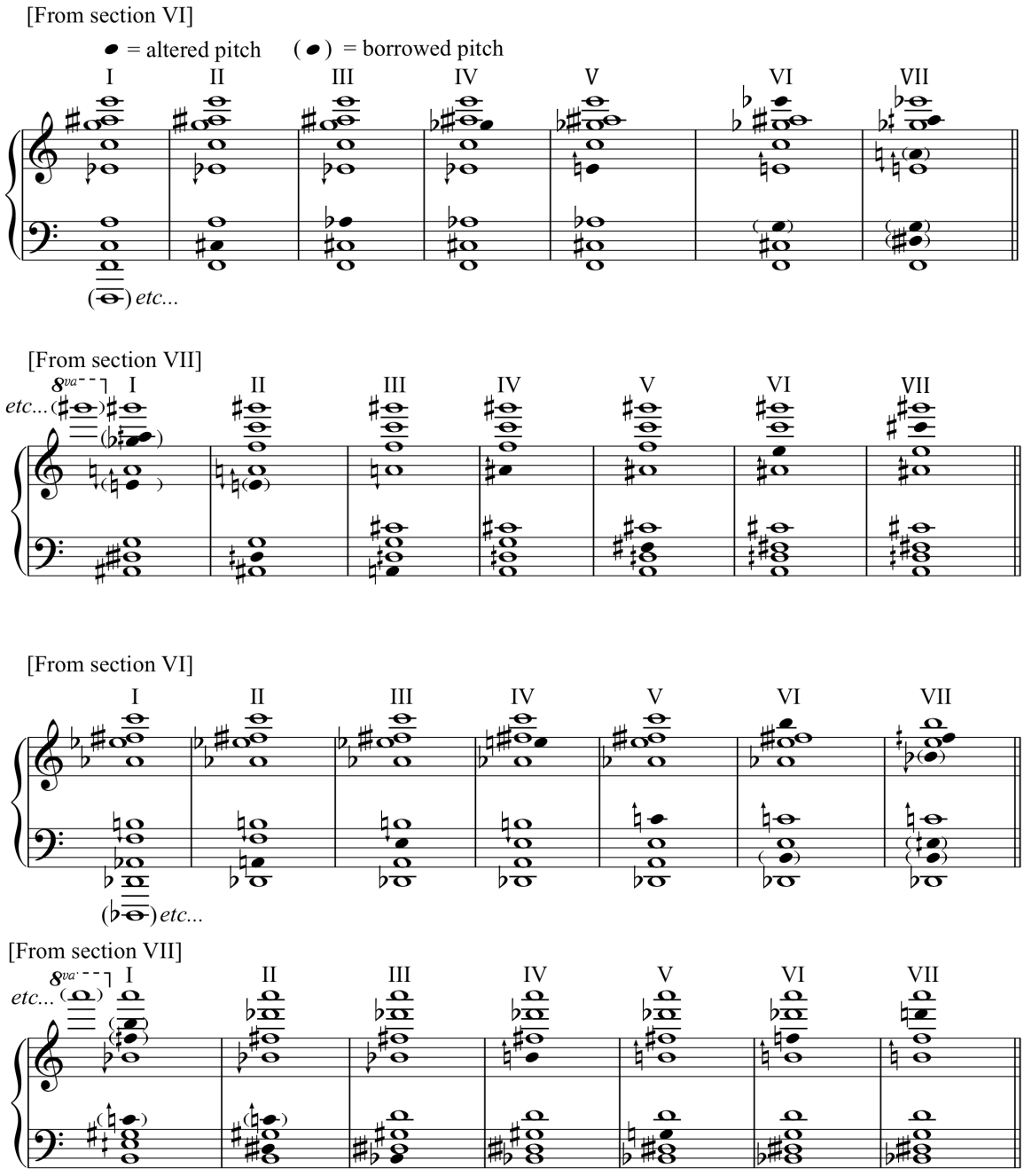
The texture throughout these two sections is sustained, but also possesses various staggered changes to the pitches to break-up the alternation between the two spectra. These staggered changes are emphasised by various instrumental pairs, with the violin I and cello beginning the process. This is followed by the flute and violin II following in the exact same rhythmic length but two beats later. The rhythmic length of these pitches is twelve crotchets for whichever pitch of the F spectrum these instruments are realising, followed by eight crotchets for the respective pitches of the Db spectrum. The other two staggered pairs are found firstly in the trumpet and trombone, and the oboe with the viola and clarinet. The viola is present in the F spectrum's orchestration while the clarinet appears in the Db spectrum. These two pairs (trumpet and trombone, oboe and viola/clarinet) have their rhythmic lengths swapped to those of the other pairs mentioned previously. This means that the length for the F spectrum partials is eight crotchets overall while the Db pitches are twelve crotchets long. The entry of the trumpet and trombone pair is staggered three crotchets after the initial pair (violin I/cello), while the oboe and viola/clarinet a further two beats later. As this process unfolds, these rhythmic lengths are gradually diminished to seven and three crotchet lengths overall by bar 160. These diminutions are then reversed during Section **VII**, manifesting in a gradual increase in length back to twelve and eight crotchets at bar 180.

The various instrumental pairs mentioned above also emerge and fade with different combinations of tone colours. To begin with, plain sustained pitches emerge and fade

with the only exception to this the strings using *sul tasto* bowing. From this point forward different combinations of instrumental timbres are used such as *vibrato, tremolo, pos norm, sul pont* and even *noise bowing* in the strings. The winds have fewer possibilities, but *vibrato* and *fluttertongue* are used along with dynamic changes for contrast. As with the rhythmic changes, these timbral combinations are repeated backwards during Section **VII**. The piano also adds further textural contrast through various solos predominantly emphasising the major/minor-sevenths and tritones of previous sections. This material is developed further, often by inverting these intervals but also adding other rarely used intervals such as thirds and sixths. The transition of the spectra, to be explained in greater depth below, also adds other interval combinations and changes to this material. The piano solos also evolve, with this material gradually occurring further into the lower register.

The turbulence technique used for the spectra of Sections **VI** and **VII** is once again to slowly transform them into inharmonic, dissonant versions. This is done by changing the interval structure and distorting them by adding more dissonant intervals. For example, the perfect-fifth above the fundamental is altered to become an augmented-fifth. The major-third above the fundamental is diminished to a minor-third. The major-second above the fundamental is lowered to a minor-second, and so forth. This process encompasses most of the partials used on both harmonic and sub-harmonic spectra throughout these two sections. In addition to this, the last two versions of the F and Db spectra in Section **VI** and the first two versions of the sub-harmonic spectra of G# and A in Section **VII** use borrowed pitches as in Section **III**. There are seven versions of each spectra overall with the sixth version of the F spectrum borrowing the pitch G from the G# spectrum. In the seventh version the pitches D three-

quartertone sharp and A 1/8th tone flat are also borrowed from the G# spectrum. The first version of the G# sub-harmonic spectrum borrows from the F spectrum the pitches A quartertone sharp, Gb and E 1/8th tone sharp; the second version retains only the E 1/8th tone sharp. The same process is carried out to the Db and A spectra and is outlined below in **Example 4.3**.



Example 4.3. Transition process of Sections VI and VII.

These mixture spectra occurring between bar 157-67 are more turbulent in order to correlate with the small climax emphasising the pivot point of the palindromic form. This climax is further emphasised by the dynamics, with all instruments executing crescendi and decrescendi to and/or from ***f***. The brass also uses *fluttertongue* for the first time in this section and the strings *noise bowing*.

During Section **VII** the piano solos are further highlighted by the instrumental parts coming together. The staggered texture is briefly abandoned between bar 174-9 with the wind and string instruments appearing simultaneously and dropping out simultaneously where the piano solos occur. This predominantly leads to the piano appearing on its own for several short moments, with these solos related intervalically and rhythmically to the adjacent solos in Section **VI**. This is done for further structural contrast and also emphasises the importance of the palindrome, as at this point the sub-harmonic spectra begin to be more audible. Earlier occurrences of these sub-harmonic spectra, particularly the initial two mixture spectra deliberately do not emphasise this difference. This is done in order to gradually reveal the underlying changes to the listener. **Appendix VII** contains a score excerpt of Section **VII**.

Section VIII: bar 190-210

As the structural palindrome continues its course, each of the following sections is related to its corresponding section in the first half of the work on some level. Section **VIII** is an exact rhythmic retrograde of Section **V** as is the distortion process. The overlapping arpeggio texture of section **V** is also retained. The difference between these two sections is that the two spectra in Section **VIII** are sub-harmonic using the fundamentals F and G. Another similarity is the number of versions for each

spectrum (five altogether); these begin as sub-harmonic spectra and transform into inharmonic versions by transposing the various arpeggios. These are mostly transposed up an octave (sometimes two) and result in more turbulent spectra as the arpeggios occur in closer registral proximity. The release of tension during Section **VII** results in the initial texture of Section **VIII** appearing very calm. As the transition process is used in retrograde, the overlapping of the parts becomes closer, the two spectra more dissonant and the cross rhythms faster, tension is again increased towards the next section.

Section IX: bar 211-39

Section **IX** is related to Section **IV**, and also contains another small climax with the brass instruments again *senza sordino*, creating a point of emphasis in the musical structure. The texture and developmental process is also related to that of section **IV**, but different rhythmic lengths are used. The two spectra are also sub-harmonic and use E and F# as the fundamentals. The texture containing glissandi and rapid scales is retained, but its contour is inverted to a downward direction and appears in the higher register. These again outline various partials and lead to a repeated texture using low sub-harmonic partials. These are again transposed to result in inharmonic spectra, but in an upward direction as in Section **VIII**. Occasionally there is also variation to the partials used. An example occurs in the E spectrum where the first version uses partials 35 and 37 (the partials used are directly up and down from numbers related to 8 and 12) in bar 212 in the cello and bass clarinet. In the second version of this spectrum (appearing in bar 219), partials 31 and 33 are used instead in these instruments to add further variation in addition to the various transpositions.

Using sub-harmonic spectra develops the texture of Section **IV** further, and also the timbre as the lower register is emphasised. This is further developed by the piano and trombone, on which are performed certain extended techniques at the end of each repeat. This involves striking small clusters on the internal strings of the piano as well as the trombone playing various low partials of each spectrum inside the piano. These low clusters emphasise the sub-harmonic spectra and rise gradually to support the rise in register as the other parts are transposed. The trombone emerges from these clusters and results in the piano strings being agitated by the sound waves, creating a resonant effect. This becomes more audible as the ninth section progresses and the amount of rhythmic space is increased at the end of each repeat. This is the direct effect of the rhythmic augmentation process that begins with the E sub-harmonic spectrum ten crotchets overall in length and the F# spectrum fifteen. The ratio of these two numerical values is the same as that of 8 and 12 (2:3). Over the course of Section **IX** and its four repeats of each spectrum, the rhythmic length is increased to twelve and eighteen crotchets respectively. This increase again preserves the same ratio.

Section X: bar 240-65

This section corresponds with Section **III**, and it possesses the same rhythmic length and transition process only in reverse. It also, by coincidence, possesses one of the same fundamentals (C) with its second fundamental being Db. The spectra of these two fundamentals are arranged in the same sustained alternation texture as Section **III**. These spectra begin inharmonic and are distorted by the same transposition technique, and gradually evolve into harmonic spectra by bar 258. The piano also adds melodic contrast again to the sustained texture by executing short solos. As one

of the fundamentals is the same as Section **III**, many of these solos are very similar to those in the third section. This is additionally reflected in the rhythmic content, which is also very similar and often varied by permutation to that of section **III**.

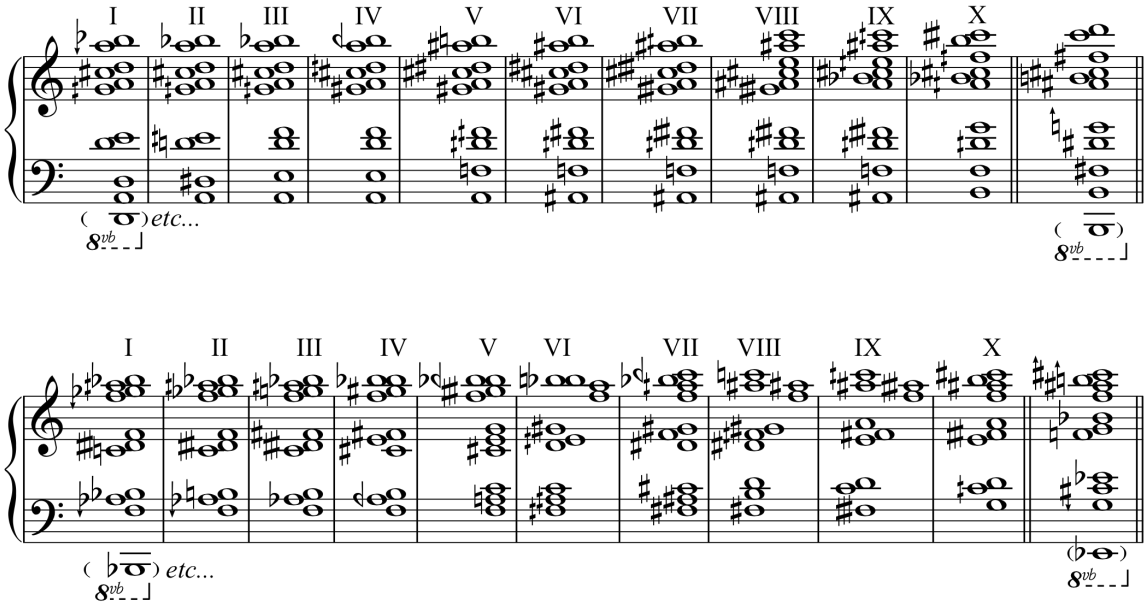
Section XI: bar 266-91

Of all the structural points found in *Zodiac Turbulence*, Section **XI** departs the most radically in the palindromic form to its corresponding section. It is related to Section **II** by its transition process, but the texture and rhythmic processes are very different. The aforementioned similarity, involves the spectra of the fundamentals in Section **XI** (D and Bb) transforming into the spectra for the fundamentals in Section **XII**. This transition process results in the D spectrum evolving into the B spectrum of Section **XII**. The Bb spectrum meanwhile, morphs into the D# spectrum of section **XII** occurring in bar 296. Inharmonic spectra soon occur as the partials of each are predominantly retuned by quartertone steps in an upward direction. These two spectra again contain partials related to the numbers 8 and 12, and are retuned until the corresponding partials of Section **XII** are reached.

The texture for this section consists of sustained swelling pitches where a rapid increase and decrease in dynamics is the predominant feature. By emphasising the various partials of the spectra in each instrument solo, this texture and the spectra are filtered. The D spectrum is realised by the bass clarinet, cello, trumpet and violin I. The Bb spectrum is realised by the trombone, viola, violin II, oboe and flute. The piano is used in both spectra, and primarily consists of fast, upward arpeggios. The first of these spectra (there are ten versions of each altogether) appear on their own and are twelve crotchet beats in length. As the rhythmic diminishment process

materialises though, the spectra begin to overlap as each contracts at a different rate. The length in between the first two versions of the D spectrum is twelve beats, while the length in between the first two versions of the Bb spectrum is eight beats. This is the cause of the initial overlap and as the rhythmic diminishments to 8, 6, 4, 3 and 2 continue, the overlapping of these spectra comes closer together. This again correlates to the section's gradual increase in tension and the most turbulent spectra.

There are two points where the spectra appear simultaneously, at bars 283 and 290. The second of which is the climax point of the above process, and in addition, the entire work. All instruments play ***fff***, with the brass un-muted and strings performing *noise bowing*. It is also the point where the texture is the most complex and dissonant, and the only section where two spectra appear on top of each other in this manner. The transition process to Section **XII** is outlined in **Example 4.4** and **Appendix VIII** contains a score excerpt of this section.



Example 4.4. Transition process of Section XI.

Section XII: bar 292-320

The final section of *Zodiac Turbulence* relates to the first, and also acts as a coda. Apart from the first two versions, the overall rhythmic length of the five spectral repetitions occurs in reverse to that of Section **I**. The first two have rapid scales added beforehand that relate to those of Sections **IV** and **IX**. They also help to link Section **XII** with the preceding climax. The rhythmic length and number of events in each spectrum is preserved from Section **I** apart from these scales.

The piano is again the main focus of the texture, and predominantly emphasises the intervals found throughout the work (M7, m7 and tritone) using B and D# as the fundamentals. As the final section unfolds, the piano begins to include extremely high partials as much of the ensemble begins to drop out. These partials are progressively transposed however into the extremely low register to contrast the bright opening of the first section with a darker tone colour. The cello, viola, trombone and bass clarinet often double the piano pitches, particularly towards the ending. The very last versions of these spectra though, appear only in the piano. These extremely low pitches gradually dissipate into nothing, as our universe may do in the very distant future.

Conclusion

The contrasting timbres outlined in this analysis that permeate *Zodiac Turbulence* are integral to this work's expression. They are devised to represent various images of the turbulent forces inflicted upon the universe. These forces can often be extremely violent, and the microtones used in this work, coupled with the dynamics and instrumentation, assist the formidable nature of these to be conveyed. The microtones

are also essential to the construction of these synthesised tone colours, for they would have a far less vivid shading if they were not included. They also emphasise the various turbulent transitions of these timbres that are linked to the work's concepts and influence the perceptions of the listener. *Zodiac Turbulence* is another example of my work where the role of microtones and tone colour is integrally linked, and is essential to my compositional expression.

CONCLUDING REMARKS

I feel my next challenge as a composer is to discover ways to combine my primary compositional aesthetic of utilising microtonal harmony and timbre with my secondary interests in exploring indeterminacy, rhythm and rhythmic space. These secondary interests have become more important in my work in recent times and began with a work from 2007 entitled *Distorted Waters* (not included in this portfolio). The other works of my portfolio (*Modes of Deception, Listen and Voltage*) include examples of these secondary interests, but are not analysed in this thesis.

My portfolio of works already demonstrates some elements of how this fusion may occur. The surging chords in *Tensility-Vortex* are an example. The rhythmic length of the crescendi and decrescendi in these chords are strictly outlined and consistently change outlining a continually shifting rhythmic space. The unmeasured sections in *The Styx* also combine these elements as the indeterminate percussion cadenzas are often accompanied by spectral harmony. *Listen* also uses spectral harmony within its indeterminate sections. My future challenge will be to make any fusion more comprehensive and musically relevant, not superficial as can be the case when using two different elements simultaneously. *Zodiac Turbulence* is an example of how these may be effectively combined as the expansion or contraction of rhythmic space used in some sections is directly related to its aesthetic concept.

I anticipate that my primary compositional aesthetic will not change though and I will continue to explore possibilities with microtonal and spectral harmony and tone colour. As demonstrated in chapters one to four the role of timbre and microtones is

intrinsically linked in my work and expression of this is its primary purpose. This purpose is to metaphorically synthesise different tone colours that relate to the aesthetic concept(s) of a work. This becomes an expressive tool to stimulate the imagination of the listener and convey imagery in these works of; stretching a vortex in *Tensility-Vortex*, the discrimination and chaos felt by Prussian immigrants in *The German Hills*, the pagan underworld of ancient Greece in *The Styx* and the turbulent forces that shape the universe in *Zodiac Turbulence*. These techniques also lead to an increase in the intensity and dissonance of various textures that would otherwise not be possible. Therefore, this aesthetic approach is extremely effective as a means to metaphorically synthesise new and vivid tone colours and intensify tensions and climaxes resulting in an original aural experience for the listener.