The Composition of New Music Inspired by Music Philosophy and Musical Theoretical Writings from Ancient Greece

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I declare that the work presented in this thesis is my own original work.

signed,

Coreen Morsink, August 20, 2013

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Abstract

This thesis consists of a portfolio of compositions linked to ancient Greece and a theoretical and historical explanation of the music of ancient Greece which led to the composing of each piece. Every composition explores an aspect of ancient Greek tuning systems or a tuning system that related to Ancient Greece. Compositions for solo violin, solo alto flute, solo quarter-tone alto flute and solo clarinet use monophony as well as harmonics from the overtone series and number series. A chamber work, string quartet and solo piano piece exploit heterophony. Harmony and polyphony based on quarter-tones from ancient Greek style scales are issued in a work for choir and orchestra. The compositions do not reconstruct music from ancient Greece but rather use the ideas of the past as a step forward to new original compositions and a new style of writing.

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1. Introduction

When I started this portfolio of compositions and thesis, I was more interested in reconstructing the music of ancient Greece than in composing new music. I studied ancient papyrus manuscripts and stone carvings of ancient Greek notation and looked at other musicologists' work and made my own transcriptions of ancient Greek music. This is a form of art, but not composition in the sense that I wanted to compose my own music. Thus began the first work in this portfolio, *Orestes' Chamber* which uses the Orestes papyrus notation fragment and texts from Euripides' play but goes forward in a new direction using a combination of old and new compositional techniques. Each piece in this portfolio explores an idea about ancient Greek music and philosophy and how it can be applied to create new music. Some pieces follow the more traditional perceptions of how ancient Greek music may have sounded, with either monophonic or heterophonic texture. Other pieces question this assumption and use harmony and polyphony. We will never know exactly how ancient Greek music sounded, but we have the philosophical and theoretical writings from ancient Greece as an inspiration for new music.

Ancient Greek music may seem to be an unusual place in order to start new music, but in reality it is an excellent base for contemporary writing. This portfolio of compositions develops the use of many centuries of tuning systems which started in ancient Greece or have a relation to Ancient Greece. The majority of the compositions use the tetrachordal system of Ancient Greece as explained by Aristoxenus (ca 320 BC), but others explore mean-tone tuning, natural harmonics as well as the well-tempered system. The question of the importance of numbers in music and philosophy throughout ancient and contemporary music is contemplated and shapes the rhythm and structure of each piece. The use of heterophony as a main texture reflects traditional assumptions about Ancient Greece music and is shown in a work for chamber ensemble (*Orestes' Chamber)*, solo piano (*12-1Preludes*), string quartet (*stolen glimpses of eternity*) and solo organ (*…catharsis…*). Monophony as well, which is documented in papyrus and stone engraved written music from ancient Greece is found in solo works for quarter-tone alto flute and regular alto flute (*Andromache's Recitativo, Aria and Subtext)*, clarinet (*Fibonacci in a Black Hole*) and violin (*erosion*). These solo

works also focus on the harmonic series and the use of multiphonics which may or may not have been used in ancient Greece in music. The use of homophony and polyphony based on ancient Greek tetrachordal modes is also explored in the choral/orchestral composition *Divine Eros*. Although the philosophy and theory of ancient Greek musicians is a continuous theme in all of the works, the object of this portfolio is not to imitate older styles but to create new ideas following the wisdom of enlightened ages past.

To begin, an exploration of the main qualities of Ancient Greek music starting approximately 5th Century BC will be shown. Afterwards, each piece will be examined along with the tuning system and number system used in its development and composition.

2. **The Musical Practices and Theory of 5th to 2nd Century BC Greece**

2.1 **Texture**

Writings by philosophers and music theorists from approximately 500BC to 100 AD and fragments of ancient music re-discovered indicate that monophony and heterophony were the main textures used in 5th Century BC Greece[1]. On the other hand, the possibility that homophony and polyphony were a part of music making during that time should not be discarded[2]. Fragments of text found engraved in stone or written on papyrus have been found with vocal notation written above the text as well as instrumental notation written usually on the same line as the text. From these fragments one can distinguish monophonic melodies and occasionally harmonic intervals, usually those of a P4. These show compositions that were either for solo voice or a solo instrument, or a combination of voice and instruments in which mostly doubling in the unison or P8 occurred. Other harmonic intervals are not apparent as "there are many melodic intervals smaller than the fourth, but they are all discordant"[3]. Improvisations on the melody by ensemble members

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[1] "Archaic and classical music was transmitted orally…music was heterophonic with free instrumental accompaniments". I. Henderson (1957), "Ancient Greek Music" in volume 1 *The New Oxford history of Music, Ancient and Oriental Music*, London, Oxford University Press, p. 336. See as well examples of Ancient Greek Fragments reconstructed in modern notation by E. Pohlman and M. West (2001), *Documents of Ancient Greek Music,* Oxford, Clarendon Press.

[2] Dr. L. Bianchini, written skype conversation included in appendix, November 6, 2011.

[3] Aristoxenus, trans. A. Barker (1989-2004), *Greek Musical Writings: II Harmonic and Acoustic Theory*, Cambridge, Cambridge University Press, p.139.

may have created dissonant harmonic intervals within the piece, but the overall texture probably would have been that of heterophony. As in Greek folk music, there would have been a "constant recreation"[4] of the music. One example slightly outside heterophony which existed in ancient Greek music was the lament in the form of call and response which was sung at harvest time as well as at the time of mourning. The lament had a leader and a chorus repeating, but again it would have been monophonic and heterophonic rather than having intended harmony or polyphony. One interesting example in a more contemporary setting is Sir Patrick Leigh Fermor's commentary on a funeral lament in Mani, Greece which he links to times and customs as old as putting a coin under the tongue of the deceased for Charon[5]. As well, there is no proof that drones and melodic ostinati were used at this time although the diaulos may have been used for this purpose since the second pipe usually had fewer holes indicating less possible notes available.

In my compositions I have mostly used monophony and heterophony as seen by doubling of parts at the octave and ornamentation. Occasional use of chord-like patterns exist, such as in arpeggiated passages in the violin variations, but they are mostly based on a quartal harmony rather than tertial in order to preserve the quality of the consonant intervals. Use of tertial harmony and polyphony is exploited only in my choral/orchestral work. Research by Graham Jackson discusses the use of chords written out by the British Druids and Celts before harmony was 'invented' in Europe[6]. The Celts were recognized and recorded in Greek historical/geographical writings by Hecataeus of Miletus, in 517BC known as the 'Kelti' (κελτοι)[7]. This opens up the possibility that harmony was used in ancient Greece. Considering the high level of technology, knowledge and education of the ancient Greeks I feel it is rather snobbish of us in the 21st Century to assume that they did not know about harmony or polyphony. More likely they preferred not to

[4] N. Watts (1988), *The Greek Folk Songs*, Bristol, Bristol Classical Press, p. 35.
[5] P.L. Fermor (1958, 1984), *Mani*, London, Penguin Books, p. 54.
[6] G. Jackson (2006), *The Spiritual Basis of Musical Harmony*, Shelburne, George A. Vauderburgh publisher, p.82. Document in British Museum MS Add.14905 as reproduced on pp. 83-84 with a transcription in modern notation pp. 85-86.
[7] http://en.wikipedia.org/wiki/Celts accessed 07-02-2012.

use harmony and polyphony as can be seen in one of *the Aristotelian Problemata*[8] which asks "Why is a doubled fifth or a doubled fourth not concordant, whereas a doubled octave is?"[9] Thus my choral/orchestral work *Divine Eros* uses ancient Greek theory combined with harmonic and polyphonic functions although the ancient Greeks normally did not use these textures.

2.2 **Rhythm and Poetic Meters in Ancient Greece**

Rhythm was an intrinsic part of ancient Greek music and primarily followed the poetic meters of ancient Greek, "for rhythm is the vital soul of music"[10]. Short and long syllables are usually written as − for long and U for short and are known as a poetic "foot" and rhythm was connected to dance as well as poetry. The strong beat was called the Step (Kato) or Thesis and the weaker beat the Lift (Ano) or Arsis and were combined to make patterns which can be divided into groups of 2, 3, 4 or combination of patterns. Rhythm was classified as well by ratio, such as 1:1 (dactyl, −UU used in Homeric songs with lyra accompaniment), 1:2 (iambus, −U) and 2:3 (paean, −UUU, used in dancing)[11]. Combinations or mixes were made as well such as dochmiac : −U −U− which showed the characteristic of urgency.

These rhythm patterns can be compared to measures as are used in Western Classical music, but often need compound divisions in order to be made into a time signature eg. 3+5/8 in the papyrus fragment G2315 from *Orestes*[12]. Rhythm patterns had different moods and qualities much like the melodic modes. Combinations of feet were combined and longer patterns made, for example, Dactlyic hexameter: -UU -UU -UU -UU -UU - -

When music followed a poetic text the beat cycle would often change which in modern notation would mean a change in time signature possibly every measure. Long syllables were subdivided into 2 or more shorter notes and even beat

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[8] A collection of questions compiled by the students of Aristotle, during and after Aristotle's time. A. Barker (1989-2004), *Greek Musical Writings: II Harmonic and Acoustic Theory*, Cambridge, Cambridge University Press, p.85.
[9] Author unknown, trans. A. Barker (1989-2004), *Greek Musical Writings: II Harmonic and Acoustic Theory*, Cambridge, Cambridge University Press, p. 95.
[10] M.L.West (1992), *Ancient Greek Music*, Oxford, Clarendon Press, p. 129.
[11] ibid., p. 131.
[12] See digital photo of fragment on page 23 of this thesis.

patterns made into irregular divisions (-U turning into two notes equal in length). These will be further explored in context of the compositions written in this portfolio.

2.3 **Tetrachordal Structure and Use of Genera with Microtones**

One of the most interesting and complex issues in 5th Century Greek music is the use of tetrachords in music involving different sizes of tones, semi-tones and micro-tones. The basic melodic unit was made from a P4 of ration 4:3 (498 cents) and from it different groups of tetrachords were made depending on the style of music being written. The outer notes of the tetrachord did not change, but the inner two notes were changeable creating different groups (classes) or *genera* (γένη). Music philosopher Aristoxenus believed in "a wholly new science that will study music on the basis principles intrinsic to itself, not borrowed from physics or mathematics"[13]. Aristoxenus divided the tone into 12 units in order to define the different genera[14] and later theorists such as Aristides Quintilianus doubled the figures[15]. A chart of the genera can be made in this manner as can be seen in the notes on *erosion*.

The most common genera used in the 5th Century BC was the enharmonic (also known as the noun "harmonia" meaning good) which used quarter tones as well as a di-tone. Thus it would be comprised of:

Enharmonic: ¼, ¼, 2 Tones= 6,6,48 units/60 (approximate example: E, E♯, F, A)

Also used were the chromatic and diatonic which could be subdivided into various shades or colours using ¼ tones, 1/3's of tones 3/8's of a tone and ¾ of a tone. Again, tuning was a matter of argument as will be discussed later. The Chromatic and Diatonic were as follows:

Tonic Chromatic (known as Chromatic): ½, ½, 1 ½ tone=12,12,36 units
Soft Chromatic: 1/3, 1/3 1 5/6 tone= 8,8,44 units
Hemiolic Chromatic 3/8, 3/8, 1 ¾ tone=9,9,42 units
Tense Diatonic (known as Diatonic): ½, 1, 1 tone=12,24,24 units

[13] Barker, *Greek Musical Writings: II Harmonic and Acoustic Theory*, p. 120.
[14] Ibid., footnote iii, p. 419.
[15] ibid.

Soft Diatonic: ½, ¾, 1 ¼ tone=12,18,30 units[16]

Tetrachords could be placed next to each other to form longer melodic stretches making the Greater Perfect system, or basically a two octave range. One could mix different genera in the same piece or use only one.

In my compositions I have made use of the different genera exploring different combinations to produce different moods. In particular, the pieces *erosion* and *Andromache* makes an in depth exploration of the different colours of genera.

2.4 **Instruments in Ancient Greece**

Students from St. Catherine's British School pose holding instruments made by Panayiotis Stefos, 2008.

Instruments used in 5th Century BC were varied and widely used by educated citizens as well as working musicians. The most commonly played instrument by citizens was the lyra, but other string instruments such as the barbitos and kitharis were also popular. The aulos was considered to be a more bawdy instrument and thus not usually taught to the upper-class. The pitch range of string and wind instruments were limited (up to 2 octaves generally) and brass instruments like trumpets, which were used for starting races in the Olympic games limited to the

[16] based on: West, *Ancient Greek Music*, p. 169, and Quintilianus trans. by Barker, *Greek Musical Writings II*, (units of genera), p. 419.

length of the tubing and harmonic series. String instruments usually had either 7, 9 or 11 strings and could be tuned to various genera, while an aulos would have particular holes for a specific genus.

Ancient Greek instruments have been re-constructed by various musicians and technicians and are played by many accomplished musicians. The group *Lyravlos*[17] led by Panayiotis Stefos has been a great influence on my compositions with his sensitive reconstruction of ancient Greek melodies and fantastic construction of new ancient Greek instruments based on vase paintings and stone engravings depicting such instruments. Described below are the most common instruments from ancient Greece which have influenced my composing.

String Section

String instruments were usually held in the arms and the strings plucked with the left hand fingers and plucked with the right hand with a plectrum.

Replicas of Ancient Greek instruments made by Panayiotis Stefos. Lyra in centre, Pandura centre right. Photo by C. Morsink

Lyra: The most common instrument learned by the educated upper-class. Made with an empty turtle shell, hide covering of sound-board, gut strings extended to either a wood frame or deer antlers, it had from 7-11 strings. Tuning pegs were made from either wood or bone.

[17] www.lyravlos.gr

Barbitos: A longer version of the Lyra, it had a deeper sound created by the longer strings and was a popular instrument among women, notably Sappho.

Kithara: Larger and heavier, the Kithara or Kitharis is a very beautiful instrument often depicted on vases. Because of its weight, men more often played this instrument.

Pandura: The Pandura was played horizontally like the modern guitar and usually had three or four strings. Instruments like the lute, al'oud and balalaika are comparable.

Forminx (Phorminx): Achilles' beautiful Phorminx is described in the Iliad when he is busy playing music in protest instead of fighting. In design it is similar to the Kithara although less ornate.

Kitharis made by Panayiotis Stefos based on sculptures and drawings from ancient Greece. Photo by C. Morsink

Wind instruments

Aulos, diaulos: The aulos is often mis-translated as flute but in reality is a double reed instrument. The goddess Athina is given credit for its creation, but such instruments were in existense in ancient Sumer in the fourth millenium BC as seen

by a silver double-pipe with finger-holes found in the Ur tombs and now at Philidelphia[18]. The diaulos seems to have had one pipe for more complicated melodies and the second for fewer notes and possibly a drone.

Syrinx (Panpipes): Panpipes are made from a series of tubular reeds bound together and played with the same embouchure as in a modern flute. According to Greek mythology Pan created the pipes by gathering reeds in the attempt to capture the nymph Syrinx who was transformed into a reed to escape Pan. These pipes were found in ancient China as well and may have gone to Peru through the east. Pipes are associated with pastoral music in ancient Greece rather than high-class society.

Sea Shell: The Cohili sea shell can be made into an instrument by cutting a hole at the smallest end. It was used mostly for announcements from ships in a morse-code like manner rather than for music.

Panayiotis Stefos and Michael Stefos perform 2008. Photo by C. Morsink

[18] G. Abraham (1979), *The Concise Oxford History of Music*, Oxford, Oxford University Press, p. 10.

Percussion

Tymbano (frame drum, or hand drum): Found in many cultures, this basic hand drum comes in many sizes and is usually played held in the left and rapped by the right palm and tips of fingers for different sounds.

Seistro (metal rattle): Commented on by Aristotle as an excellent toy to keep a baby busy and out of trouble, the seistro also was used in music with its metal rings which rattle together.

Kymbala (finger cymbals): Small round metal discs played by holding a leather string and striking the edge of one against the other. The have a pure ringing sound.

Krotala (clappers): Clappers were used in rhythmic music to keep time and rhythm patterns and were carved from wood.

Brass Section

Brass instruments were usually used for announcements, military and starting athletic competitions. Brass instruments are only used in the work *Divine Eros*.

In pieces for western classical instruments I have attempted to echo the sound of the original instruments. Often the instruments and vocal parts use a restricted range reflecting the instruments of the past, but in other pieces I have let the modern instruments freedom take over.

2.5 **Concert Pitch in Ancient Greece in Relation to my Composition Portfolio**

There is a certain amount of controversy[19] in the topic of concert pitch[20] in ancient Greece and in modern music. For better or for worse, the current standard concert pitch is A=440hz and some countries use A=442hz or A=444hz. From the period of about 1700 to present day there has been a difference in opinions about

[19] Mendel, (1978), "Pitch in Western Music since 1500. A Re-Examination", *Acta Musicologica*, vol. 50, p. 11. http://222.jstor.org/stable/932288. Accessed: 02/08/2013 05:22.

[20] Concert pitch is sometimes referred to as absolute pitch, but in this text I will continue to use the term concert pitch to avoid confusion.

what should be concert pitch ranging from Handel's own tuning fork of A=426.4[21], to A=458.46 which was Broadwood's 'High Pitch' in 1874[22]. From this, some questions come to my mind. Did this sort of controversy exist in ancient Greece as well? Was there a need for a concert pitch and did it have an effect on the emotional inflection of the music they created? What concert pitch is the most appropriate for my compositions?

18th century German Theorist Johann Mattheson wrote that "the ethical effects of the ancient Greek "keys" were not determined by the placement of the semitones but by pitch"[23]. What M.L. West writes about the relationship of notation and absolute pitch in *Ancient Greek* Music is that "it is unlikely that a specific standard was maintained everywhere at all times without error; but any fluctuation seems to have been small."[24] Aristotle wrote in *Politics* that "music is conducive in some degree to virtue"[25] and wrote,

> There exist in rhythms and melodies likenesses, most closely approximating to the realities, of anger and mildness, of courage and moderation and their opposites, and of all other dispositions, as the facts make clear; for our souls are altered when we hear such things.[26]

Was this to do with the pitch of the music or only the choice of genus? If it were pitch, what pitch would the Ancient Greeks have chosen as a centre or absolute pitch to tune from?

In Western Classical music, the first physicist to formally write about and create the word 'acoustics'[27] was Joseph Sauveur in 1701 with his treatise *Principes*

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[21] Ellis, (1876) "On the Sensitiveness of the Ear to Pitch and Change of Pitch in Music", Proceedings of the Musical Association, 3rd sess. pp. 1-32. Taylor & Francis Ltd. http://www.jstor.org/stable/765234. Accessed: 05/08/2013 01:56. p. 28.

[22] ibid.

[23] Steblin, "Towards a History of Absolute Pitch Recognition" *College Music symposium*, Vol. 27, (1987) pp. 141-153. Published by College Music Society http://symposium.music.org/index.php?option=com_k2&view=item&id=2021:towards-a-history-of-absolute-pitch-recognition&Itemid=143, paragraph 19 (no individual page numbers given on site).

[24] West, *Ancient Greek music,* p. 274.

[25] Aristotle, *Politics* trans. Barker, *Greek Musical Writings* I, p. 173.

[26] ibid., p. 175.

[27] 'Acoustique' or the English equivalent 'acoustics' comes from the Greek word ακούω (akouo) meaning 'to hear'. From Sauveur's treatise: "J'ay donc crû qu'il y avoit une science superieure à la Musique, que j'ay appellée Acoustique, qui a pour objet le Son en general, au lieu que la Musique a pour objet le Son entant qu'il est agreable à l'oüie." English translation: "I believe that there is a superior science in music, which I have called Acoustics, whose aim is Sound in general, rather than that music is intended just to be pleasant in the hearing (or perception of sound)." Sauveur, *Principes d'Acoustique et de Musique*, Paris, 1701; reprint, ed., Genève: Minkoff, 1973, Graphics:

d'Acoustique et de Musique. His treatise covers the topics of the overtone series and he presents the 'fundamental son'[28] of 100vps as the first step towards creating a scientific concert pitch which he demonstrates can be used to classify the intervals in Western classical music, Ancient Greek music[29] and Persian music. In the chapter on "Diapason ou Octaves" in he writes,

> Ces Intervalles se partagent d'abord par Diapason ou Octaves, ce qui arrive lorsque le Son le plus aigu fait deux vibrations contre une du plus grave; ainsi le Son qui monte, passe par les Intervalles d'une premiere, seconde, troisiéme, quatriéme, et cetera Octave, lorsqu'il fait 2, 4, 8, 16, et cetera vibrations contre une du premier; et ce Son passe par de semblables Octaves en descendant, lorsqu'il ne fait que 1/2, 1/4, 1/8, 1/16 des vibrations du premier son.[30]

In 1713 he proposed that the most appropriate concert pitch was c^1=256[31]. If one starts with 1hz per second, upon doubling this initial pitch one finds the octaves doubling in value until one mathematically reaches 256hz. This has the number series: 1,2,4,8,16,32,64,128,256 etc. C=256 is sometimes called the 'philosopher's pitch'[32]. Joseph Sauveur's attempts to convince musicians to use C=256hz did not succeed. In 1843 J.H. Schreibler published his scientific findings in *Der Physikalische und musickalishe Tonmesser* and proposed A=440 as concert pitch concluding that it is "the mean of the variation of Vienna grand pianos by temperature"[33]. The concert pitch of A=435hz called Diapason Normal was agreed upon in 1858 and adopted in 1859 in France after a meeting of physicists and composers including Meyerbeer, Berlioz and Rossini[34]. Giuseppe Verdi felt that Italy should also have a standard concert pitch and thought highly of A=435hz

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SAUPRI 01GF-SAUPRI 09GF http://www.chmtl.indiana.edu/tfm/18th/SAUPRI_TEXT.html. (As this is a document on the internet pages are given with square brackets as shown in text) p. [-1-].

[28] Sauveur, ibid., p. [-30-].

[29] ibid., p. [-28-]

[30] ibid., English translation: "These intervals are initially shared by Diapason or Octaves which is what happens when the most acute (high) vibration is two against one of the more serious (low), and the tone which rises through the intervals of the first, second, third, fourth, et cetera Octave, when it is 2, 4, 8, 16, and so a vibration against the first, and it is through this similar pattern of Octaves going down with only 1/2, 1/4, 1/8, 1/16 of the first vibration." p. [-4-].

[31] Mendel, (1978), "Pitch in Western Music since 1500. A Re-Examination"*, Acta Musicologica*, vol. 50, http://222.jstor.org/stable/932288. Accessed: 02/08/2013 05:22. p. 89.

[32] ibid.

[33] Ellis, (1880), quoted in Mendel, "Pitch in Western Music since 1500. A Re-Examination", p. 89.

[34] ibid.

as it aided singers in range and tone quality[35]. He agreed to a national pitch of A=432hz (when the Italian Ministry of War issued a decree for the normalization of pitch), saying that if the scientists of Italy found that 432hz is more appropriate by "mathematical exigencies"[36] than 435hz, the difference "is so small, almost imperceptible to the ear"[37] that it would be acceptable. Verdi also failed in convincing the musical community to lower concert pitch and it kept on creeping up until the ISA (International Federation of the National Standardizing Associations) in 1939 decided on A=440hz as international concert pitch[38] and it was confirmed in 1955 by the ISO. One of the justifications of A=440hz, as J.C. Deagan explained in his article "A=440 Pitch Adopted, PITCH versus TEMPERATURE" is that A=435hz in France was calculated at 15 degrees celcius (59 Farenheit) while in the USA that was considered far too cold for concert halls and the equivalent pitch at a better temperature (68-72 Farenheit) would be 440hz[39] which helps the clarinets stay in tune[40]. Deagan claimed that when the American instrument makers made clarinets at A=435hz there were complaints that the intonation was too low, therefore the industry must make the instruments at 440 so there would be no complaints about the clarinets being flat."[41]

Back in Ancient Greece there were no clarinets, but the aulos would have had similar problems as the modern oboe and other woodwind instruments. Pictures and sculptures replicating the ancient aulos give a clear idea of how it was built, but we cannot determined the actual fundamental pitch of the instruments without a

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[35] Opera Singers such as Mirella Freni, Renata Tebaldi, Placido Domingo and the late Pavorotti all recommended A=432hz as it is more appropriate for bel canto singing and that higher pitch can damage the vocal chords. Hamerman, (1988) "Reivive Verdi's Tuning to Bring Back Great Music" *Executive Intelligence Review,* Volume 15, Number 32, August 12, 1988, Washington DC, New Solidarity Internationsl Press Service, http://www.larouchepub.com/eiw/public/1988/eirv15n32-19880812/index.htmlp. pp. 28 and 30.

[36] Verdi, ibid. p. 26.

[37] ibid., paraphrase of Verdi's speech. As well Verdi is quoted as having said "For my part, I would like a single tuning to be adopted in the whole musical world. The musical language is universal: Why then would the note that has the name 'A' in Paris or Milan have to become a B-flat in Rome?" p. 26.

[38] Mendel, (1978), "Pitch in Western Music since 1500. A Re-Examination"*, Acta Musicologica*, vol. 50, http://222.jstor.org/stable/932288. Accessed: 02/08/2013 05:22. p. 90.

[39] Deagan,(1918), "A=440 Pitch Adopted, PITCH versus TEMPERATURE", 1918, *The Music Quarterly*, Vol. 4, No. 4 (Oct., 1918), pp. 587-592. Oxford University Press. http://www.jstor.org/stable/737883. Accessed: 02/08/2013 04:44. p. 587.

[40] ibid., p. 588.

[41] ibid., p. 588.

reed[42], which, of course would have rotten over the course of time. The tuning of string instruments could have varied, so most likely it would have been the aulos that would have determined the pitch that an ancient Greek ensemble would play in[43]. Mention of musician tuning to each other is shown in specific texts[44] and specialist in ancient Greek music Stefan Hagel writes,

> If virtuoso auletes took their instruments to different places, an international tuning standard would have been useful. There is also evidence about tuned resonators forming part of citharas which would ensure fixed pitch without extraneous devices[45].

What that actual pitch could have been, if it was needed, we do not know for sure. Kathleen Schlesinger in her book *The Greek Aulos* calculates all her findings using C=256hz and gives the reason that the fundamental in the ancient world, particularly in China was Fau at 352hz (F=352hz) since this can be found from the dimensions written about a standard tuning pipe in Ancient China and that the equivalent pitch is C=256 (or A=432hz[46]) since F=352 is the 11th harmonic of C=32[47]. Schlesinger is not always taken very seriously by academics[48] probably

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[42] "…pitch cannot be computed from the length in the reed-blown pipe, more especially is the affair of the mouthpiece in the first place and unlike the flute, the aulos resonator has no absolute pitch." K. Schlesinger (1939), *The Greek Aulos*, London, Methuen & co. ltd., p. 61.

[43] Hagel, (2010), *Ancient Greek Music: A New Technical History*, Cambridge University Press. Hagel writes, "Finally it is perfectly possible that aulos music developed in the direction of fixed pitch, perhaps quiet early, while lyre players maintained a relative tuning-based conception as reflected by Ptolemy." p. 70.

[44] West writes, "Xenophon describes a young singer at a symposium tuning his lyre to the girl piper's aulos before beginning." *Ancient Greek Music,* p. 273.

[45] Hagel, *Ancient Greek Music: A New Technical History*, Cambridge University Press. p. 36.

[46] How to find A=432hz from C=256hz. If one takes the overtone series starting at C=64hz one finds that A as part of the harmonic partials of the fundamental C=64 is actually the equivalent of 430.5 or 430.7, not 432hz. To find the mathematical relationship of 432 to 256 one must use the ratio 3:2 or a true Pythagorean perfect 5th starting with C=64 and then you will find that A=108hz which multiplied by 2's for the octave reaches 432. Another way to find it is by finding a true major sixth above 256 which is the ratio 16:27. This is a different size of major sixth than the Just major sixth of 5:3. Let us find 432 using the ratio 16:27. For example if you take again C=64 and want to find A in the equivalent octave you can use the equation; 16:27=64:A, then 16/27=64/A so A=108. This is a bit faster than going up the circle of fifths using the 3:2 ratio. In order to find A=432 a chart can be made such as one made by Kathleen Schlesinger starting with c=64vps. going through an ascending pattern of P5ths of the ratio of 3:2. Her calculations on p. 304 of *The Greek Aulos* are: c=64, g=96, d=72, a=108, e=81, b=243, f#=91.1, c#=136.69, g#=205, d#=157.7, a#=230.6,e# (f)=172.29. In order to find the octaves, one would either divide or multiply by 2, thus a=108 would be A=216 and A=432.

[47] Renold, *Intervals, Scales, Tones and the Concert Pitch c=128 Hz.* p. 71.

[48] J. Handschin (1948), "ludicia de novis libris", *Acta Musicologica*, Vol. 20, pp. 60-62. International Musicological Society Stable. http://www.jstor.org/stable/931586. Accessed: 16/07/2011 12:23. Also Graham Jackson explains in *The Spiritual Basis of Musical Harmony,* p. 36 that her thinking was too 'radical' for her times.

for her connection to Steiner who also maintained that concert pitch should be c=256hz or A=432hz[49]. The "philosophical pitch" can also be related to the sounds of nature such as bird song[50]. As well as sounds from nature, I have found a good amount of folk music tuned to A=432 such as in some of the tracks in the recording *Sprinting Gazelle*[51] of Reem Kelani singing and playing on Palestinian folk instruments, Prof. Emeritus Dr. Baily's fusion Afghanistan group in the CD *Ensemble Bakhtar Live*[52] playing tuned to 432 without even realizing it[53], examples of Chinese folk music tuned to 432[54], some recordings of music from Indonesia[55] as well as some tracks from the Bulgarian CD *Le Mystère Des Voix Bulgares.*[56] Some folk singing from the 1960's was also played at 432, (probably without specific intent of tuning at a particular pitch), such as by Pete Seeger[57]. Not every group mentioned here always played every piece at A=432hz, but there are enough examples to show that A=432 or c=256 has a common sympathy amongst many cultures around the world[58]. It may not be the Universal pitch, but there seems to be a human and natural sympathy to this pitch as our ears are built on the spiral of c=256 which is the pitch of the tuning forks used by ear doctors[59].

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[49] Renold, *Intervals, Scales, Tones and the Concert Pitch c=128 Hz*, p. 161.

[50] One example among many others is a recording of the White Throated Sparrow (reproduced with permission from Monty Brigham on CD 2, track 5 of this thesis) which is pitched in the 432 range (at the equivalent of 3456hz) a minor third above A432 falling to A432. Almost all the recorded songs on this track either start on A and go up to a minor third, or start on the E and go to the A 432. CD recording: *Bird Sounds of Canada*, by Monty Brigham, volume 3, Warblers to Sparrows CD 2, track 9, white throated sparrow, Holborne Distributing co. Lt. Mount Albert, Canada. As well, a website used to determine frequency is http://www.seventhstring.com/tuningfork/tuningfork.html which can be tuned to 432 rather than 440. On this website one can play the keyboard, or if one prefers one can use the sister website http://www.seventhstring.com/tuner/tuner.html which also can be set to 432 to determine frequencies.

[51] R. Kelani (2005), *Sprinting Gazelle*, UK, Fuse Records, CFCDO48. A=432hz applies to the tracks which do not use piano.

[52] J. Baily, (2006), *Ensemble Bakhtar Live,* BOLBOL CD03. This is particularly evident in track 5, "Bada Bada" which uses an Eflat to Aflat tetrachord in 432 tuning.

[53] Email, July 2011, John Baily to Coreen Morsink, see appendix.

[54] J. Bomback producer, (1998) *China, time to listen*, New York, Ellipsis Arts.

[55] W. Vitale recording, (1986) *Music of Bali*, New York, LYRICHORD.

[56] The Bulgarian State Radio and Television female Vocal Choir, (1987) *Le Mystère Des Voix Bulgares,* New York, Elektra/Asylum/Nonesuch Records.

[57] P. Seeger, *Folk Music of the World*, CA, Legacy international, CD 342.

[58] 432 Musician Fred Cusinato, has found that the only song of Bob Marley recorded at A=432hz is "Three Little Birds". Source: FRED CUSINATO interview "Music and the Cosmic 432 An interview with Fred Cusinato about A=432hz" *Other World Global Radio*, May 28, 2013. http://www.blogtalkradio.com/otherworldglobalnetwork/2013/05/29/fred-cusinato-interview-music-and-the-cosmic-432

[59] Renold writes: "Ear specialists still use the tone c=128 today. Large medical supply shops sell tuning forks of c=128,256, etc. Hz, which are used for medical examinations. None of the many

I have considered A=432hz as concert pitch in ancient Greek partly because of the love of numbers by the Pythagoreans[60] and also because of A=432hz in nature. As we do not have any ancient tuning forks dug up from excavations, for now we can only speculate as to whether or not absolute pitch existed in Ancient Greece. To aid the imagination I have included my compositions which were originally recorded at A=440hz also changed to A=432hz. In this way the listener can decide for himself/herself which concert pitch is more appropriate for my compositions. I personally prefer A=432hz and would prefer my compositions to be played at this lower pitch, as I feel it is more connected to nature, the human physique, folk music and ancient Greek music. Particularly in my compositions that feature bel canto passages in the high register of the soprani such as in *Orestes Chamber*, and *Divine Eros*, A=432hz would be most appropriate. To conclude this topic I quote Rita Steblin who writes in her book *A History of Key Characterisitcs in the Eigthteenth and Early Nineteenth Century* about absolute pitch, that there are

> …theories of Monro, Hornbostel and Gombosi about the dominant role of pitch in the Greek doctrine of ethos, but this is still quite a controversial matter, and no attempt is made here to settle this issue.[61]

For now, I will leave this issue and move on…

2.51 **Notation in Ancient Greece**

Notation in Ancient Greek music was a system of symbols written above a written text or between texts. Two sets of different symbols existed: one for vocal music and one for instrumental. Those for vocal notation mostly use the Greek alphabet in capital letters with each letter showing a microtone. The instrumental symbols are mostly other shapes which are rotated to create different notes.

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doctors questioned by the author could give a reason for the use of this particular frequency." Renold, *Intervals, Scales, Tones and the Concert Pitch c=128 Hz*, p. 80. See as well an excellent diagram of the ear and explanation by Brian T Collins, (2013) *The Importance of 432 Music*. http://omega432.com/432-music/the-importance-of-432hz-music

[60] See references to Philolaus and the Pythagoreans in compositions "Fibonacci in a Black Hole" and "Divine Eros".

[61] Steblin (1983), *A History of Key Characteristics in the Eighteenth and Early Nineteenth Century*. Ann Arbor: UMI Research Press, p. 16.

Eg. Vocal notation: A B Γ = F#, F♯, F natural

Instrumental notation: \ / N= F#, F♯, F natural

Example of vocal and instrumental notation[62]

Many variants occur in the symbols depending on the fragment, and the author of the explanation of the notation (Quintilianus gives some different symbols than other philosophers).

A dot placed above a syllable would indicate that the syllable was the arsis. Written musical examples engraved in stone and written on papyrus show that music notation existed but was apparently not very commonly used. More likely melodies were learned by ear and used as a base for improvisation. Notation can be for voice or instruments and was only specific in relative pitches and not in rhythm, articulation or dynamics.

I have written my scores with modern notation which is not perfect but easier for me to convey my ideas than with ancient Greek notation. The scores should have an improvisational feel. Specific markings are in the score but there is considerable room for the performer to make his/her own creation of the music as I believe would have been the practice in Ancient Greece upon playing a notated melody.

2.6 **Tuning and the Overtone and Undertone Series**

Most of the compositions in this portfolio follow the tuning instructions written by Aristoxenus and Quintilianus combined with modern equal-temperament tuning. Pure P8, P5, and P4 were used in order to find the size of the tone, semi tone and

[62] Orestes Papyrus G2315, photo courtesy of Stefan Hagel, Austrian Academy of Science, Vienna http://www.oeaw.ac.at/kal/agm/

microtones. As Aristoxenus explains (reinforced by later writer Quintilianus) the outer P4 of the tetrachord should be pure from the ratios of the overtone series, and then by taking the lower note, going up a P5 and then down a P4 one would find the size of a tone below the upper tetrachord note. This can be done vice versa for the lower notes starting with the upper note of the tetra chord and moving down a P5. Thus by ear one can find all the tones and semitones needed to make the chromatic and diatonic genera. At that point, in the Aristoxenian school of thought, by ear one would split up the semi-tone into two quarter tones, or the tone into 3 thirds, and make different combinations to create different shades of genera.

Another way of finding the tuning system is to use the overtone and undertone series. The Overtone Series is quite obviously heard in the divisions of strings and harmonics. We can show the first six notes of the overtone series as follows:

C,C,G,C,E,G

Whereas the Undertone series would be the inversion:

C,C,F,C,A♭,F

The Undertone series is the exact opposite, giving that missing minor third[63]. The overtone series can be compared to the physical world around us and the undertone as the spiritual and unseen world[64]. Research by Kathleen Schlesinger shows that nearly all the folk wind instruments from ancient civilizations and folk wind instruments that are still in use have their finger-holes in equidistant proportions which lead to the notes in the undertone series[65].

2.7 **Modulations**

Musical fragments of Ancient Greek music written on papyrus and engraved in stone show that modulations in 5th Century BC music existed. Modulations were limited according to the instrument used (for instance, within tuned strings available on a lyra) and usually strengthened the original mode used. For example, if the piece started in the Dorian mode on the pitch E, somewhere in the piece the same

[63] E. Godley, "The Minor Triad", *Music & Letters*, Vol. 33, No. 4 (Oct., 1952), pp. 285-295 Published by: Oxford University Press, http://www.jstor.org/stable/729740Accessed: 02/12/2010 05:26, p. 285.
[64] G. Jackson, *The Spiritual Basis of Musical Harmony*, pp. 14-15. "We begin to see, thus, that the undertone series may represent the spiritual pole in life, whereas the usual overtone series then represents the bodily pole."
[65] K. Schelisinger (1939), *The Greek Aulos*, intro. p. vii.

mode may have been used but starting on a different note which was part of the original collection of notes. Tonicisation has also been found in fragments of music from this time[66]. I have taken into consideration the difficulties of modulating on ancient Greek instruments, but in *Divine Eros* I have used modulation to express the capabilities of modern instruments.

2.8 **Historical, Cultural and Ethical Importance of Music in Ancient Greece**

Music was a very important part of life in 5th Century BC Athens. Citizens of Athens were given musical instruction as part of their education, usually learning the lyra at about the age of 13[67]. Thus the audience at theatre productions would have had a musical background and the ability to judge music. Music was considered the balance to the more academic thinking and physical movement also highly regarded in society. A balance was needed between all three to produce a psychologically healthy person. Music was also a part of poorer society and songs were sung in all parts of life such as at weddings and funerals. Some examples of songs types are: laments, harvest songs, seasonal songs, working songs and lullabies. Music was a part of mythology and religion: indeed a central part of society and perhaps even more important in the 5th Century BC then now. Music competitions similar to our modern Eurovision, theater competitions, writings about music by Aristotle and Plato all point to the importance of music in ancient Greece. Music had an ethical value and Plato wrote that by educating children in music correctly one provides them with the "development of moral goodness"[68].

The pieces in this portfolio try to keep that sense of meaning and spiritual importance of music as a part of our everyday lives.

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[66] N. Sultan, "New Light on the Function of "Borrowed Notes" in Ancient Greek Music: A Look at Islamic Parallels" *The Journal of Musicology.* vol.6, No. 3. (Summer), p. 387-398. University of California Press, http://www.jstor.org. accessed 03/10/2008.
[67] Barker, *Greek Musical Writings: I*, Cambridge, Cambridge University Press, p. 162.
[68] ibid., p. 141.

3. **Arabic Folk Music and its Relation to Ancient Greek Music**

3.1 **Texture**

Traditional Arabic folk music[69] uses both monophony and heterophony and has a rich tradition of improvisation. The use of improvisation on themes with varied instruments is an aspect which is part of this portfolio. The importance of melody and text in monophonic a cappella melodies is another link between Ancient Greek music and Arabic music. Plato writes of his wonder of the knowledge of music in Egypt[70] in his *Laws* and despite the fact that Ancient Egyptian music was not written down[71] there seems to be evidence that there was a direct link between the music of Ancient Greece and Ancient Egypt[72]. Arabic music technique is used in *Orestes' Chamber* , *Andromache's Recitativo, Aria and Subtext,* and in *Divine Eros.*

3.2 **Rhythm**

Rhythm in Arabic folk music has many parallels to Ancient Greek rhythms. Often the rhythm follows the rhythm of the text, and many song forms are from poetic meters. Each piece has a basic rhythm pattern called "wazn" (measure)[73] which has a unit of at least 2 time values and the patterns can be joined together to make larger measures. Often rhythm patterns of odd numbers are used such as 11/4, 13/4 and even 17/4 time and are broken up internally into smaller units. (e.g. Reem Kelani's version of the "Baker's Dozen" in 13/8 time: a group of 3+3+3+1+3) Rhythms usually have a lighter sound called "tak" and a deeper sound "dum" which is the way rhythms are remembered and taught rather than in written western notation. Thus the Baker's dozen would become dum tak tak, dum tak tak, dum tak tak, dum, dum tak tak.

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[69] As well as a good proportion of modern Arabic music and music from many other countries.
[70] Plato, trans. Barker, *Greek Musical Writings: I*, p. 144-145.
[71] Pulver, (1921-1922),"The Music of Ancient Egypt". Proceeds of the Musical Association, 48th sess. (1921-1922), pp. 29-55. Published by Taylor & Francis Ltd. on behalf of the Royal Music Association. http://www.jstor.org/stable/765727. Accessed: 02/08/2013 04:36. p. 38.
[72] ibid., p. 30 "The Greek sages visited Egypt to study music, among other sciences for which it was reknown." Again in many passages of Platos' *Laws* there is discussion and admiration for the music and knowledge of music in Egypt.
[73] H. Touma, (1996), *Music of the Arabs*, Cambridge, Amadeus Press, p. 48.

Improvisation is a central part of rhythm in Arabic music and normally would not be written out. The dum sound must always stay in the same place and cannot be added to. If a faster rhythm is needed attached to the dum, the extra notes will become tak. A faster rhythm than tak, like semi-quavers will become tak-a.

In this portfolio I have used rhythm patterns from Arabic folk music in *Orestes' Chamber* but have written them with modern notation and written out patterns to resemble improvisations.

3.3 **Tetrachord Structure in Modes, Use of Microtones**

Arabic music theorists such as Al-Farabi (950 AD) wrote their theoretical works based on those of Aristoxenus and other ancient Greek philosophers calling music "Musiqi" after the Greek word for music (mousiki). Thus the tetrachordal structure of Arabic modes and the tuning of string instruments by fourths in the 10th Century AD is not suprising. Microtones are formed in the same way as in ancient Greek music but the actual tetrachords often stress different genera than those used in Athenian 5th Century music. For example:

Rast tetrachord: T, 1/4, 3/4T

Opening of Hijaz mode: ½, 1 ½, ½ (used commonly in harmonic minor)

These tetrachords and modes I have used in this portfolio of compositions as well as the feeling that microtones are a part of a mode rather than an interval which is unusual in Western classical music.

3.4 **Instruments and Ranges**

Arabic instruments are mostly non-fretted (such as the al'oud) allowing the use of microtones with ease. The instruments are like cousins to the ancient Greek instruments: Greek mythology claims that Athina invented the aulos, but most likely it came from Libya or Phrygia. Percussion instruments such as hand drums are very similar. Some of the most similar are:

<u>String Instruments</u>

The al'oud literally means 'made from wood'. It is derived from the Persian barbat having similarities to the Pandura and is tuned by fourths. The European equivalent is the lute. The use of the guitar in *Orestes' Chamber* reflects the traditional playing of the Al'oud. The rabab (or rebec) is a string instrument played

with a bow. Sections of *erosion* imitate this instrument in the flexibility of microtonal modes.

Wind

The nay is a bamboo or wood flute which I heard for the first time when Reem Kelani demonstrated for me the Palestinian nay. *Andromache's Recitativo, Aria and Subtext* has characteristics of traditional nay playing. The double-reed shawm is similar to the aulos and is reflected by the oboe part in *Orestes' Chamber.*

Percussion

The duff is a frame drum which has similarities to traditional Greek folk drums as well as ancient Greek drums. The drum part in *Orestes' Chamber* is based on drumming techniques shown to me as well by Reem Kelani. The riqq is a tambourine style percussion instrument which is used as well in *Orestes' Chamber.*

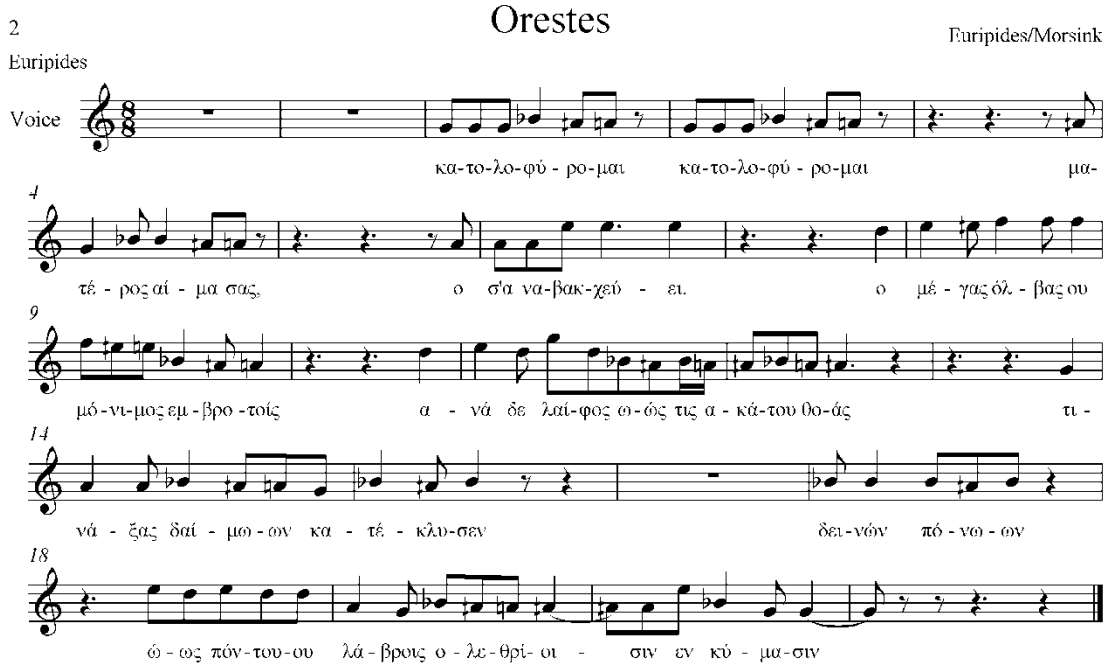
3.5 **Tuning and Temperament**

According to Arabic music theorists such as Al-Farabi, the octave should be tuned in 24 equal parts. On the other hand, often quarter-tones were made "sweeter" such as in the Rast tetrachord in which the E 1/4 flat is often slightly higher.[74] In the 19th century a system of "cents" was created to show the distance or interval between notes with clarity. The octave was given the number 1200 and the distance of a semi-tone became 100 cents after dividing the octave into 12 parts. Thus a mathematical way of describing the intervals is possible.

4. **The Reconstruction of Euripides' *Orestes*' Chorus Fragment**

The starting point of this composition portfolio was the analysis of the *Orestes* fragment and my own personal reconstruction of this fragment.

[74] S. Marcus (2006), *Music in Egypt*, Oxford, Oxford University Press, p. 27.



Euripides' *Orestes* papyrus fragment is the most complete segment of Euripides music existing, but requires reconstructing in order to be heard as a complete musical selection. This fragment, known as G 2315, located in the Austrian National Library in Vienna[75] has been known since 1890[76] having both vocal and instrumental notation along with the text from a chorus lines 338-344 from the melodrama *Orestes*. By re-working this damaged document one can re-create the music of the 5th Century BC in the style of Euripides. Missing notes can be decided upon by using the theoretical writings about music by Aristoxenus and Aristides Quintilianus as well as consideration of Arabic Folk music whose music theory such as seen in the writings of Al-Farabi.

Euripides (C484-407 BC) is mostly known now as a writer of tragic drama, but was as well a composer of the music to go along with his plays. Growing up in Salamis, an area of which Athens had possession, Euripides received a good upper class Athenian education in which music was an important part of the curriculum. In Plato's *Laws*[77] music education is described as having three years of practical learning of the lyra (7-9 string harp) starting at the age of 13, as well as

[75] See page 23 of thesis for digital photo.
[76] Pohlmann, and West, *Documents of Ancient Greek Music, p. 14.*
[77] Barker, *Greek Musical Writings: I*, p.162.

studying rhythms, modes, ornamentation and intervals of smaller sizes (presumably such as ¼ tones). Thus he would have had an excellent knowledge of music and proficiency to compose the music necessary for his tragedies as exemplified in his known segments from a chorus in *Iphegenia in Aulis,* and the segment of a chorus from *Orestes*.

The *Orestes* fragment was found on mummy cartonnage and unfortunately is missing notes and text due to time and glue spots. The actual papyrus is dated approximately 200 AD. Songs from different dramas were used in a recital style context like an aria concert and performed by groups touring the Roman empire called the "Καλλίφωνοι τραγωδοί" (beautiful voiced tragedies) and were also accompanied by instruments[78]. This papyrus could have been one of these extracts, written to give the general idea of the music which the group would have to complete with appropriate heterophonic improvisation. Enough is visible in this scrap in order to understand the basic melodic contour and the text. Since music notation was "not highly regarded in antiquity"[79] one can assume these indications of pitches were in order to trigger the memory of the melody which would normally be learned by ear such as in Arabic and Greek folk music. The pronunciation of the text in this reconstruction will be aimed at the time period of 200 AD using the modern Greek pronunciation rather than the dipthong double vowel pronunciation thought to have been used at earlier times.

The vocal notation is written above certain syllables and instrumental notation between syllables such as:

Π Ρ C̄ . Ρ Φ Π

(ΚΑΤΟΛΟΦ)ΥΡΟΜΑΙ**Ζ**ΜΑΤΕΡΟΣ [80]

The notes written indicate the ancient Greek Phrygian mode and mostly likely meant to be played in the enharmonic shade as was used most commonly in the 5th Century BC. The movement is very chromatic as well as having demanding leaps of strange intervals (such as A quarter sharp followed by high E, followed by

[78] Watts, *Greek Folk Music,* p. 30.
[79] Pohlmann, and West, *Documents of Ancient Greek Music*, preface p.1.
[80] An excellent chart translating symbols to modern notation can be found in M.L. West's book *Ancient Greek Music p. 256*. See p. 23 of thesis for digital photo of the fragment.

B flat) which reflect the mood of anguish of the main characters of the play. Perhaps this demanding music was why his plays only won the competitions five times even though he wrote more than 70 plays? Aristophanes mocked the music of Euripides in his comedies such as *The Frogs* and said he filled his plays with "heart-rending" songs which were not approved of by audience and critics[81]. The public was obviously very educated in music but perhaps this music, much like all contemporary music was not much appreciated by the public and judges!

The chorus would have been sung by 12-15 men dressed as women as is listed for the plays of Aschylus, but a precise number of chorus members for *Orestes* is not known. H.D.F. Kitto describes the chorus as 15 members who are a "nuisance" barging in on sleeping Orestes just as Electra wants quiet. They are implored to stop singing and go home again[82]. In the case of the papyrus extract, if it was performed as an individual piece, various amounts of singers and musicians or even a solo singer could have been employed to perform the song in the time period of 200 AD.

The music, most likely, would have been heterophonic in nature with possible doubling at the octave, but harmony of any sort is unlikely as there are no references to any existence of use of intervals except P1 and P8 in any of the Greek sources[83]. The instrument accompanying the chorus would most likely have been an aulos suitable for tragedy (a variety of different auloi for different moods exist) and quite possibly a string instrument like a kitharis, lyra, a drum capable of producing two different sounds like a Arabic frame drum, and finger cymbals. A general picture is then made of a disjointed papyrus, but in order to complete it, help from theorists like Aristoxenus and Quintilianus is necessary.

Aristoxenus was first taught by his father who was a musician, later by the Pythagorean teachers of music and lastly was part of the school of Aristotle. After being rejected as successor to Aristotle to the Lyceum (the successor being Theophrastus, also a music theory writer) he was little known except, (fortunately) for his extensive writing on music. In his writings he brutally attacks the

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[81] C. Giovanni (1991), *Music in Greek and Roman Culture*, Baltimore and London, The John Hopkins University press, p. 34.
[82] H.D.F. Kitto (1939), *Greek Tragedy*, London, Methuen & Co., p. 348.
[83] West, *Ancient Greek Music*, p . 41.

Pythagoreans and other music theorists and acknowledges only Eratocles (5th Century BC) who had made a basic chart of the modes which have been handed down to us today. We know about the methods of melodic tetrachords and how to make larger harmonai (scales/modes) mostly because of Aristoxenus' writings.

As Aristides Quintilianus remarks,

> Of these the diatonic is more natural, since it can be performed by everyone, even the wholly untutored: the chromatic is more technically sophisticated, being performed only by those who have been trained: and the enharmonic demands stricter precision, being accepted only by the most outstanding musicians, while for most people it is impossible.[84]

Thus we can use the two tetrachords which make up the ancient Phrygian scale[85] and fill in missing notes accordingly. Two "shades" of tetrachords can be used forming a mixed scale using different shades,

G A A♯ B♭ D E E♯ F (G)* (A)*

*not on papyrus but implied

This scale can be described in many ways. Described backwards (the scaled were usually described from highest to lowest notes like the lyra strings), the first G is an extension of the scale and (A A♯ B♭ D) is the first tetrachord in enharmonic shade followed by notes E E♯ F G A which can be interpreted as enharmonic when the G is left out (E E♯ F G) or diatonic when the E♯ is avoided (E,F,G,A) showing that different shades can be used in the same piece. I have added the upper G and A to the scale as these notes are implied even though they are not visible on the papyrus. Different sizes of ¼ tones were used in Ancient Greek music but the equal tempered tuning of the piano is the easiest way to demonstrate the scales, using blu-tak when necessary to lower particular strings by a ¼ tone. Diatonic and chromatic tetrachords can be played on the keys of the piano but ¼ tones must be played either only on single strings, or plucking strings that have been changed. Thus the octave would be divided into 24 units as in Arabic music.

The writings on rhythm by Aristoxenus have mostly been lost so hence a later philosopher, Aristides Quintilianus must be referred to for rhythmic notation. The rhythmic mode which is most appropriate for the *Orestes* fragment is the dochmiac

[84] Aristides Quintilianus, trans. Barker, *Greek Musical Writings II*, p. 418.
[85] Note that in Roman time the names were changed and now this scale is known as Dorian.

foot which is a mixture of two feet, the Iambus (3/8 time, short, long) and Paean (5/8 time, long, short, long). Altogether the basic rhythm pattern is U- -U-. *Dochmios* means 'aslant'[86] which accounts for Aristides Quintilianus' comments the combination is mixed and complex. He wrote that compound rhythms are emotional because of their unequal rhythms giving tempestuous and uneven confusion pulling "the soul in opposite directions"[87]. Quintilianus continues the explanation that someone walking in this rhythm would be extremely passionate in nature as opposed to someone walking in a dactyl rhythm would be even tempered like the rhythm. The uneven rhythm is then extremely appropriate for Orestes who is torn in two. On one hand he feels he was right for killing his mother since the god Apollo ordered him to avenge the death of his father by his mother (and also he would be unjustly an outcast for the rest of his life), but on the other hand he knows that it is a terrible crime to kill one's mother which as well will make him an outcast for life by law. After the crime he is attacked by doubt (or by the furies or evil spirits) which literally drive him crazy and he refuses to eat or wash for 6 days. Surely this tempestuous dochmiac rhythm is appropriate for the chorus at this point of the drama. Overall the words to the chorus give the meter and rhythm of the music, but occasionally Euripides, or the transcriber who wrote the papyrus repeats a syllable to make it longer or possibly to change notes in a melismatic way.

The last consideration is using Arabic folk music characteristics to aid in reconstruction. The modes used in Arabic music are also based on tetrachords using quarter tones. For example, the rast mode similar to the enharmonic genus. A good example of the rast tetrachord can be heard in Reem Kelani's interpretation of *As Nazarene Women Crossed the Meadow* from her CD *Sprinting Gazelle*[88]*.* The song is in the sikah mode, but the rast mode (C D E♭ F) opens the song while an E flat drone is heard in the background. Although the placement of quarter tones differ in Arabic music compared to Ancient Greek music, the similarities are striking.

The reconstruction of the Orestes Papyrus that I have made is written for voice in the soprano range. Another voice type could be used transposing the

[86] Barker, *Greek Musical Writings,* Volume II, ft. 201, p. 441.
[87] Ibid., p. 441.
[88] R. Kelani, *Sprinting Gazelle.*

melody appropriately, and another instrument used capable of playing quarter tones. In this way music of the 5th Century BC can be reconstructed, particularly in the style of Euripides. Despite the incompleteness of the *Orestes* fragment found on Papyrus one can hear an echo of the past, bringing this ancient music back to life.

5. **Notes about the Recordings and Performances of the Portfolio**

Recordings of four of my compositions are included in this thesis. I have altered the pitch of the recordings which was originally at A=440hz using the Audacity[89] program so that it can be heard both at A=440hz and at A=432hz which I believe to be more appropriate for my music. This issue will be discussed in more detail in relation to *Andromache's Recitativo, Aria and Subtext* along with a survey taken describing listener's reactions to a recording first at A=440hz and then lowered to A=432hz. The listener should listen to the recordings at both pitches, frequency 440 and 432 and decide which is preferable to the individual and which suits the compositions. As a reference point for sounds of nature at A=432hz I have included with permission from Monty Brigham, author of the CD *Bird Sounds of Canada*, his excellent recording of examples of the White Throated Sparrow. I have only put this file on the A=432hz CD. This file is used for educational purposes only.

5.1 **The Recordings**

CD 1: Tracks recorded at A=440hz
CD 2: Tracks changed to A=432hz

Track 1: ***erosion*** variations for solo violin
Performed by Mizuka Yamamoto, 2009. World premiere, live performance. Theocharakis Foundation Concert Hall, Athens, Greece.

Track 2: ***Andromache's Recitativo, Aria and Subtext*** for Quarter-Tone Alto Flute
Performed by Carla Rees, studio recording, 2011, London UK.

[89] http://audacity.sourceforge.net/

Track 3: ***12-1 Preludes*** for Prepared Piano
Performed by Coreen Morsink, 2009. World premiere, live performance, Deptford Town Hall, London, UK.

Track 4: ***stolen glimpses of eternity*** String Quartet no. 1.
Performed in a workshop by **The Allegri String Quartet**, edited from workshop recording by C. Morsink. 2011, Goldsmiths, University of London, UK.

Track 5: (on A=432hz CD only) “White Throated Sparrow”, from Monty Brigham’s CD *Bird Sounds of Canada*, Volume 3, *Warblers to Sparrows*, CD 2, Track 9.

6. Explanations and Descriptions of Compositions in Portfolio

6.1 **Orestes' Chamber**

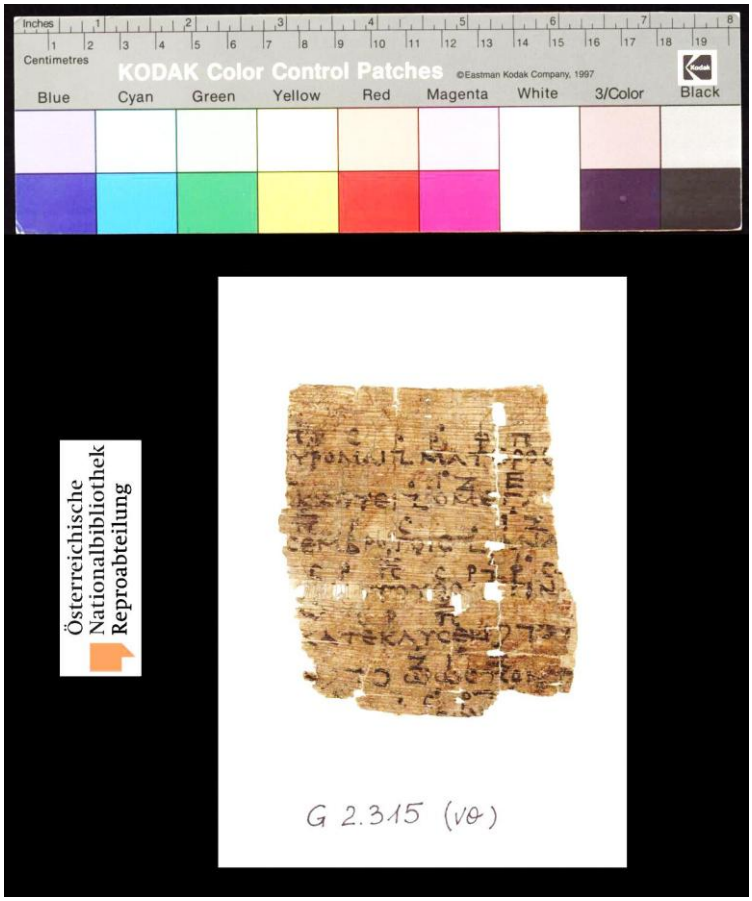
New Compositional Techniques Linked to Ancient Greek Music[90]

Orestes' Chamber is a four movement work I have composed for classical chamber ensemble including soprano, oboe, re-strung guitar, prepared piano and percussion based on theoretical musical techniques of 5th Century BC, Arabic folk music and contemporary Western Classical techniques. The composition quotes from my reconstruction of the Euripides' *Orestes* papyrus fragment. The concept of the piece is to combine techniques from ancient Greece and Arabic folk music which was influenced by ancient Greek theorists and contemporary music. This in turn, can be linked together by use of quotation, microtones, use of rhythm patterns, changing bar structure and heterophony.

1. Quotation in contemporary music

A technique in contemporary music is quotation from older musical selections such as can be heard in particular works of Stockhausen and Charles Ives. In the case of *Orestes' Chamber* the first movement quotes the musical fragment known as G2315 written on papyrus and dated approximately third Century BC. The text is from Euripides' *Orestes* melodrama and although it cannot be proved, the musical notation most likely is an example of a melody that Euripides had composed three centuries previously. The melody may have been handed down through generation aurally and then written down on the papyrus which was later used as mummy cartonnage. Possibly it was a popular tune since it was notated or the exact opposite: since it was not well known there was a need for it to be notated in order for it to be passed down to future generations. The original papyrus is in delicate condition and has holes and glue spots which hide notes.

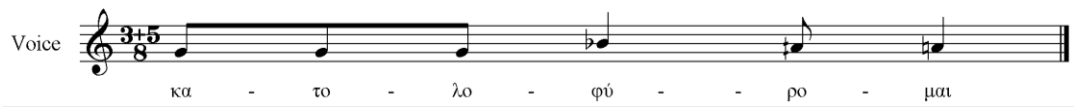
[90] This section is based on the article of the same title I had written in 2009 published as part of the *2nd International Conference for PhD Music Students*, Aristotle University, Thessaloniki Greece, in association with University of Edinburgh, UK. Some wording and some of the musical extracts have been updated to fit the context of this thesis. See Section 4 of this thesis for my own personal reconstruction of the Orestes fragment and more detailed historical analysis.



G 2315 from Austrian National Library (digital photo courtesy of Austrian National Library)

The fragment can be reconstructed in many ways: my own reconstruction fills in the missing notes using as a base the theoretical writings of Aristoxenus.

Example 1.



(translated: I grieve)

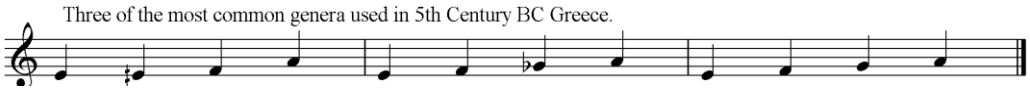
As one can see from the existing fragment the first three syllables of the first word and notes are torn. Presumably the first three notes will either be G, A, A quarter

tone or B flat as these are the notes fitting with the enharmonic genera most commonly used in the 5th Century BC in Greece. This reconstructed motive is quoted exactly by the oboe and is played and sung with notes modified in many places in the third movement of *Orestes' Chamber* in order to have a texture of heterophony .

2. Genera and microtones:

In Ancient Greek music of the 5th Century as well as in contemporary music, microtones are a regular part of musical composition. In this chamber work I have often used the enharmonic tetrachord which requires the guitar player to re-string the guitar in order to have quarter tones on open strings and for harmonics. Blu-tak[91] must also be added to certain strings of the piano to moderate the pitch by a quarter-tone. The size of the quarter-tones is half of a semitone using well-tempered tuning. The second movement uses the tonic chromatic genera which, like the tense diatonic genera used for most of the last movement does not have quarter tones.

Example 2.



Enharmonic tetrachord Tonic chromatic tetrachord Tense diatonic tetrachord

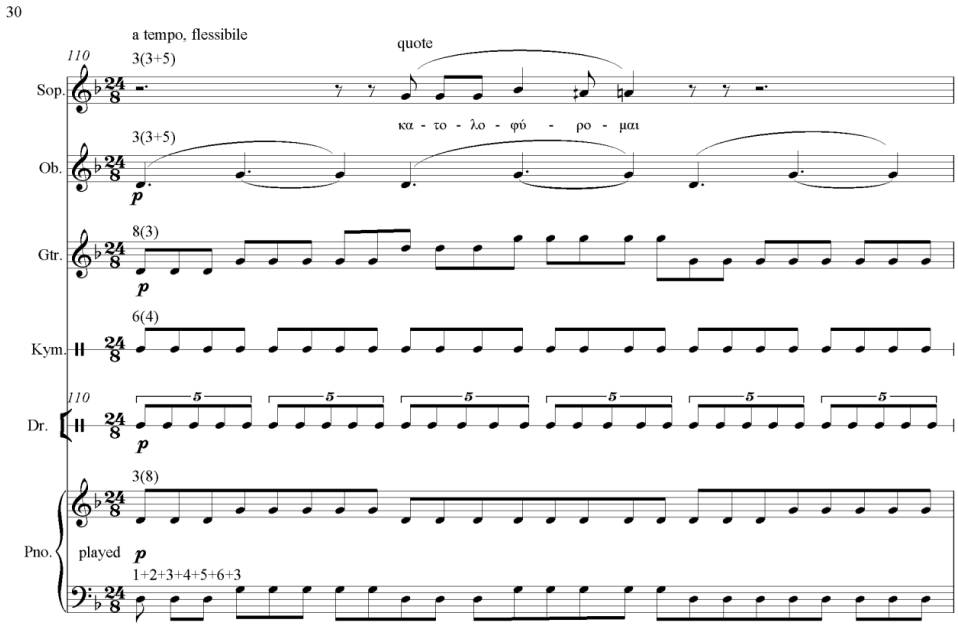
3. Rhythm patterns

Rhythm patterns in Ancient Greek music usually follow binary combinations of long and short, following the rhythm of a text. Commentary was made by ancient philosopher Dionysius of Halicarnassus that many "contemporary" composers of the 5th Century BC were making horrible rhythms which did not follow speech patterns[92]. This criticism acknowledges that speech patterns were not always followed. The vocal line in the third movement uses speech pattern for rhythmic

[91] Plasticine or chewing gum can also be used.
[92] West, *Ancient Greek Music*, p. 132.

patterns, (such as the dochmiac rhythm pattern, 3+5/8, see example 1.) but the closing section of the same movement uses different densities of rhythms to create movement and written out accelerandi/ritardando, similarly as used in contemporary music.

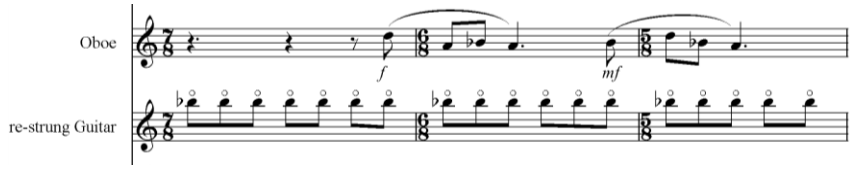
Example 3. Third movement, Recapitulation



4. Changing time signature structures

Ancient Greek beat patterns usually give an indication of time signatures for a complete piece, but there are indications that not all musical selections followed a simple straightforward “time-signature”. Pindar’s *First Pythian Ode* has examples of changing bar length[93] moving from 7/8 to 3/2 back to 7/8, then 6/8. The first movement of *Orestes’ Chamber* shows examples of changing time signatures to link the past and present together.

Example 4.

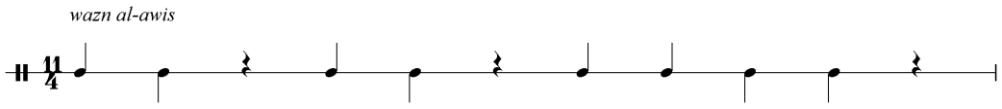


[93] Ibid., p. 152.

5. Arabic folk music

The second movement uses an Arabic rhythm pattern in 11/4 time called wazn al-alwis[94]. Rhythm in Arabic folk music has many parallels to Ancient Greek rhythm. Often the rhythm follows the speech pattern of the text, and many song forms are from poetic meters. Each piece has a basic rhythm pattern called 'wazn' which has a unit of at least 2 time values and the patterns can be joined together to make larger measures. Often rhythm patterns of odd numbers are used such as 11/4, 13/4 and even 17/4 time are used and are broken up internally in smaller units.

Example 5.



Al-Farabi and other theorists between 800-1400AD based their musical writings on those of ancient Greek philosophers such as Aristotle and Aristoxenus. Luckily they valued the works of ancient Greek philosophers and translated a great amount of information into Arabic. Otherwise, most of the ancient Greek works might have been lost in the middle ages. Abu Nasr al-Farabi (d.950AD) wrote *The Grand Treatise on Music* which included the science of sound, intervals, tetrachords, lute frettings in regular and microtonal intervals. In addition to being an excellent mathematician he was also a practical musician who understood the problems of actually playing music rather than only writing about it in a theoretical manner. Consequently, he was very similar in his thinking to Aristoxenus.

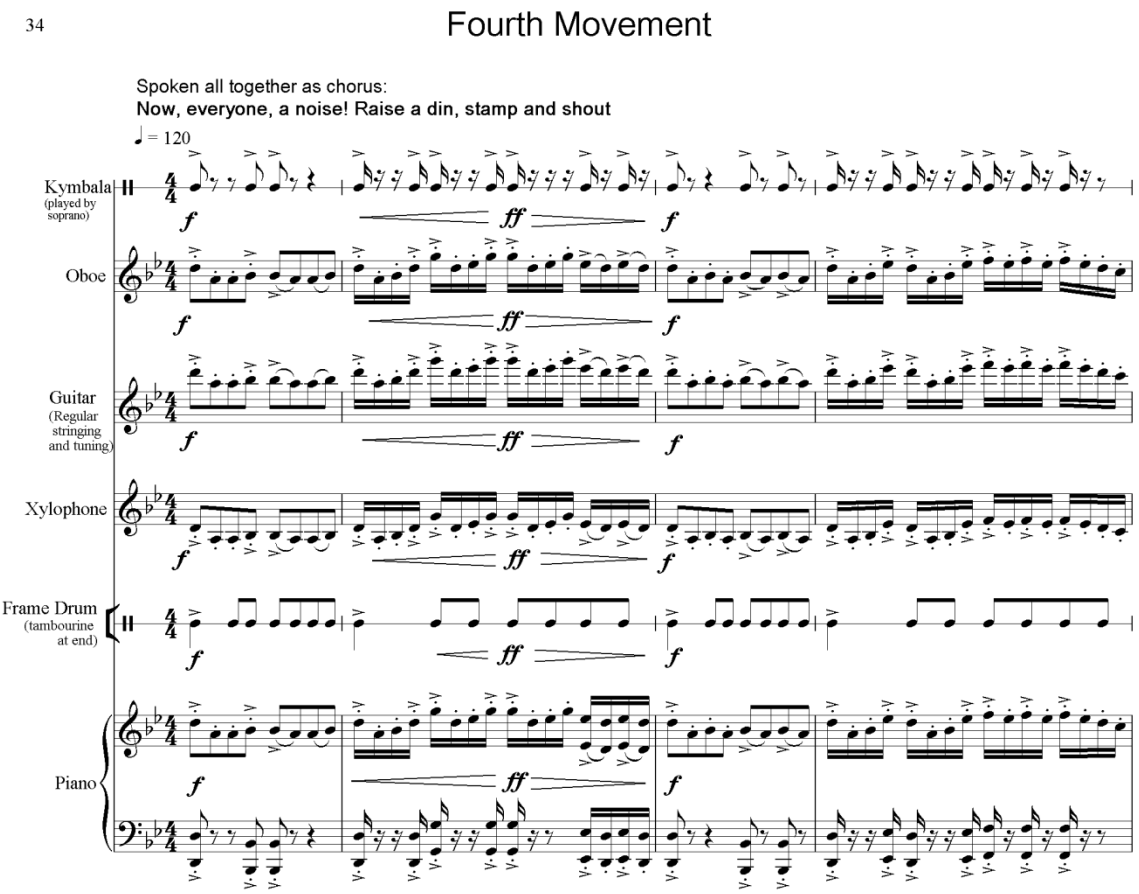
6. Heterophony

The opening melody of the fourth movement is very simple in character using the diatonic genera, 4/4 time and having a rhythm of quavers and semi-quavers.

[94] Touma, *The Music of the Arabs*, p. 53.

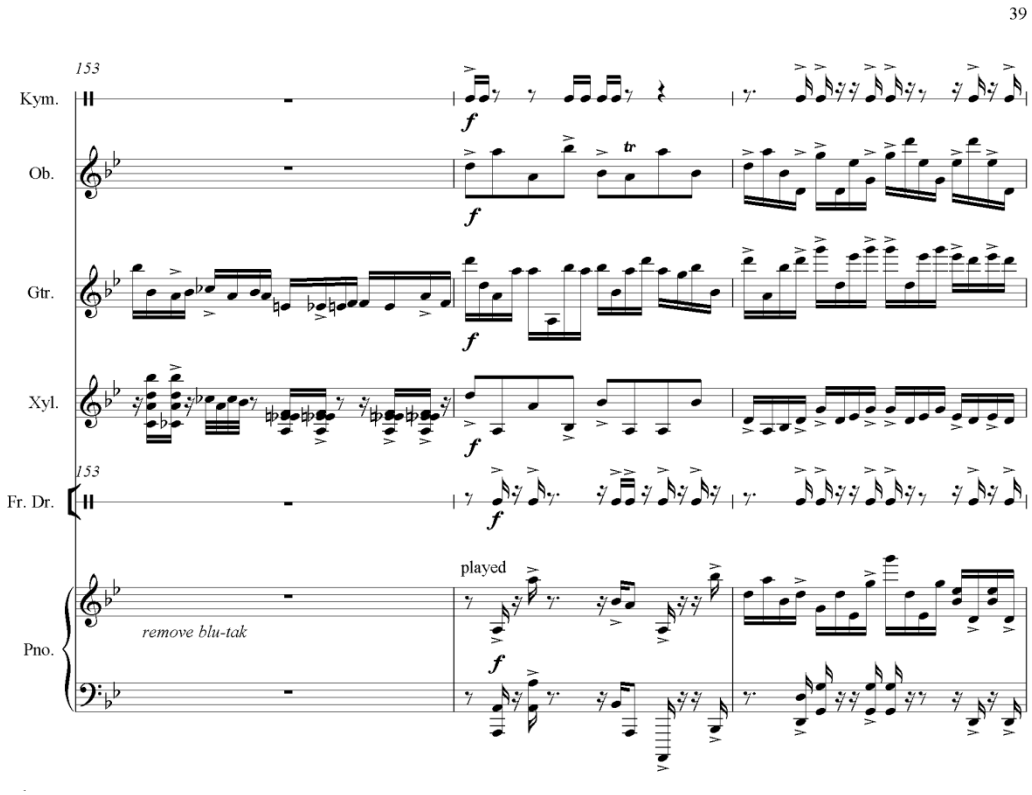
The four measure melody is played in unison by the oboe, guitar, piano and xylophone but is later changed in the following textural heterophonic manipulation:

Example 6. measures 1-2 of four measure melody, fourth movement



One example of heterophonic transformation is applied in measures 154-155 using octave changes in melody, ornamentation, removal of notes in melody and rhythm (filtration), displacement of accents.

Example 7, fourth movement

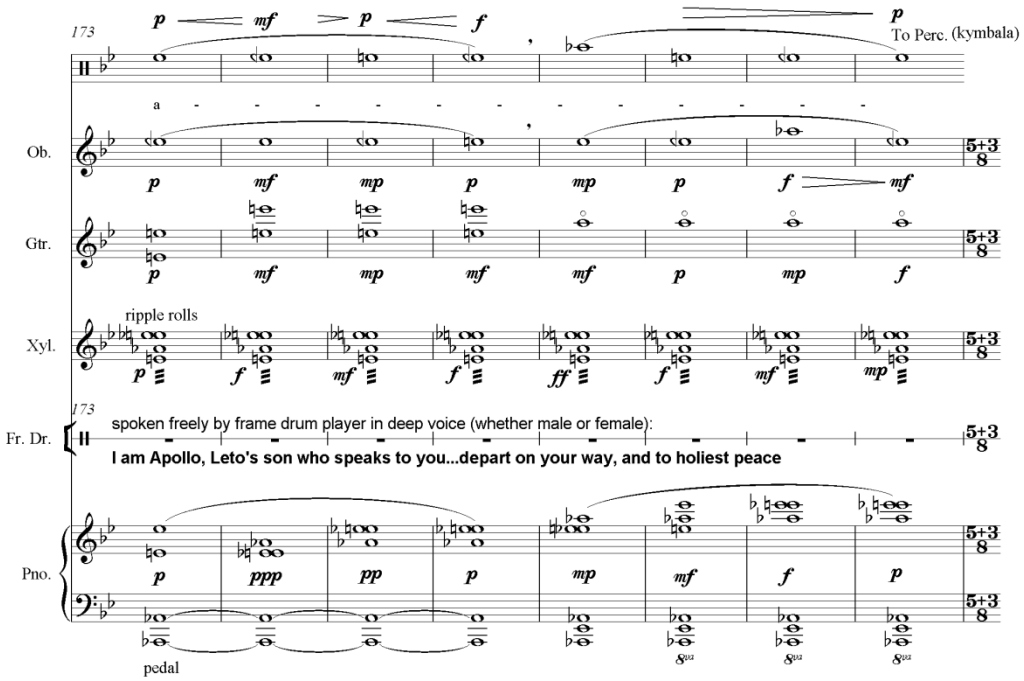


Techniques of heterophonic manipulation used in this piece include parallel motion using dissonant intervals, pointillism in which the melody changes octaves and instruments, rhythmic changes within the melody, “micro-variations” different articulations within the same rhythm[95], ornamentation, unusual accentuation contrasting in instrumental parts, repetition of notes, harmonics, tone colour changes and melodies in different genera at the same time.

One final example of 20th and 21st Century techniques used in *Orestes’ Chamber* is chord clusters based on the pitches of the genera used. This is in a similar fashion to serial music use of chords based on hexachords built on the first and last six notes of the tone row used in the composition. Klangfarbenmelodie is then used in order to exchange and stress different pitches in different instruments.

[95] ed. N. Cook and A. Pople (2004), *The Cambridge History of Twentieth-Century Music*, Cambridge, Cambridge University Press, p. 527.

Example 8. Chord Clusters of Genera



Orestes' Chamber is a composition using techniques from diverse eras borrowing from one and blending with another. The possibilities of using Ancient Greek music combined with contemporary techniques are indeed unique and create many new areas of thought.

6.2 **erosion**

variations for solo violin

Dedicated to violinist Mizuka Yamamoto.

erosion is an exploration of compositional techniques of the 5th Century BC Greece as well as the use of changing time signature patterns used in the 20th and 21st Century AD. The theme starts in the enharmonic genus in 3/8 time and is followed by five variations which use different 'hues' or shades of the chromatic and diatonic genera. The variations also use poetic feet using combinations of time cycles used in poetry in 5th Century BC. Variation Six is a summary of the previous variations with disappearing time signatures in the end. The next variation labelled (i) is a variation upon the opening theme and six variations using the time signatures in a 20 measure structure. Each following variation has time stolen away like soil eroding from a cliff by the sea when it rains. The effect is a slow disappearing act until the final variation (viii) is only a quaver. The ending comes almost by surprise such as the final eroding of earth which vanished without being noticed.

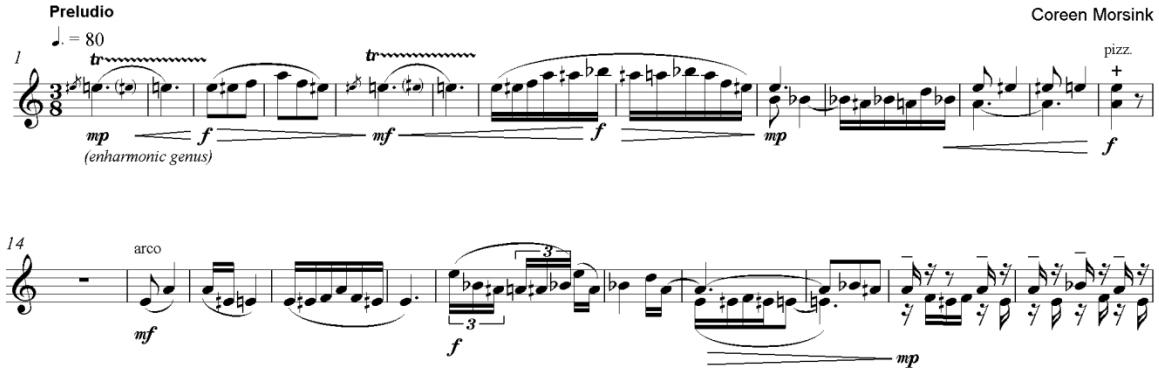
Performance Notes:

The modern violin is used with the strings in equal temperament tuning. Accidentals are to last for the whole measure. Symbols such as a natural or sharp with an arrow attached are to show tuning such as soft chromatic when the distance of a tone is divided in 3 equal parts creating an F which is 7/60 of a P4. One can use the chart below for a guideline in microtones but the tuning should be done by ear. For exact divisions and placements of microtones philosopher Aristides Quintilianus divided the P4 in 60 equal parts to show the placement of microtones[96]. One should be aware that F1/3↓ is 1/60th smaller/lower than F↓. In terms of cents, the difference is not noticeable to the ear (the amount of 5 cents is said to be detected by the human ear) but a difference in thought should occur.
Theme: enharmonic, 3/8 time (iambus)

[96] Barker, *Greek Musical Writings: II Harmonic and Acoustic Theory*, p. 419.

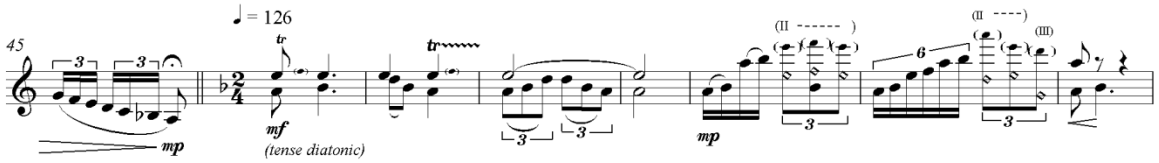
erosion
variations for solo violin

dedicated to Mizuka Yamamoto

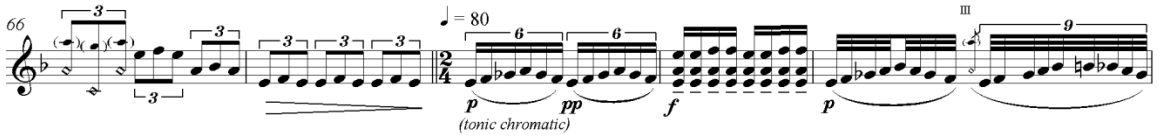


etc.

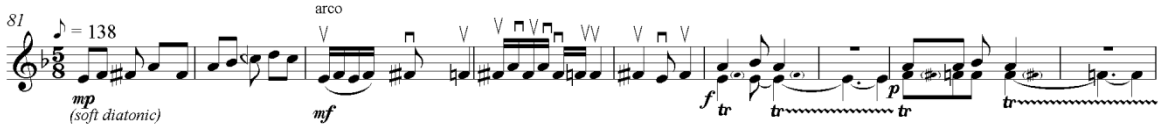
1st variation: tense diatonic, 2/4, ¾ time (dactyl, ionic)



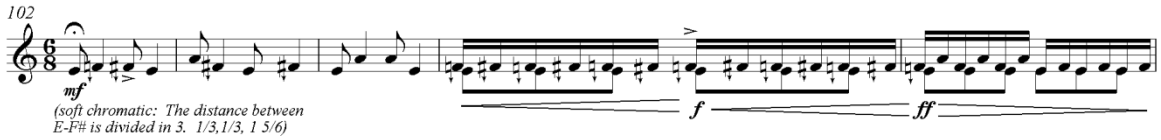
2nd variation: tonic chromatic, 2/4 time (dactyl)



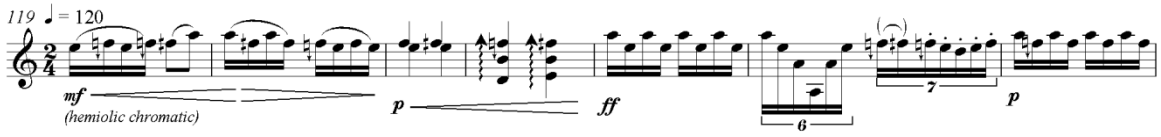
3rd variation: soft diatonic, 5/8, 3/8 time, (paean, iambus)



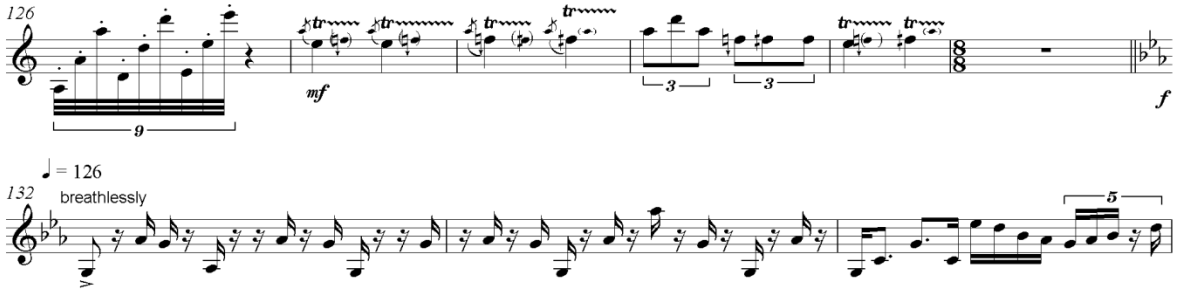
4th variation: soft chromatic, 6/8 time (iambus)



5th variation : hemiolic chromatic, 2/4 time (dactyl)



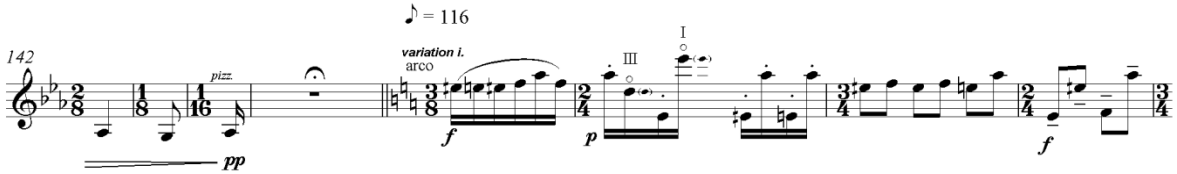
6th variation: a summary of the 5 variations in 8/8 time for 5 measures and then an elimination of a quaver in each bar resulting in a succession of 7/8, 6/8, 5/8, 4/8, 3/8, 2/8, 1/8 and finally disappearing on 1/16. The shade is the tense diatonic.



Variation i: A 20 measure structure uses changing time signatures from the theme and 6 variations. Each of the next 7 variations eliminate a quaver from the previous time signatures slowly eliminating measures of 1/8 time. The structure is as follows:

i) enharmonic

3/8 2/4 3/4 2/4 3/4 2/4 5/8 3/8 5/8 6/8 2/4 8/8 7/8 6/8 5/8 4/8 3/8 2/8 1/8 1/16



ii) tense diatonic

2/8 3/8 5/8 3/8 5/8 3/8 4/8 2/8 4/8 5/8 3/8 7/8 6/8 5/8 4/8 3/8 2/8 1/8

iii) tonic chromatic

1/8 2/8 4/8 2/8 4/8 2/8 3/8 1/8 3/8 4/8 2/8 6/8 5/8 4/8 3/8 2/8 1/8

iv) soft diatonic

1/8 3/8 1/8 3/8 1/8 2/8 3/8 1/8 5/8 4/8 3/8 2/8 1/8

v) soft chromatic

2/8 1/8 2/8 4/8 3/8 2/8 1/8

vi) hemiolic chromatic

1/8 3/8 2/8 1/8

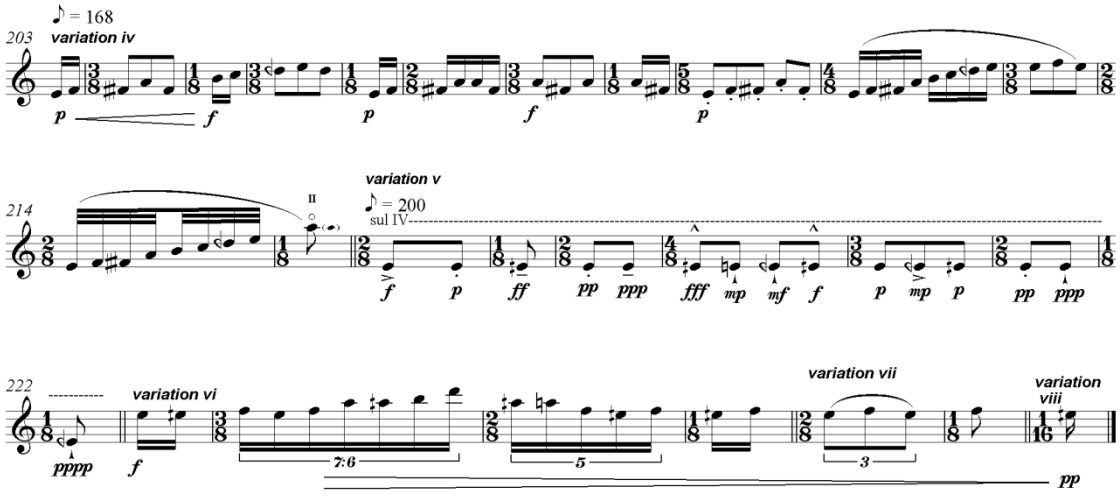
vii) tense diatonic

2/8 1/8

viii) enharmonic

1/16

(variation iv-viii)



Microtonal Guidance Charts

Intervallic distance in Cents (equal temperament tuning)

Let 1200 equal the octave and each semitone equal 100 cents (P4=500 cents rather than a pure P4 of 498 cents from the ratio 4:3[97])

Western Chromatic scale: 100, 100, 100, 100, 100

Enharmonic: 50, 50, 450

Soft chromatic: 66.6, 66.6, 366.6= 499.8 or 67, 67, 366= 500

Hemiolic chromatic: 75, 75, 350

Tonic chromatic: 100, 100, 250

Soft diatonic: 100, 150, 250

Tense diatonic: 100, 200, 200

Genera as fractions of a tone

Enharmonic: ¼, ¼, 2

Soft chromatic: 1/3, 1/3, 1 5/6

Hemiolic chromatic 3/8, 3/8, 1 ¾

Tonic chromatic: ½, ½, 1 ½

Soft diatonic: ½, ¾, 1 ¼

Tense diatonic: ½, 1, 1

Notes on Genera Chart[98]

This chart shows the P4 or "tetrachord" divided in 60 equal parts. The distance of the dotted line to line 60 should be thought of as a string stopped at the point of a P4 or as in this example, A on the E string of a violin. Thus the dotted line would be the sound of E if the string were to be played open. Each line should be thought of as a placement of a possible note. The numbers and letters indicate the line directly above and A is written outside of the chart to indicate the 60th line.

[97] Based on: West, *Ancient Greek Music*, p. 12.
[98] Ibid., p. 169.

Chart of Genera as categorized by Aristides Quintilianus in units: division of the tetrachord E to A into 60 parts to show different shades

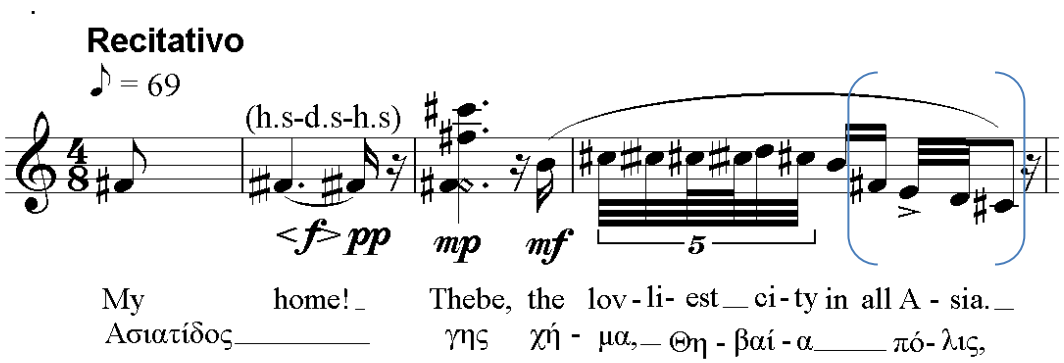
Division of P4 in 60 equal parts E=0	**Western Chromatic** E,F,F#,G,G#,A E=0	**Enharmonic** E,E1/4#,F,A E=0	**Soft Chromatic** E,F1/3↓,F#1/3↓,A E=0	**Hemiolic** E,Fflat↓, F1/4#, A E=0	**Tonic Chromatic** E,F,F#,A E=0	**Soft Diatonic** E,F, G𝄬, A E=0	**Tense Diatonic** E,F,G,A E=0
1							
2							
3							
4							
5							
6		**E1/4#**					
7							
8			**F1/3↓**				
9				**F↓flat**			
10							
11							
12	**F**	**F**			**F**	**F**	**F**
13							
14							
15							
16			**F1/3↓#**				
17							
18				**F1/4#**			
19							
20							
21							
22							
23							
24	**F#**				**F#**		
25							
26							
27							
28							
29							
30						**G**1/4 flat	
31							
32							
33							
34							
35							
36	**G**						**G**
37							
38							
39							
40							
41							
42							
43							
44							
45							
46							
47							
48	**G#**						
49							
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							
60	**A**	A	A	A	A	A	

6.3 **Andromache's Recitativo, Aria and Subtext for Quarter-tone Alto Flute**
in collaboration with flautist Carla Rees

Andromache's Recitativo, Aria and Subtext is a 'song' for quarter-tone alto flute where the words are played rather than sung. The recitativo follows the example of ancient Greek music using the text as a base for the notes and rhythm. The Aria moves away from direct use of speech-rhythm but still uses the number of syllables as a means of ordering the phrases. The text is then reflected by the music. The subtext is where the characters get to play out their real emotions. These are the thoughts of Andromache, Hermione and the goddess Thetis who are the main female characters of Euripides *Andromache*. Andromache and Hermione are the victims of society and war, frustrated and hoping for something better in life. Thetis is the cold goddess looking down disdainfully at the situation.

The English translation of the text used is that of Philip Vellacott because, for me, his work shows the real universal emotional elements in all the characters. His translations also follow very closely the original ancient Greek which I have written only in the opening phrase (see ex.1). As much as possible, the flautist must try to be each character and play the role as would an actor/actress on stage.

Example 1. Opening phrase with English and ancient Greek text: bracket designates genus of diatonic tetrachord C#,D,E,F#.



The actual notes follow the modal genera from ancient Greece, using quarter-tones and thirds of tones as well as semi-tones and whole tones which were all a part of music in approximately 5th-2nd century BC. The equivalent in cents (1/3 of a tone equaling 66.6 cents) has been included in the score if the

flautist wishes to play in numeric value. Well-tempered tuning otherwise is to be used with a quarter-tone equaling half the size of a semi-tone.

This piece was written in collaboration with flautist Carla Rees who gave me valuable information on the technical aspects of the quarter-tone alto flute. The genera I chose and the actual starting pitch of the piece reflect her advice about the actual physical capabilities of the instrument. As well, many of the multiphonics I chose from her examples in her CD rom explaining the techniques of the instrument. As I wrote the piece she commented and gave her opinion as to how certain sounds should be written. Thus I consider that I have written this piece "for and with" Carla although the compositional ideas are my own.

In Carla Rees' PhD thesis[99] she writes a chapter called *Case Study 3: Andromache's Recitativo, Aria and Subtext (2010)* in which she describes in detail the initial ideas I had in writing the piece and how they transformed as I learned about the subtleties of the Kingma System alto flute. She comments on what changes were necessary in making the piece technically work, such as in microtones, multiphonics and in use of the high register.

In my score, a glossary and notes for the performer explain that accidentals only affect the note they precede. Certain short forms are used to explain techniques on the flute such as w.t. with a diamond note head indicating a whistle tone, d.s. representing a dark sound, h.s. for hollow sound, a.s. for airy sound and f.s. for full sound. Flz stands for flutter tongue and ord. meaning the end of the flutter tone. An 'x' indicates a key slap and a diamond note means that the note should be sung rather than played. Lastly, a think slash / means that the flautist must stomp her/his foot or feet while playing, a bit like having a temper tantrum.

Technical and Theoretical explanation of Andromache:

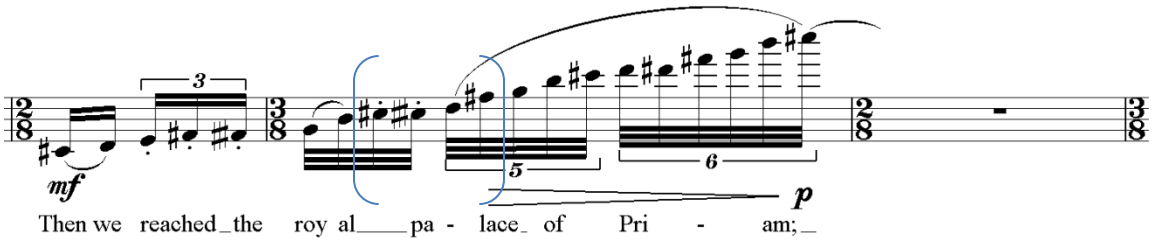
Recitativo (m1-37)

The Recitativo is the main character's statement (Andromache) of her plight using speech/text rhythm and tetrachords. Her emotions range from nostalgia,

[99] Rees, 2013, *Collaboration in Practice: Developing a Repertoire of Extended Techniques for the Kingma System Alto and Bass Flute*, London, RCM. Note that at the time of writing my thesis Carla Rees was just submitting her thesis, so exact page number references or quotes cannot be given.

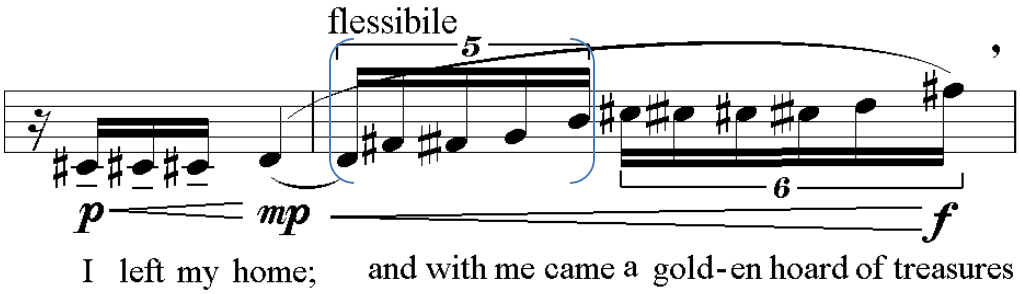
envy, bitterness, sadness, anger, frustration, loss of pride and resignation. She talks about places such as Thebe, Asia and Troy and comments on the people in her life that have most affected her such as Hector, Priam, Achilles, Astyanax and Neoptolemus. The melody and use of multiphonics is in the realm of word painting where the sound qualities reflect the mood and ideas of the text (see example 2). The rhythm of the melody follows the English translation of the text generally but not always exactly.

Example 2. m9: Word painting showing the palace as being far away and in a high place. Bracket designates enharmonic genus of C#, C♯ and D,F#



In the c^1-b^1 low range Andromache uses the tense diatonic tetrachord of C#,D,E,F#[100] (see example 1.) and the enharmonic genus of F#,F♯,G,B (see ex. 3) whereas in the c^2-b^2 range the enharmonic tetrachord of C#, C3♯ and D,F# and tense diatonic F#,G,A,B are used (see example 2) followed by c^3-c^4 range tonic chromatic tetrachords of C#,D,D#,F# and the same F#,G,A,B tense diatonic genus as in the c^2-b^2 range.

Example 3. m5. Bracket designates enharmonic tetrachord of F#,F♯,G,B



[100] Note-names refer to the written pitches rather than the sounded pitches of the quarter-tone alto flute.

Section A (m1-13) uses the following text from Andormaches first monologue[101]:

> My home! Thebe, the loveliest city in all Asia!
> I left my home; and with me came a golden hoard
> Of treasures for my dowry. Then we reached the royal
> Palace of Priam; there I became Hector's wife,
> To bear him true sons. My name is Andromache.

The characteristics of the melody are slow and dramatic. Following the text the following time signatures are used:

i) 13 beats (3 measures of 4/8 (plus one eighth pick up)

ii) 13 beats (3 measures 4/8, one of 1/8 rest)

iii) 15 beats (2/8,3/8,2/8,3/8,5/8)

iv) 5 beats (5/8)

Section B (m14-28) is as follows:

> It was an envied name in those days; now there is
> No woman living whose life holds such bitterness.
> I saw my husband Hector killed by Achilles' sword;
> And on the day the Greeks took Troy I saw my son
> Astyanax thrown to death from the high battlements.

This section is faster and a bit hysteric (2+1+2)

i) 5 beats 3/8,2/8

ii) 15 beats 3/8,2/8,5/8,5/8

iii) 13, (1/16,4/8,4/8,4/8,1/16)

iv) 13 (1/8,5/8,5/8,2/8)

Section C (m29-37) concludes with:

> And I, the famous daughter of a noble house,
> Was brought to Hellas as a slave, a chosen prize
> From the spoils of Troy, awarded to the island prince
> Neoptolemus, for valour.

[101] Euripides, trans. by P. Vellacott (1972), *Orestes and other Plays,* London, Penguin Books, p. 145.

This expresses Andromache's anger, frustration, resignation and loss of pride

i) 7 (4/8,3/8)

ii) 9 (2/8,1/8,3/8,3/8)

iii) 8 (4/8,3/8,1/8)

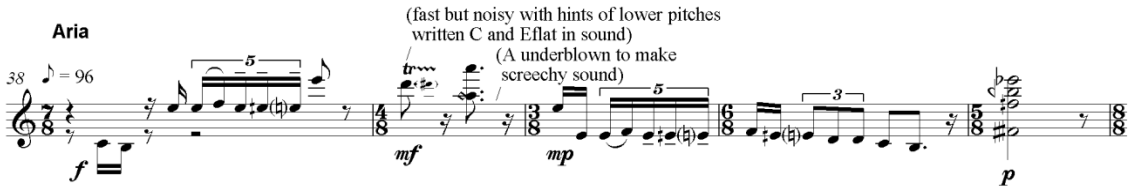
Aria

The Aria uses 3 voices:

1) Andromache, low voice range b-b^1 (B,C,C#,E and F#,F♯,G,B)
2) Hermione, high voice: notes from b^1 and upwards, out of tune, shrill
3) Characters such as Neoptolemus, Menelaus, (usually c^1-b^1 range, and notes B,B♮,C,E,E♮,F,A)

The text is not written in the score but is understood as the emotion behind the notes. The measure lengths take their amount from the text as follows:

Example 4. m38-42. The time signatures follow the number of syllables in text.



m38.....but my master took a wife, (7)

m39-41 Hermione, from Sparta; he had no further need (13=4+3+6)

m42-43 For his concubine, who now became the target for (12=5+8)

m44-45 Hermione's malice. She says that by secret spells (13=6+7)

m46-47 I make her barren, make her husband tired of her; (12=5+7)

m48-49 That I mean to oust her from her lawful marriage, and take (14=12+2)

m50-52 Her place in his house. When I had that place, it was (12=5+5+2)

m53-55 No choice of mine; now I have quitted it. Great Zeus (12=4+6+2)

m56-57 Be witness, I had no wish to be his concubine. (13=3+10)
m58-59 Hermione won't believe this; she desires my death. (13=8+5)
m60 In this her accomplice is her father Menelaus, (13)
m61-62 Who has come from Sparta for this very purpose, and (13=12+1)
63-65 Is now in the house. He frightens me; so I've come here (13=5+4+4)
66-67 For sancturary to the shrine of Thetis, which is close (14=11+3)
68-70 To the palace, hoping this may save my life. (11=4+7)

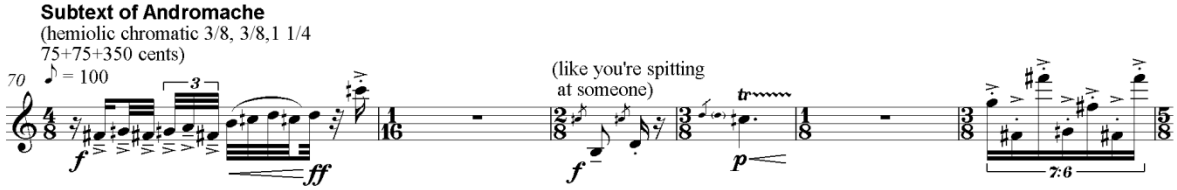
Subtexts

This section reflects the emotions of the three main female characters in the play Andromache. Each section has a different flavour which is reflected in the choice of genus. There is no text supplied as the emotions are felt rather than actually put into words.

Subtext of Andromache

The subtext of Andromache (m70-95) is in the genus of hemiolic chromatic which is 3/8, 3/8,1¼ of tones or 75+75+350 cents. The time signatures follow those of the recitativo but reduces the number of measures if the time signature is for more than one measure. Measures of silence are cut in half.

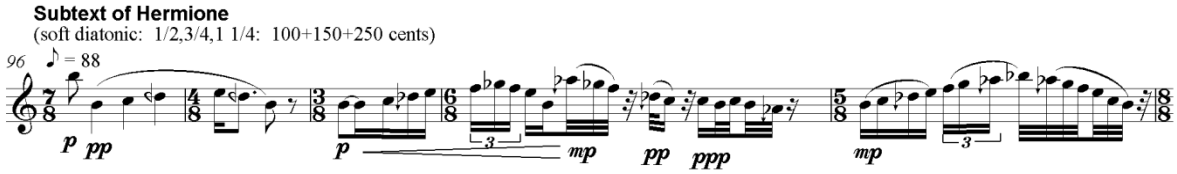
Example 5. m70-75, Subtext of Andromache.



Subtext of Hermione

The subtext of Hermione (m96-112) uses the soft diatonic: 1/2,3/4,1¼ of a tone or 100+150+250 cents. The time signatures are those of the Aria only in sections mentioning Hermione

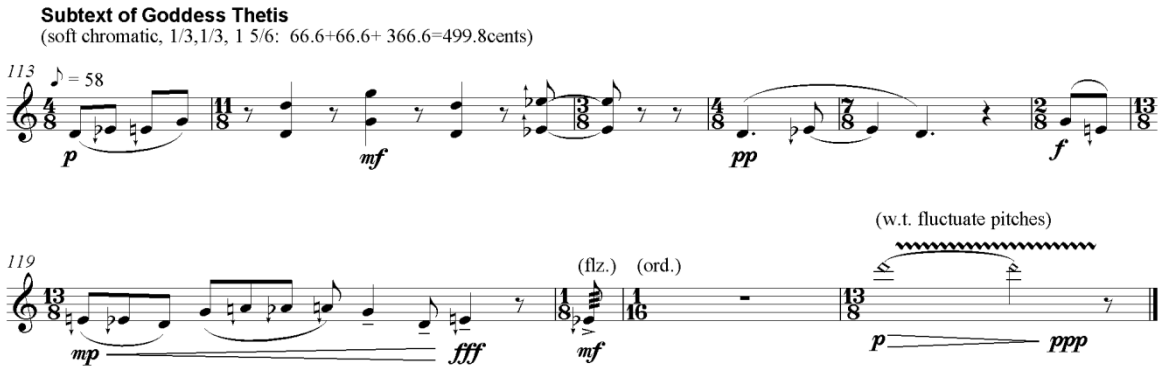
Example 6. m96-99. Subtext of Hermione.



Subtext of Goddess Thetis

The subtext of Goddess Thetis (m113-122 to end) uses the soft chromatic, 1/3,1/3, 1 5/6 of a tone or 66.6+66.6+ 366.6=499.8cents and follows the time signatures of those in the Aria referring to Thetis

Example 7. m113-118. Subtext of the goddess Thetis



Microtonal Guidance

As mentioned in guidelines and charts for the composition *erosion*, the tuning of scales for this piece uses ideas from the writings of Aristoxenus and from M.L. West's book, *Ancient Greek Music.* All of the notes chosen in this piece have been derived from the theories of tetrachords used in classical Greece rather than the ancient modes of Pythagoras. Whereas with a string instrument the notes were tuned to specific notes, wind instruments may have had more flexibility and thus I have made different genera for different octaves. Since the quarter-tone alto flute has much more flexibility than wind instruments such as the ancient aulos, I have used this ability to make a wider range of notes which probably weren't available in 300 BC wind instruments.

Use of Specific Frequencies

I would prefer this piece be played (if possible by the performer[102]) at the frequency of A=432hz rather than A=440hz or A=442-444hz. According to research done by Maria Renold and musicologist Kathleen Schlesinger, folk music instruments from around the world and from ancient Greece have been found to be pitched at 432 rather than higher frequencies[103]. Calculations done showing our "human rhythmic system (breath and heartbeat)"[104] also relate to the number 432. Thus recordings both at 440 and 432 have been made of *Andromache* to show the difference in pitch and to explore the possible effect the different pitches may have on emotions and physical well being. Most people listening to music at A=432hz describe the mood as being more "peaceful, pleasant and full"[105] as well as using other positive adjectives. In contrast music heard by the same people at A=440hz was considered by most to be "uncomfortable, oppressive…irritating and very aggressive"[106]. At the initial time of writing this piece I had not made this conclusion and wrote conscious only of music being played at 440. Thus Carla Rees recorded the composition at 440 and I have changed the pitch to 432 using Audacity music program. Although this piece has not yet been played at 432 I would presume that it could be possible through elongating the flute to some degree, although perhaps a whole new quarter-tone alto flute may have to be made as it is a very specific instrument. The recordings supplied can be compared and the listener can decide if the final outcome changes the perception of the piece. At the *2nd Athens Composer/Performer Conference for PhD students*[107] I took a survey on the audience's perception of the difference between the original recording of Carla Rees playing at A=440 and the altered version at

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[102] Understandably, most classical musicians in the present time have been trained to play at A=440 or a higher frequency making it difficult if not impossible for them to play at A=432 without a partial or even complete retraining. Thus performances at A=440 for this piece at the present time will be acceptable due to the restrictions caused by current education.
[103] Renold, *Intervals, Scales and Tones and the Concert Pitch of c=128*, p. 71.
[104] ibid., p80. "Taking the average rate to be 18 breaths and 72 heartbeats per minute"
[105] ibid., p. 77.
[106] ibid., p. 76.
[107] see website http://athensconference.blog.com/

A=432. The full results can be seen in the appendix but to summarize, out of 26 participants (some of whom were PhD/doctoral students, others musicians, music students of undergraduate and upper-school level as well as non-musicians) six felt there was no difference in the recordings, one said the change was negative and 19 felt that the piece sounded more appropriate at A=432 particularly as it was a piece relating to ancient Greece.

Andromache is a work based on ideas from ancient Greece both from the Pythagorists and followers of Aristoxenus, but is a modern composition springing forward from the past. As composer Elsie Hamilton wrote about her music which used ancient Greek modes described by Schlesinger:

> "In 1935 this new language of Music was introduced at Stuttgart, Germany, where a small Chamber Orchestra was trained to play in the Greek Modes. Singers have also found little difficulty in singing these intervals which are not those of our modern well-tempered system...I merely mention these performances as a proof that the Ancient Greek Modes can be used as a basis for modern composition, for they are built upon the natural law of sound itself, the only musical law which has been given us by Nature. In doing this I should also like to express the hope that other composers might be encouraged to make experiments in this fascinating realm."[108]

Andromache's Recitativo, Aria and Subtext is, I believe, part of this concept and I hope that it will encourage other composers to also delve into this "fascinating realm".

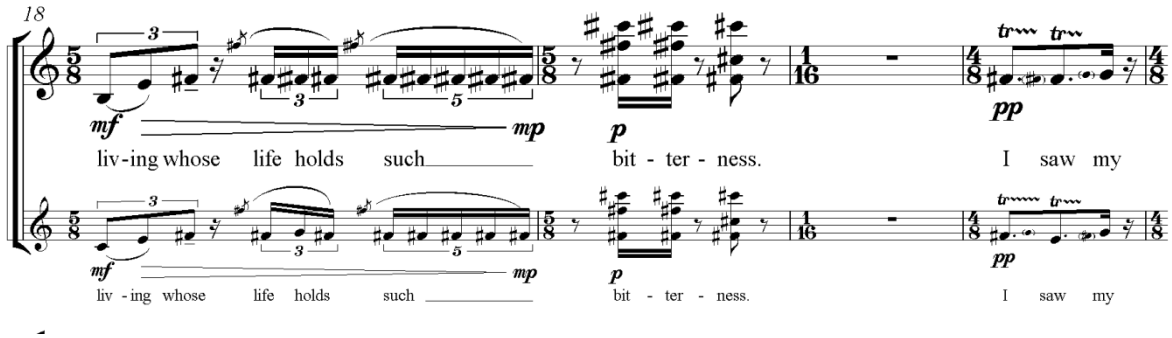
6.31 **Andromache's Recitativo, Aria and Subtext for Alto Flute**
in collaboration with flautist Carla Rees

In order for this piece to be played on the 'regular' alto flute I have worked out, in collaboration with Carla Rees, alternative notes to replace those note that can be played only on the quarter tone alto flute. The following examples show how the notes were altered in order to keep the overall effect of the piece as well as the theoretical planning of the pitches.

The most common change was to raise the low B's to C's to fit the alto flute's range. To improve the melodic content, I changed the order of some of the notes,

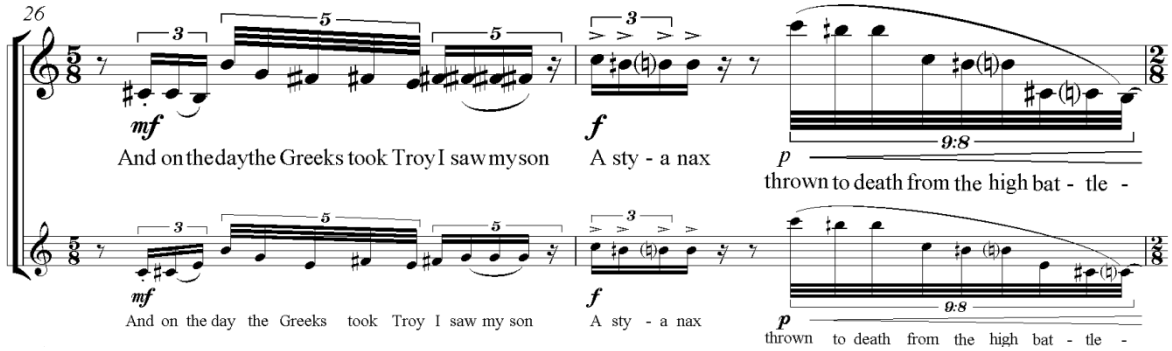
[108] E. Hamilton, (1953) *The Modes of Ancient Greece,* accessed from http://www.nakedlight.co.uk info@nakedlight.co.uk, July 17th, 2011, p. 1.

because the change in pitch altered the flow of the melody. Certain quarter-tones were not possible, so the melody had to change slightly. These changes were not too difficult or drastic and so the overall effect and nature of the music is the same. The first example shows a simple change from B to C, and F3/4 sharp changed to G (top stave quarter-tone alto flute, bottom ossia stave, regular alto flute.
Example 1.



The second example shows the more serious decision of changing the first three notes of m26 completely as well as the last three notes of m27.

Example 2.



Overall, the piece is almost the same in the actual pitches and there is no difference in the emotional aspect of the piece, so that both pieces have the same title and references to Ancient Greek music.

6.4 **12-1 Preludes**
For Prepared Piano

Instruments such as the piano are obviously limited for quarter-tone pitches unless prepared or re-tuned. Composer Nicola Vicento (ca1511-1576) invented a harpsichord with three keyboards which could play chromatic and enharmonic genera as well as diatonic. This instrument "claimed to recapture powers of ancient Greek scales"[109]. As instruments of Vicento are not readily available, I have required particular piano strings to be lowered a quarter-tone with blue-tak, plasticine or chewing gum.

The 12-1 Preludes really started in 1988 when my piano teacher Margaret Parsons-Poole had me learn half a dozen Chopin Preludes (Opus 28). When Mrs. Poole died the summer after my first year at university, I felt the only way to pay tribute to her was to learn all 24 preludes, much to the horror and dismay of the piano professor with whom I was studying.

Twenty years later in the quiet of Sopron Hungary I was suddenly possessed with the desire to write a set of preludes. The first idea came to me Christmas morning as I listened to the charmed church bells ringing with their exuberant overtones, never managing to ring in synchronization. At the same time I was trying to understand the structure of Brian Ferneyhough's *In Nomine à 3* which gave some inspiration for the changing time signatures, odd quintuplets and other numbered groupings and the binary form. The preludes all follow the genera of Ancient Greece but the ending of No. 1 has a jazz sound at the end almost as if Oscar Peterson had been transported back to Ancient Greece. Each prelude starts a semi-tone higher than the previous prelude. Thus the Preludes follow the equal tempered tuning system as well as the Ancient Greek tetrachord genus tuning. Humourously, I call this style of writing the "Old Complexity". Most of the preludes were written originally on more than two staves but then reduced to two staves to make the appearance more pianistic rather than orchestral.

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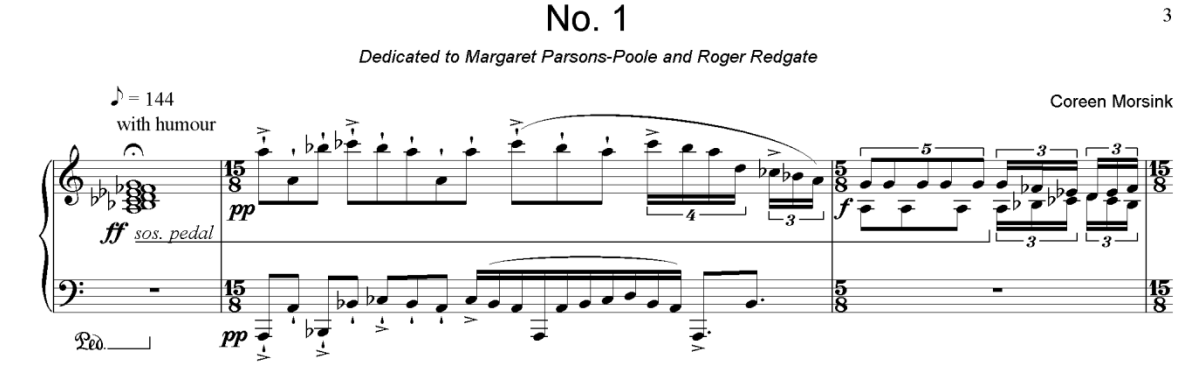
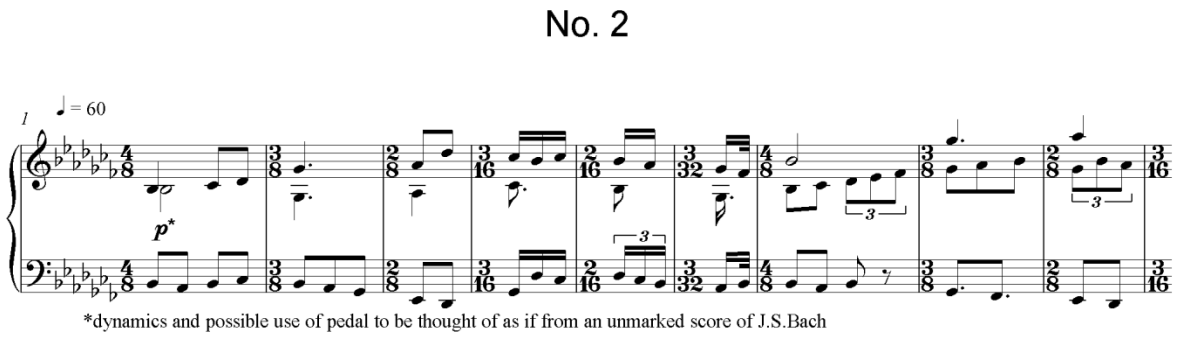
[109] J. Grout and C. Palisca (1960, 1996), *A History of Western Music,* 5th Edition, New York, W.W. Norton & Company, Inc., p. 158.

No. 1 using the enharmonic genus starting on A.



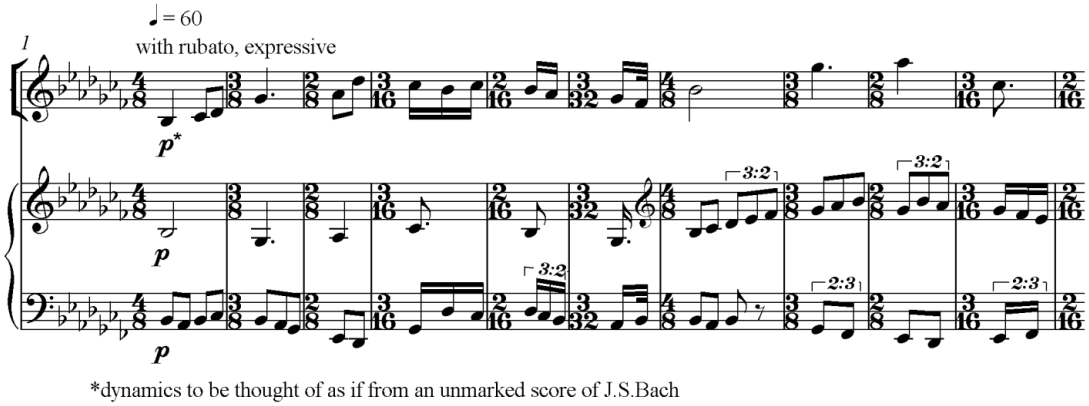
No. 2 is a reflection of the Preludes of J.S.Bach, with the idea of part writing and voicing which was indicated originally by the three different staves. Also in reflection of Bach is the lack of dynamic markings except one climactic point. The genus used is the diatonic.

Finished score:



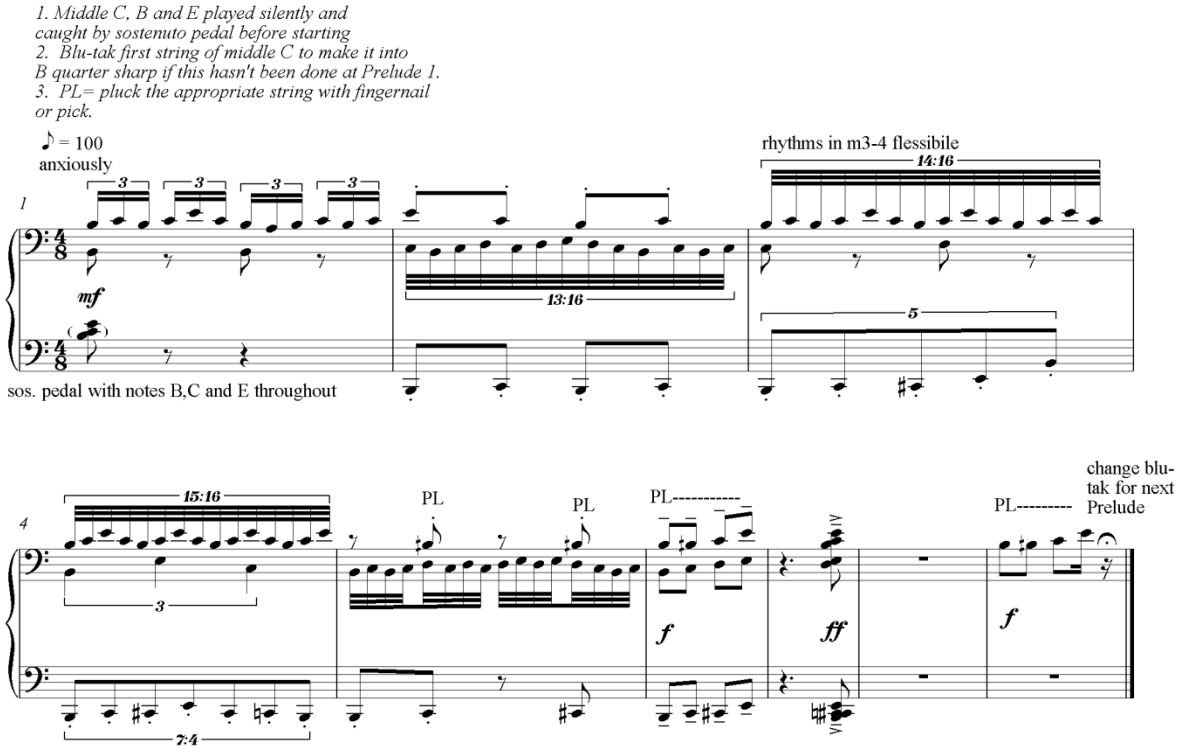
Original score:

No. 2



No. 3 and 4 are more reflections of Ancient Greece and use blu-tak on strings to make the ¼ tone changes needed in the enharmonic genre.

No. 3

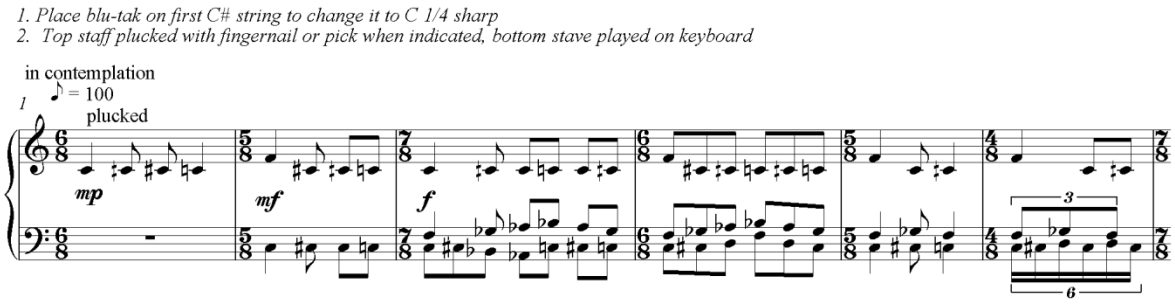


No. 4 uses rhythm patterns reflecting the poetry of Sappho. At the start of my PhD portfolio of compositions I had written a piece for prepared piano called *Scattered Lines* which was based on small extracts of Sappho's poetry translated from ancient Greek to modern Greek and to English. This was the start of my use of

ancient Greek text and translations in my instrumental music. The poem quoted here is reflected by the first 13 notes although only the first measure follows the

–UU- pattern fully.

> Ψαύην δ'ου δοκίμωμ' οράνω δυσπαχέα[110]
> I could not hope to touch the sky with my two arms[111]
> -Sappho

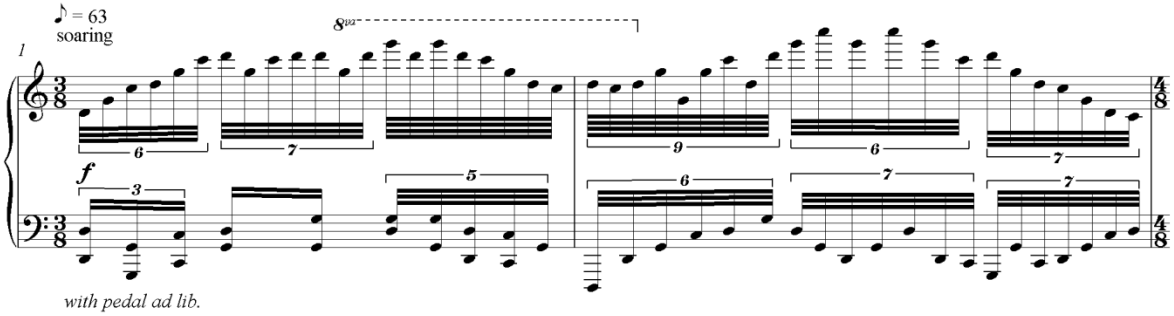


No. 5 uses the chromatic genera and is rather Bartokish in nature- another reflection of the mood I was in traveling in Hungary.

6+7 is a deliberate mistake of combining two genera in one Prelude. This is in the Jewish tradition of making a purposeful error to say that when we create something new we are not God even though we are trying to create something wonderful. As well, the error is an act of humility to all the composers who have written preludes that I love: Bach, Chopin, Debussy, Messiaen, Scriabin, Rachmaninoff…the list goes on. The opening motive is very Chopinesque in character reflecting the virtuoso style that Liszt loved so much in his friend's music. Again after having coffee in the Liszt café, how could I resist this temptation?

[110] Sappho, (1995) *Αρχαίοι Έλληνες Λύρικοι,* Επικαιρότητα O.E., p. 128.
[111] Sappho, translated by Willis Barnstone, (1962, 1988) New York, Shockenn books, p. 68.

No. 6+7

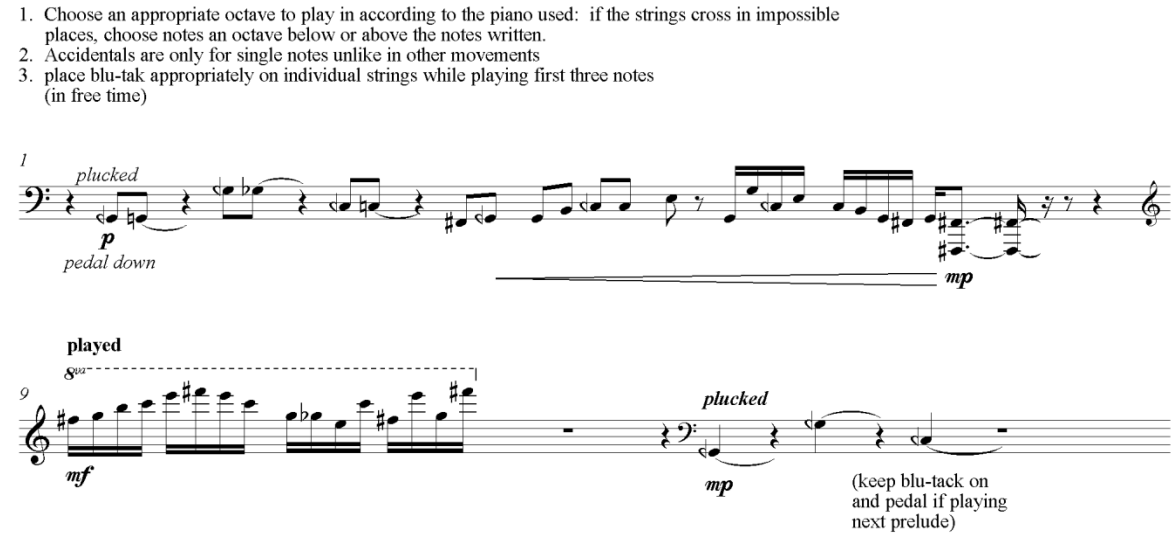


No. 8 goes back to ancient Greece in a poly-heterophonic melody which uses different genera in each voice playing the same melody.

No. 9 flies to the Toronto airport where I reflected on Toru Takemitsu's music which I had been listening to prior to take off…

No. 10 plucks the strings as if it is a lyra.

No. 10



No. 11 transports to Chopin's No. 3 in G major using fragments of the left hand pattern but changing the mode.

No. 12 to end things off really doesn't end. It just keeps on repeating with improvisation on the set two measures until the player feels it's time to stop.

Performance Notes

Piano preparation materials needed: Blu-tak, plasticine or chewing gum to be stuck temporarily on specified strings.

The 12-1 preludes are meant to be played as a set, much in the same manner Chopin's 24 Preludes are played as a whole set, but they can also be re-grouped or played individually. If one plays all 12 or even the first three together, it is advisable to place the blu-tak for Prelude 3 before starting the set. One should already have prepared small amounts of blu-tak to be ready to place for Prelude 10. The placing of the blu-tak should be done in a Brechtian style: as if the performer is changing characters/costumes in front of the audience to let the audience know that this is not for real: it is the stage which is a reality in a different sense. The performer is a creator as well as the composer.

1. Accidentals carry through the measure except when indicated.
2. Blu-tak is used to lower certain pitches by a quarter-tone. This is harmless to the piano and easy to remove. If using a piano which is not a problem to damage, chewing gum may be used as a substitute for blu-tak or plasticine. Other colours of 'blu-tak' can be used, but sometimes white 'blu-tak' is too loose and gooey in texture.
3. If playing all Preludes, place blu-tak on first string of middle C to make it B quarter sharp (preparation for Prelude 3)
4. For pianos without a sostenuto pedal the pianist may use the sustain pedal when appropriate or hold down extra notes silently to produce extra reverberation. (sos=sostenuto pedal)
5. Further instructions are given separately in Preludes needing adjustment

6.5 **Fibonacci in a Black Hole**

for solo clarinet, dedicated to Sharon Morsink

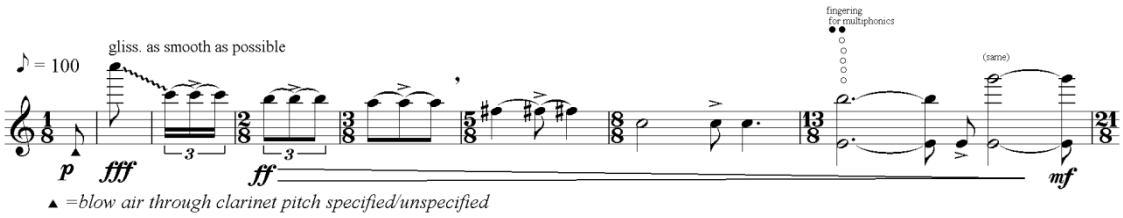
Fibonacci in a Black Hole started one summer morning in Toronto, 2009 when my sister was talking about black holes (her speciality in physics) and also in the same breathe suggesting the Fibonacci series for a base of a music composition. Naturally, I put the two ideas together and wrote for the clarinet which had been Sharon's instrument when she played in the high school wind ensemble.

The piece is in three movements each reflecting on a commentary given by Dr. Sharon Morsink and some answers she gave to clarinettist Tom Jackson who was interested in knowing more about black holes. Each movement tries to capture the mood of the black hole described as well as using the Fibonacci number series in climaxes of the golden ratio (also known as the golden section). The third movement is built on the fact that the Fibonacci series can start on any number and not just on the number 1, as was discussed by three teachers at my work place, St. Catherine's British School, math teacher Vernon Waddington, Chemistry teacher Dr. Stuart Bond and Physics teacher Dr. Light.

Leonardo Fibonacci (c.1170-c.1250) was an innovative mathematician born in Pisa, Italy. Fibonacci was taught Hindu-Arabic numeration systems when his family was living in Bugia, North Africa. His book *Liber Abaci* "was instrumental in replacing the clumsy Roman numeral system and introduced computation similarly used today[112]. Fibonacci is known now mostly for the series which 19th century mathematician E. Lucas named after him. Fibonacci demonstrated this series of numbers in his book by telling a story about pairs of rabbits multiplying. The series starts by adding 1+1, then 2+1, then 3+2 etc. adding each new number to the previous number. The sequence of numbers has a ratio of adjacent terms approaching rapidly the golden ratio of 1.618. The Fibonacci series, which I use in the time signatures of movement **I** is:

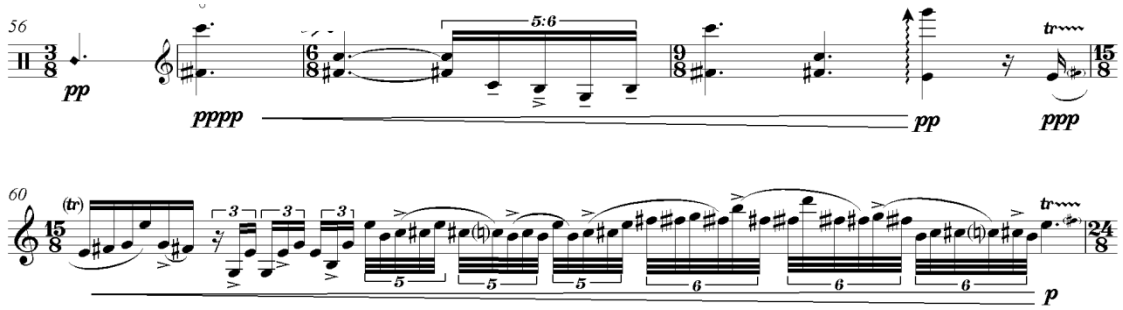
1,1,2,3,5,8,13,21,34,55,89…

[112] Hoggatt, (1969) *Fibonacci and Lucas Numbers*, Santa Clara, CA, Houghton Mifflin Company *,* p.1.



Or, starting on 3 followed in this case by another 3 (called the Lucas sequence[113]) the numbers I use in Movement **III** are:

3,3,6,9,15,24,39…



Originally when I started writing this piece I thought of using pitch relationships which would reflect the Fibonacci series, but afterwards I decided it would be better to use the ancient Greek tetrachordal techniques I was using in my other compositions. The number of notes in each section, however, add up to numbers in the series, and accented notes are on the previous number value of the series to emphasize the golden section. I use the Fibonacci series to reflect nature which has numbers of the Fibonacci sequence (sunflowers and pine cones[114] for example) and Classical Greek philosophy as "the proportions of the Golden Rectangle appear often through classical Greek art and architecture"[115].

In relation to my other works in this composition portfolio, this work pertains to the Pythagoreans of ancient Greece who believed that, "all things, indeed, that are known have number: for it is not possible for anything to be thought of or known without this."[116] The Pythagoreans believed in the purification of the soul

[113] Hoggart, *Fibonacci and Lucas Numbers,* p. 7. Any first and second number can be chosen.
[114] ibid., p. 81.
[115] ibid., p. 12.
[116] Philolaus, (470–c. 385 BCE) trans. Barker, *Greek Musical Writings: II,* p. 36.

and part of the process was through numbers[117]. Music as well was thought of in terms of numbers, particularly in the harmonic series and the ratios between overtones. Thus, in this piece I have emphasized the use of multiphonics based on the harmonic series to show the purity of numbers and the simplest ratios.

I

all things have number

Further Quotations:

> If something falls into a black hole and it emits light at regular intervals as it falls in, the light will become redder and redder and the intervals between the light pulses will become longer and longer. In the sound wave analogy, if a clarinet were to fall into a "dumb hole", before it falls in the notes will become lower and lower, and the time between tones will become very long and quiet.[118]

-Dr. Sharon Morsink, University of Alberta

"Nature in the universe was harmonised from unlimiteds and limiters, both the whole universe and all things in it."[119]
-Philolaus

The notes I chose in this movement make up two diatonic tetrachords of B,C,D,E and F#,G,A,B. Time signatures are used in the series starting with 1/8,2/8,3/8,5/8 etc. There is a total of 233 quavers in the first movement with a climax of *pp* followed by *f* on 144 as part of the series. The accented notes are those with numeric reference to the previous number, for example, in measure 6, the whole time value is 5 quavers meaning that the third quaver should be stressed.

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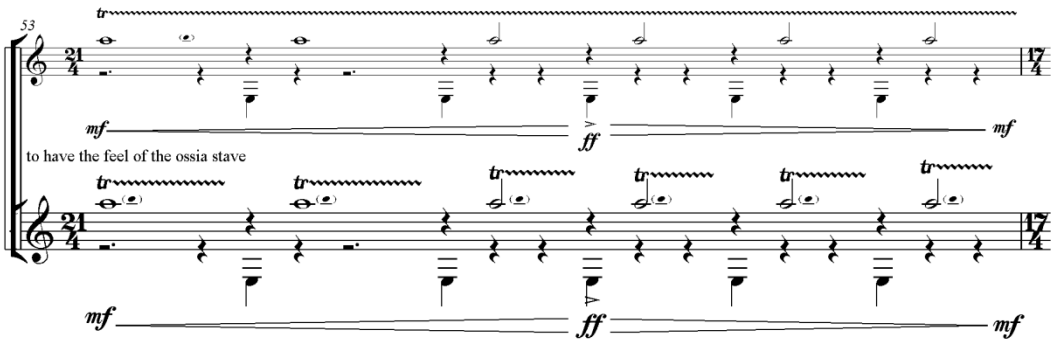
[117] Barker, *Greek Musical Writings: II*, p. 28.
[118] Dr. Sharon Morsink. All quotes are from emails and published with permission from author. More details of Dr. Morsink can be seen at: http://www.ualberta.ca/~morsink/
[119] Philolaus, (470–c. 385 BCE) trans. Barker, *Greek Musical Writings II*, p. 36.

II

faster than the speed of light

> Anything that can travel faster than light can escape from a black hole (as long as it hasn't hit the singularity). Black holes are defined through the speed of light, so they can only trap stuff that has to travel at light-speed or less. -Dr. S. Morsink

Movement II tries to capture the feeling of the light trying to escape being captured by the black hole. The low notes represent the black hole and the high notes the light. The trill in m53 is to be faster than the speed of light in order not to be captured by the black hole. (The ossia stave is the ideal playing the trill continuously with the understandably moderated stave below meant for reality!) An enharmonic tetrachord of E,E♯,F,A is combined with a diatonic tetrachord of B,C,D,E. Similar to movement I, accents are for a numeric purpose and the time signatures follow the Fibonacci series starting on one.



III

two black holes merge

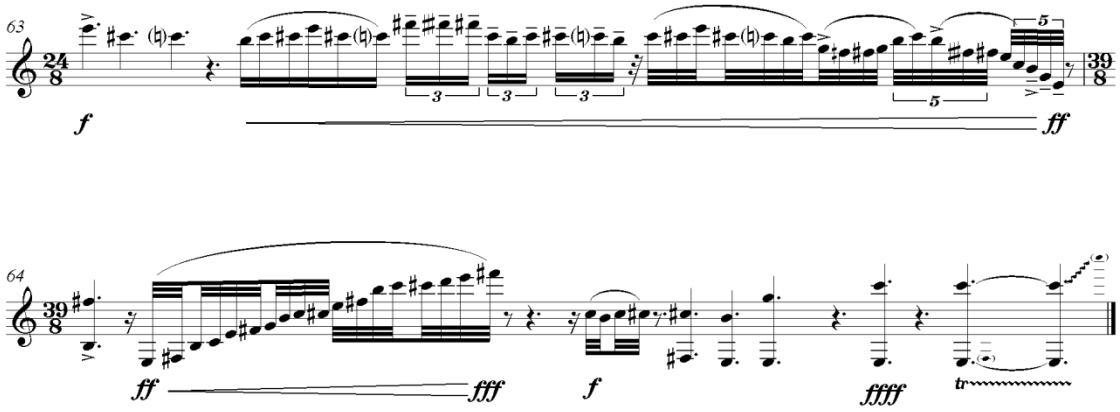
> Black holes could potentially collide head-on, but the more likely, and more interesting type of collision is when they are orbiting around each other and spiral in towards each other and finally merge into one larger black hole. When they do this they lose energy and emit something called "gravitational radiation". You can't hear gravitational waves, but since the oscillations they create oscillate at frequencies between about 20 and 20000 Hz (the range that the human ear can hear sound waves), scientists often like to represent

the gravitational radiation with sound waves. The sound waves sound like a chirp - they start off with low frequency and low volume and become louder and higher frequency.

-Dr. S. Morsink

"The Fibonacci series can start on any number"[120]

Movement III uses a different number base for the time signatures showing that the series can start on any number and still have the same ratio values and golden number relationship. The series is then 3,6,9,15,24,39…etc. There is a chromatic tetrachord of B,C,C#,E followed by F#,F𝄪,G,B. The ending glissando from c^3 to as high as possible reflects the opening glissando but lets the pitch ascend into infinity just as the series can continue on forever.



[120] Conversation by math, chemistry and physics teachers Vernon Waddington, Dr. Stuart Bond and Dr.Light as quoted by Vernon Waddington. Also can be called the Lucas series.

6.6 String Quartet No. 1
Stolen glimpses of eternity

stolen glimpses of eternity
a drop of water
in the palm of my hand
waiting, pain, fear
at the edge of eternity
all good things become monotonous?

longing for the essence of infinity,
to feel the wind
after a stifling day
inside;
to feel that moment of ecstasy
with no fear of
ever ending

-Coreen Morsink

There are moments that seem to last forever; some pleasant some unpleasant, some which you want to hold on to and others which you never want to experience again. *stolen glimpses of eternity* is an attempt to capture the essence of something impossible to perceive or prove. Elements of nature which are part of infinity are described as well as emotions. Each element and feeling is captured in a block of sound. There is overlapping, foreshadowing and remembering of glimpses almost caught, like a memory of a dream that escapes before we can see the end. Each section has a particular sound quality, emotional reflection or physical association as if one is trying to move on to something else and forget the past. But past events always creep in as well as worries about the future. Thus time is not a straight line, but an overlapping of realities and overlapping blocks of sound. Consider it like a Rubik's cube: There are blocks of sound and colour, but at times they are all scrambled up and can't seem to regain their original colour. Sometimes the whole face is one colour, but other times there is a mixture of all sides. Another way I have thought about it is as if it is a mixture of past, present and future. We don't as people just move from one decision to another without a mixture of past thoughts and thoughts of the future. As in a dream, the past gets all jumbled up mixing up people, places, time and sometimes predicting possible

future events like “a view of life as an array of multi-directional, tangential, conflicting events”[121]. At the same time there are restrictions in the music as there are very limited amounts of pitches used, based on the ancient Greek scheme of tetrachords. Sections have set pitches reflecting the instruments of ancient Greece; the lyra, the kitharis which had either 5,7,9 or 11 strings and would be tuned to a particular set of notes for each playing, thus “all invention comes from restriction[122]” as said by Brian Ferneyhough. Another restriction placed on the composition is a number series which controls the amount of time each section will enact as a reflection of life which has periods of development and growth. The Leibniz series is a repeating number series starting with 4/1 - 4/3 + 4/5 - 4/7....which if expressed as a decimal eventually equals a number close to π. The idea of using this series is to have a pattern which takes a very long time to climax, in contrast to the Fibonacci series which almost immediately comes to the golden ratio. This series continues on like eternity to infinity. The piece at times has an infinite feeling like the endless Leibniz series, but the whole piece reflects a circular motion in structure reflecting π. Each section is based on an addition of measures that follow the series. The actual time-signature is not the series but is made up of the basic unit. The piece could literally go on to infinity; but I have completed the piece just like physical life eventually terminates; but with that end comes the spiritual beginning of a new infinite life beyond.

[121]I. Pace (Jul. 1997) “The Panorama of Michael Finnissy II”, *Tempo New Series*, No. 201, pp. 7-16, Cambridge University Press, p.15.
[122] B. Ferneyhough (1995) *Collected Writings*, Amsterdam, Harwood Academic Publishers, p. 132.

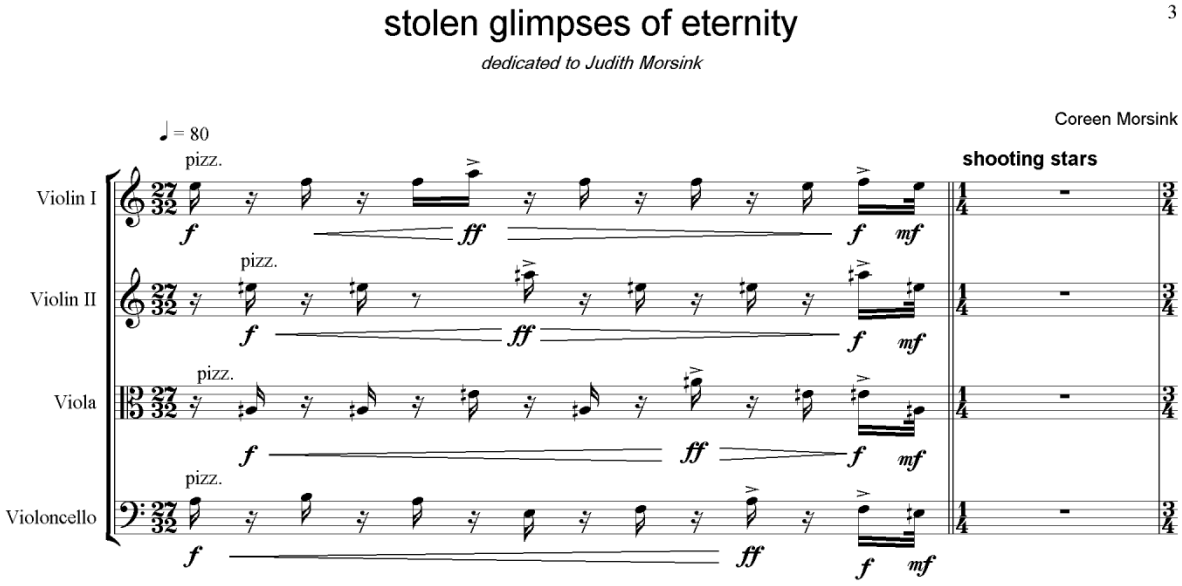
Structural Layout of the Composition and Descriptions of Each Section

Section i)

a stolen glimpse

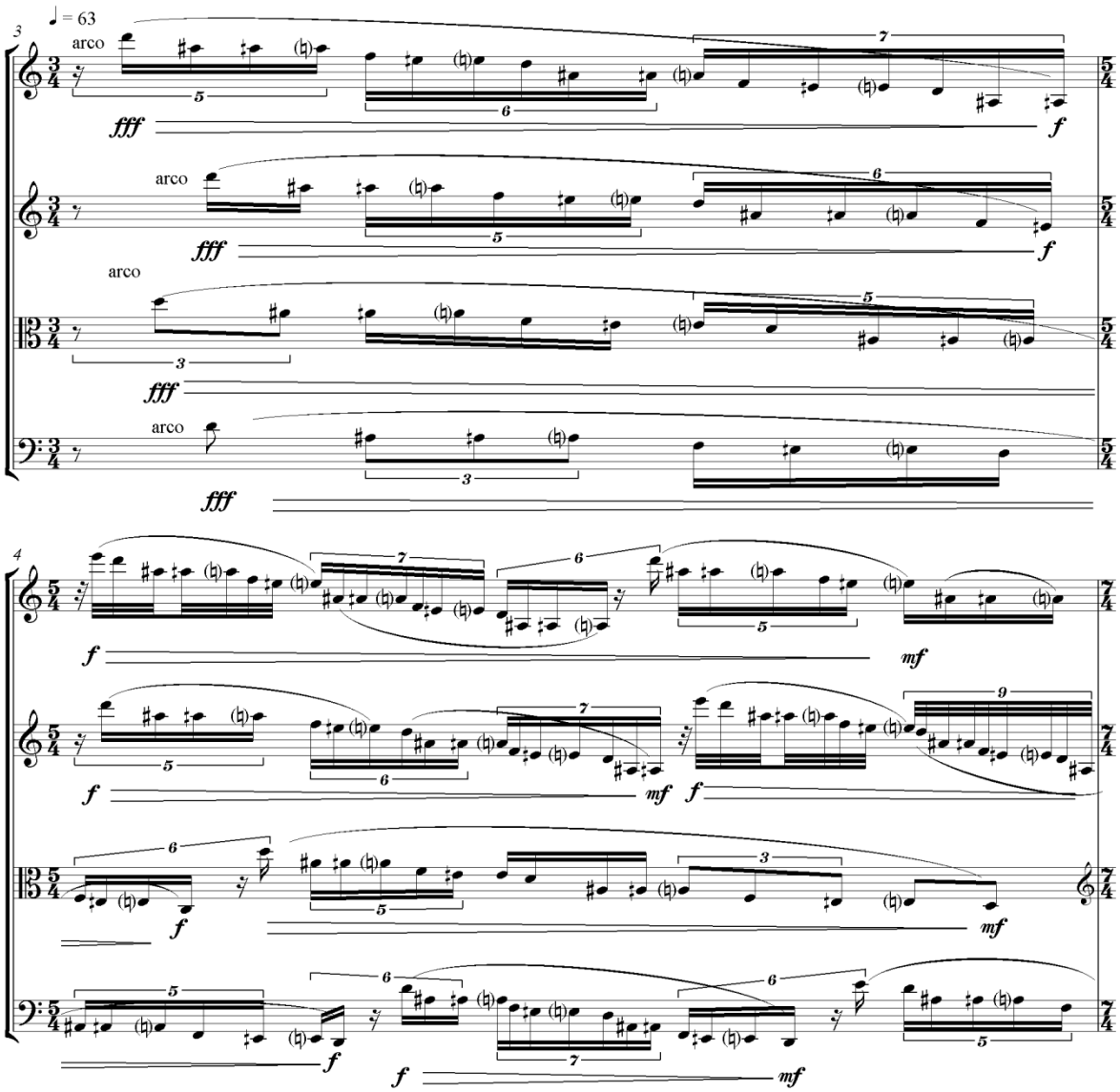
Photo reference: a lonely pine tree grows on an island in a lake surrounded by mountains reflecting my father's spiritual love of trees and nature. Photo by Judith Morsink on a trip with Willem Morsink.

m1: **no time**



The opening bar introduces a pizzicato motive based on an enharmonic tetrachord of the notes E, E♯,F and A which is hinted at throughout the whole piece. Originally there was no time signature for this measure to indicate that it is out of time: out of the number scheme that controls the rest of the sections as if it is a glimpse of infinity. Afterwards I added a time signature of 27/32 which is completed at the end of the quartet with a measure of 5/32 in aid of the performers.

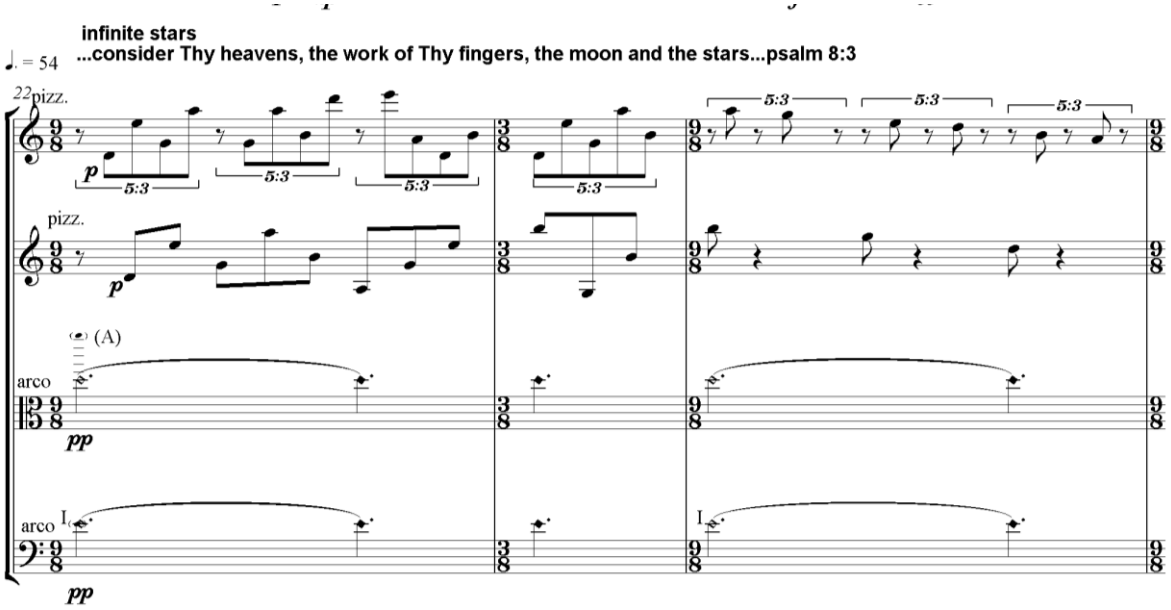
(I) **Shooting Stars**



m2-21: Blocks of time using time signatures of 1/4, 3/4, 5/4, 7/4, 9/4, 11/4, 13/4, 15/4, 17/4 and 19/4. Larger numbers in the time signatures have been broken into smaller units such as 13/4 becomes a measure of 6/4 followed by 7/4. Two joint descending enharmonic tetrachords of D, A#, A𝄭, A and A, F, E𝄭, E are used to symbolize falling stars in a moonless dark sky.

(IIa) **Infinite Stars**

...consider Thy heavens, the work of Thy fingers, the moon and the stars...psalm 8:3



The never ending number series is reflected in this section by using pitch groups that again keep on increasing. The numbers are broken up into three segments which each have a reference to the amount of pitches inside the section. The first group starts only with 5 notes D,E,G,A and B and each group increases by 2 notes.

The feeling of infinity reaches until the measure “dawn” appears.

m22: 9+3+9=21 within: (5:9, 5:3, 5:9) using notes D,E,G,A,B

m25: 9+5+9=23 (7:9, 7:5, 7:9) C,C#,D,E,G,A,B

m28: 9+7+9=25 (9:9, 9:7,9:9) C,C#,D,E,F#,G,G#,A,B

9+9+9=27 (9:9, 9:9,9:9) C,C#,D,D#,E,F#,G,G#,A,A#,B

m34: 9+11+9=29 C,C𝄭,C#,D,D#,E,F#,G,G#,G𝄪,A,A#,B

m37: 9+13+9=31 C,C♯,C#,D,D♯,D#,E,F#,F♯,G,G#,G♯,A,A#,B

m40: 9+15+9=33 C,C♯

C#,D,D♯,D#,D♯,E,F#,F♯,G,G♯,G#,G♯,A,A#,B

m43: 9+17+19=35 C,C♯,C#,C♯,D,D♯,D#,D♯,E,F#,F♯,G

G♯,G#,G♯,A,A#,B,B♯

46: 9+19+9=37

dawn

Sunrise in Agia Paraskevi, Athens Greece. Photo by C. Morsink.

m47:

C,C♯C#,C♯,D,D♯,D#,D♯,E,F#,F♯,G,G♯,G#,G♯,A,A♯,A#,A♯,B,B♯

(IIb) **flowers**

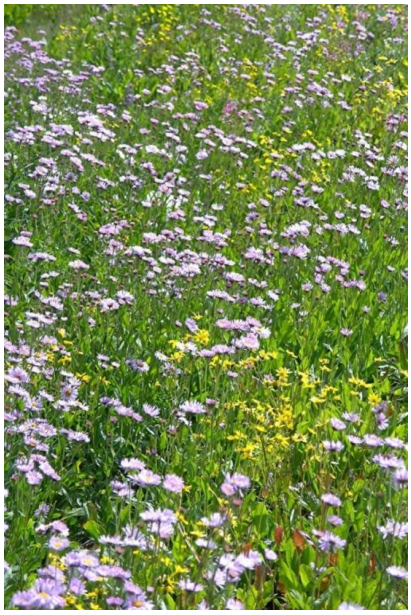
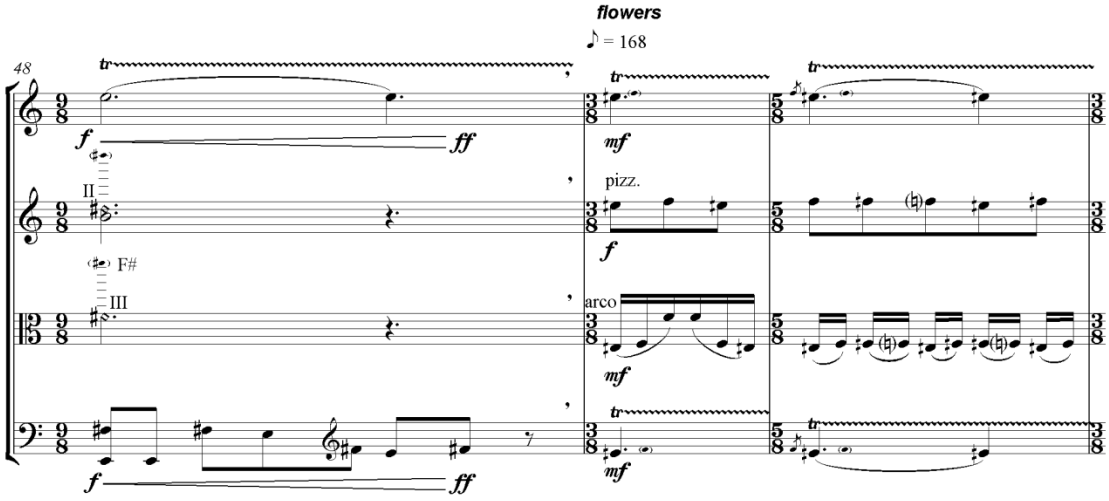


Photo by Judith Morsink



This uses the notes not used in the previous section, E♯,F and F♯. It is a reflection of the colours and movement of flowers in the wind in a vast field with a feeling of frenzied joy.

m49: 3+5+3+5+3+1+3+5+3+5=3=39

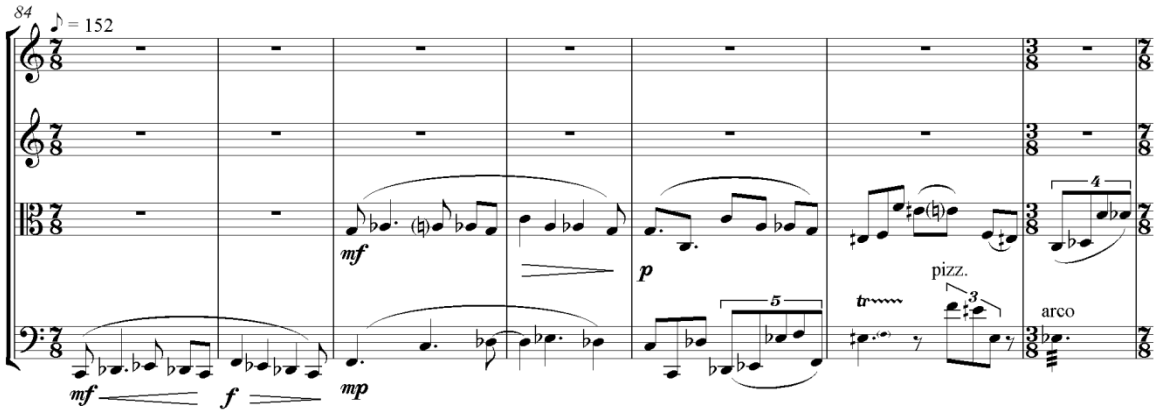
m60: 3+5+3+5+9+5+3+5+3=41

m69: 3+1+3+1+3+1+5+1+3+5+3+5+3+1+5=43

(II) **trees**

And he will be like a tree firmly planted by streams of water,
Which yields its fruit in its season,
And its leaf does not wither,
And in whatever he does, he prospers.
-psalm 1:3

Photo by Judith Morsink



This section is a fugue reflecting the dense patterns of a forest. The opening 'subject' consists of the tetrachord C,D♭, E♭ and F and is used a P5 above starting on G but using the chromatic form in the answer (G,A♭, A and C) creating mixed modes in the forest just as the forest is a mixture of different species of trees.

m84: 7x6+3=45

m91: 6x7+5=47

m98: 7x7=49

m105: 7x6+9=51

m112: 2+3+4+5+6=7x4+5=53

m122: 7x3+7x2+3+7x2=55

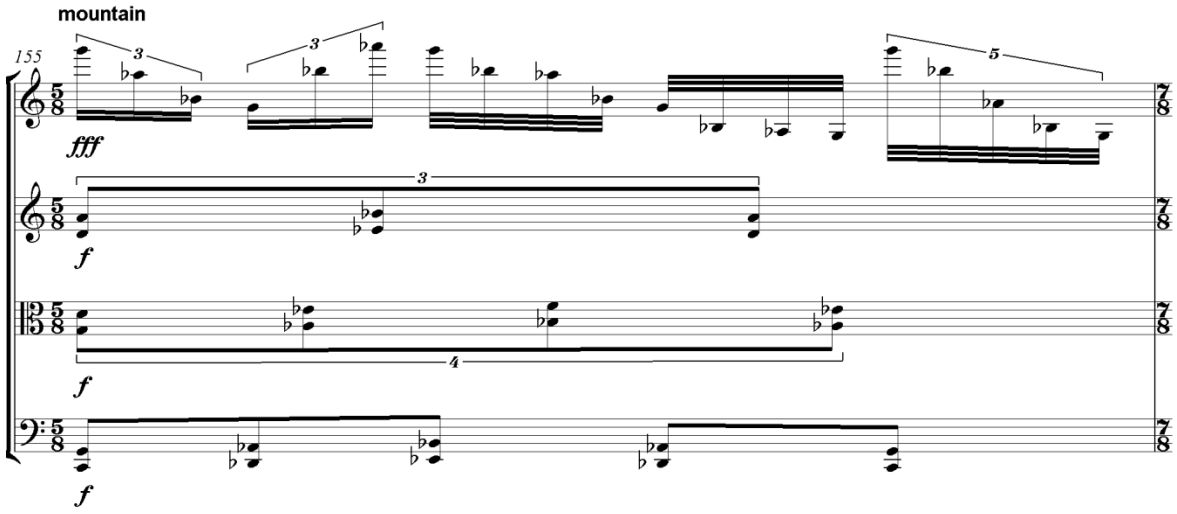
m131: 7x8+1=57

m140: 7x3+5+7+5+4+3+2+1+.5+1+2+3+4 =58.5

Mountain

Photo by Judith Morsink

m155: 5+7x8+.5=61.5



(III) **View Point**

Photo by Kostas Chrysanthopoulos

This is a recapitulation of opening and development using a mixture of the tetrachords from the previous section blending into the pitches from the opening shooting star section. This reflects a need to step back and look at what has happened from a distance as one does at the top of a mountain, viewing the world below. A time to contemplate and wonder what has happened and what will happen in the future.

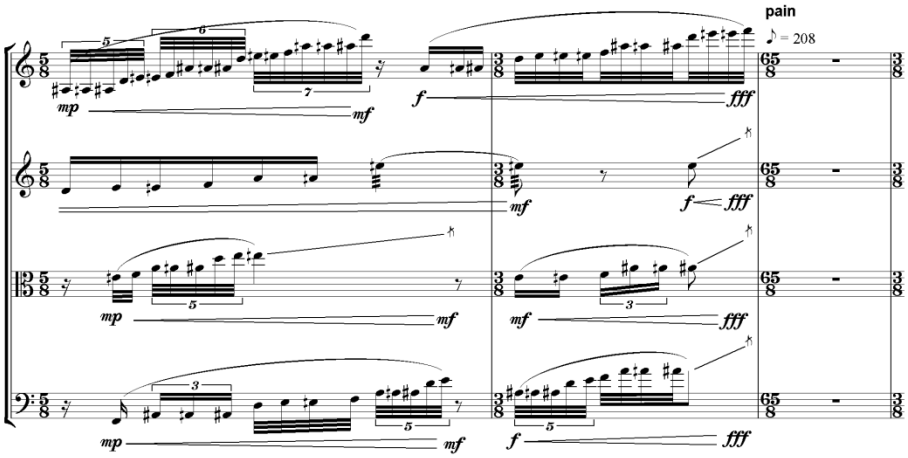
m165 =63 number patterns like those of the falling star section

(IV) **Pain**

Photo by Judith Morsink, mask from Alaska

m177: =65, **in silence**

Pain is without time; a timeless feeling like eternity although perhaps lasting less than a second. As I waited in my father's hospital room I reflected on his endless pain and the time seemed endless like a never ending abyss. Thus the silence of this section: because no words can express the misery of pain. Only in silence can we hear hope of relief in an infinity beyond. This mask reflects the face we wear to confront the unbearable; some are better than others in wearing the mask. For some when pain comes all the fear and horror comes out and the mask is broken showing their true self in fear of the end.



(V) **Questions**

Photo by Judith Morsink, Delphic oracle in Greece

We all have questions and want answers that we can understand. At the Delphic oracle answers were given but were like riddles, shadowed and uncertain in their meaning. The music in this section reflects the plucking of the lyra in a paean style expression like the riddles of the oracle.

m178: 22x3+1=67

m201=69

more questions

Photo by Judith Morsink- Delphic Paean, Delphi, Greece

m224=71 **and more questions**

Photo by J. Morsink, Delphi

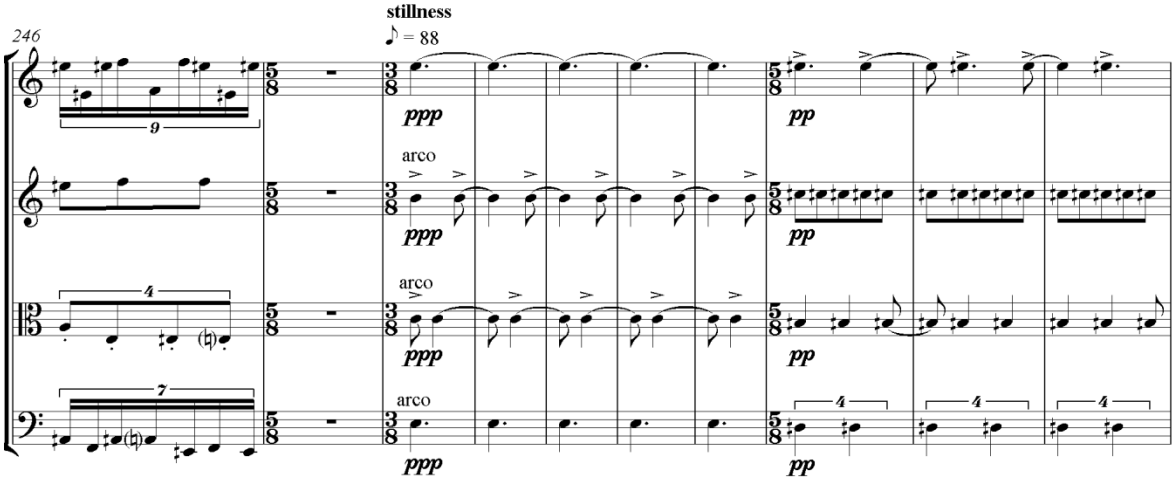
(VI) **Stillness**

Photo by J. Morsink

The stillness of nature is reflected by the static movement of the pitches in this section. There is movement, but rather like the movement of small grasses and flowers growing on rock covered with lichen- the progress is slow and laborious and time seems to stand still. The violin climbs from E to E♯, F and F♯ like the flowers grow while the bass descends as the rock slowly is eroded.

m248: 3x5+5x3+7x3+5x3+3x2+1=73

m263: 3x5+5x3+5x3+5x3+3x5=75



(VII) **Waiting**

Photo by K. Chrysanthopoulos; our daughter Katerina waiting patiently…

Like a child waiting patiently for her photo to be taken, waiting can be difficult. This is a section of waiting while the viola caries on alone.

m265: 11x7=77

(VIII) **Fear**

Photo by J. Morsink: totem pole in Alaska

m286: (11x6)+x=79 (2 beats missing- to be found in other section)

(IX) **Anger**

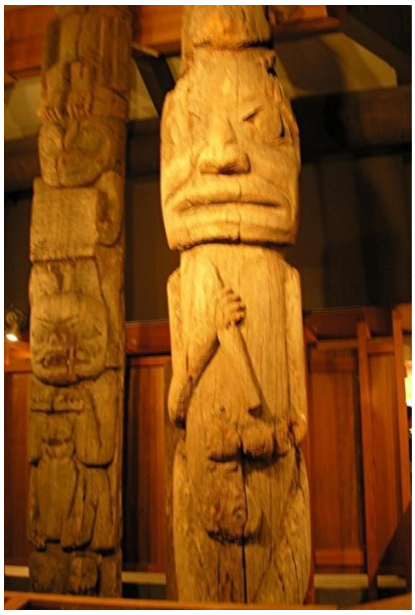


Photo by J. Morsink, totem pole in Alaska

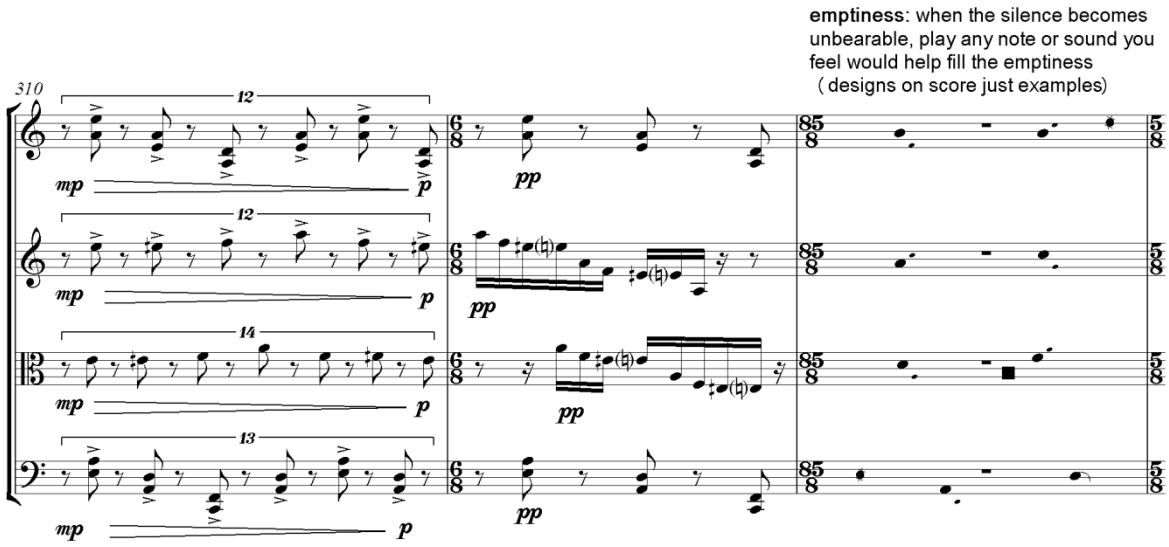
m293: 3+(5x2)+(6x11)+x=81 (2 missing to be found in other section)

(X)**Frustration**

Photo by J. Morsink

m302: 9x9+6=83 +extra 4 from previous sections, hence the frustration

(XI) Emptiness



A section of silence and improvisation trying to fill the void.

m312: 85/8 time

(XII) **spinning**

A repetitive section in a minimalistic style to show how when one is dwelling on one problem the mind sometimes goes around in circles without end. Each tetrachord is played at different ratios of time in an overlap of swirls.

m328: (5x35)+1=87+89

m347: 5+1+5x17=91

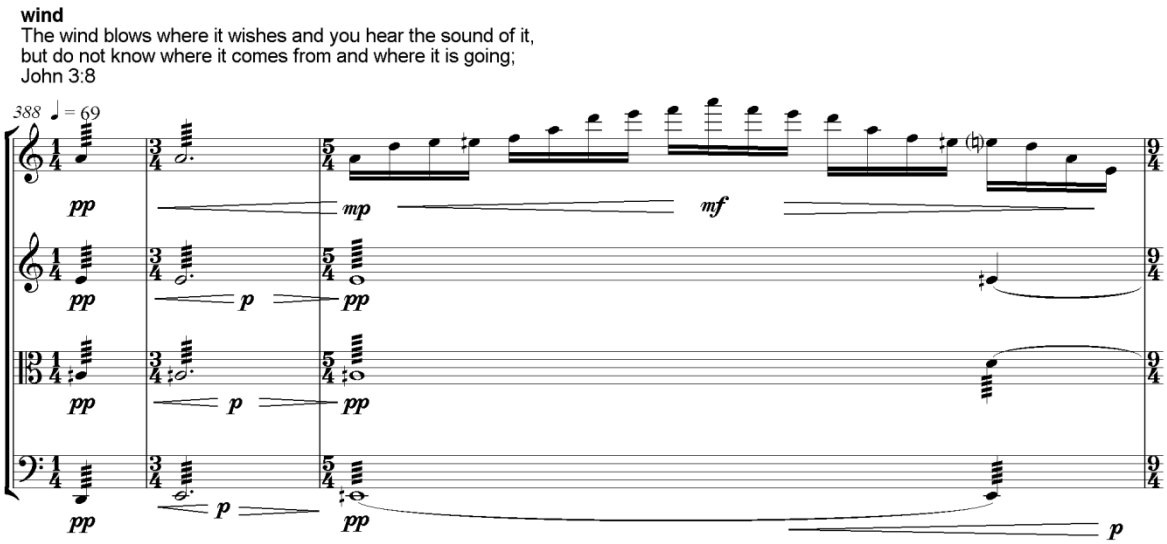
m366: 3+1+5x15+4+4+3+2+1=93

(XIII) **wind**

The wind blows where it wishes and you hear the sound of it, but do not know where it comes from and where it is going; John 3:8

Photo by C. Morsink

A reflection of the Holy Spirit bringing inspiration and creativity to our lives. The wind motive can be found in many of the other sections, a feeling that the Holy Spirit is everywhere and the constant glimpse of eternity which never actually leaves us here in life or in death.



m388: 1+3+5+9+11+13+15+8+8+1+(9+9+1)+1=95

(XIV) **rain**

The notes of the tetrachords fall like streams of rain while the other instruments pluck single drops of water at a time. There is a hint of ice and snow at the end of

the section as if the temperature is dropping and foreshadowing the final theme of snow.

snow

m401: 1+3+7+9+6+5+6+7+3x8+1+7+5x2+3+1+5+5=97

Photo by K. Chrysanthopoulos

(XV) **ice**

Long suspended notes creep up the tetrachordal pitches in a feeling of tension as if one is trying not to slip while walking on an icy ledge. Some drops of rain fall like thoughts flitting through the mind but also turn to ice. Loud strummed chords crash at the end of the section like a landslide of giant icicles falling down.

m425: 1+5+7+9+11+13+15+17+19=99

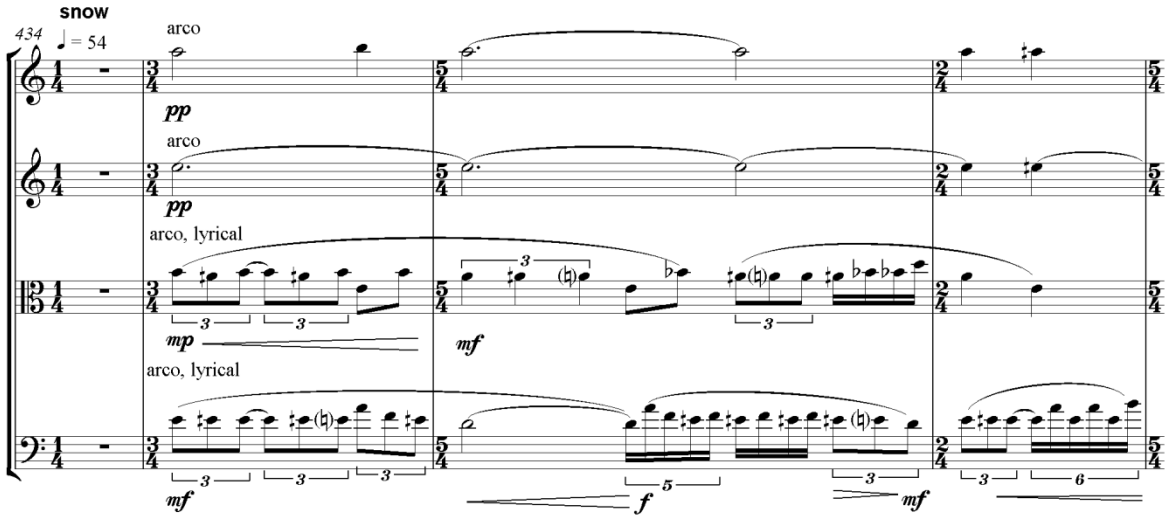
Photo by K. Chrysanthopoulos

(XVI) **snow**

Photo by K. Chrysanthopoulos

A theme finally arrives in the viola and cello that has been hinted at in many sections of the quartet. The second violin plays the opening tetrachord in a manner like a cantus firmus. The violin starts as well with long notes but then changes to a pizzicato remembrance of the opening glimpse motive as short interruptions of the theme.

Photo by J. Morsink

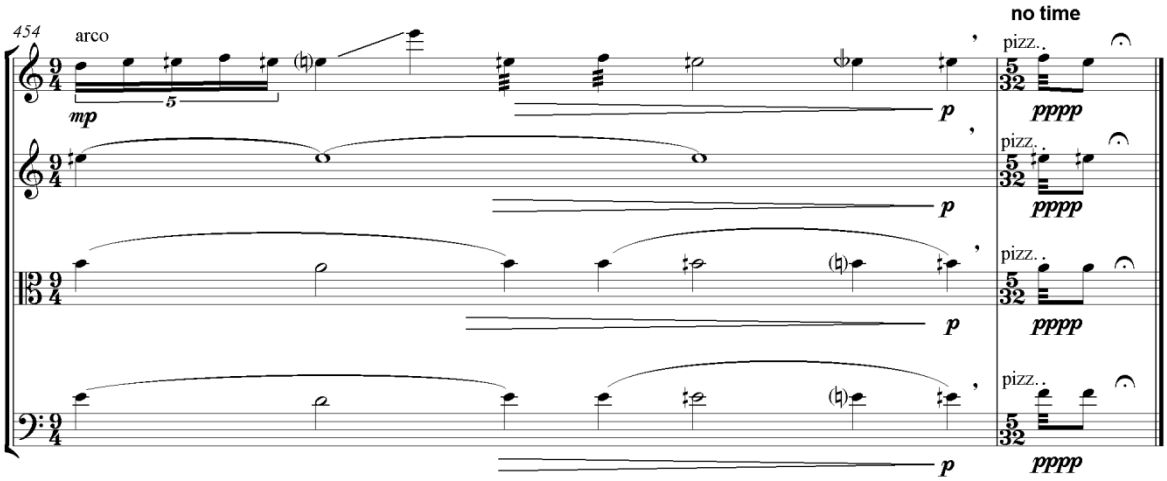


At the end of the snow section there is a restating of the main themes in the violin as if one's life is flashing before one's eyes. The numbers finally reach 100 a multiple of 10 which was in ancient Greece a magic number of the tetraktys (1+2+3+4=10)[123]

m434: 1+3+5+2+5+9+5+1+5+6+1+6+7+1+7+8+1+8+9+1+9=100

[123] See a more detailed description of the tetraktys in the description of *Divine Eros* in this thesis.

(XVII) **no time**



m454: a completion of the opening measure making the piece circular rather than a straight line. The circle of life continues.

Photo by J. Morsink

6.7 **Divine Eros**

For Choir and Orchestra
Text by St. Symeon, translated by Daniel Griggs

Divine Eros is a choral/orchestral work based on the English translation of the hymns of Saint Symeon[124]. St. Symeon was "an abbot and ascetic writer in tenth-century Constantinople"[125] as well as an exile for most of his life because of his religious ideas. His hymns express the need for Divine love in our daily lives and that we all must experience the vision of God and light in this life on earth. His poems are partly expressions of his joy in his love for God, but also his sadness in his own failings. The hymns are also answers to dogmatic questions asked by theologians trying to trick him, much in the same was that Jesus was questioned.

I have taken selected passages that have inspired me spiritually and musically and made them into sections following different scale patterns based on the music theory of ancient Greece. Since the original text is in Greek, I felt there was a connection to my style of writing and philosophy. I have used the English translation to make the work more accessible, and as well to celebrate the most wonderful translation by Dr. Daniel Griggs. I have not used the complete text as it is immense and have used only one complete hymn. The sections sometimes have only a line or two from a hymn. In this way there are 10 sections:

I) Mystical Prayer[126]
II) How are You both a fire gushing forth (Hymn 6)
III) Transition (no text)
IV) I have learned a strange thing (Hymn 10)
V) And listen, if you wish, you may learn the energies of love (Hymn 17)
VI) I am seated in my cell (Hymn 17)
VII) What is this spine-chilling mystery? (Hymn 1)
VIII) Do you know the depth of mystery? (Hymn 30)
IX) Canon: With the light of a lamp shining on me (Hymn 25)
X) Coda: Glory to the Lord forever! (Hymn 25)

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[124] The original was written in Byzantine Greek.
[125] St. Symeon, trans. by D. Griggs (2010), *Divine Eros.* New York, St. Vladimir's Seminary Press.
[126] ibid., Texts from: Mystical Prayer, pp. 33-35, Hymn 1, pp. 35-44, Hymn 6, pp. 55-56, Hymn 10, p. 64, Hymn 17, pp. 93-119, Hymn 25, pp. 195-199, Hymn 30, pp. 230-248.

Each section uses a particular scale in a harmonic manner as can be seen in the following analysis of each section. The chords are based on the degrees of the scale and make chords the same way a major chord would be made from a major scale (in one section the chords are based on perfect fourths). The second last section is a polyphonic canon. I decided to use harmony in this work to show that ancient Greek theory can work in the textures of homophony and polyphony as well as monophony and heterophony (as already seen in the other works of this portfolio). Perhaps polyphony and harmony were even used in ancient Greece as discussed in the introduction. The Skolion or 'drinking' song[127] perhaps was a melody sung as a canon rather than the winding changing song as it is usually depicted in textbooks on ancient Greek music. But let us start at the beginning and discuss each section in length as to form, harmony and melody.

Section I) Mystical Prayer

The opening section uses a scale pattern consisting of 2 tetrachords:

A, A♮, A#,D and D,D#,E,G

The scale is used to make chords just as tertial chords are made from a major or minor scale with each scale degree owning a chord, such as:

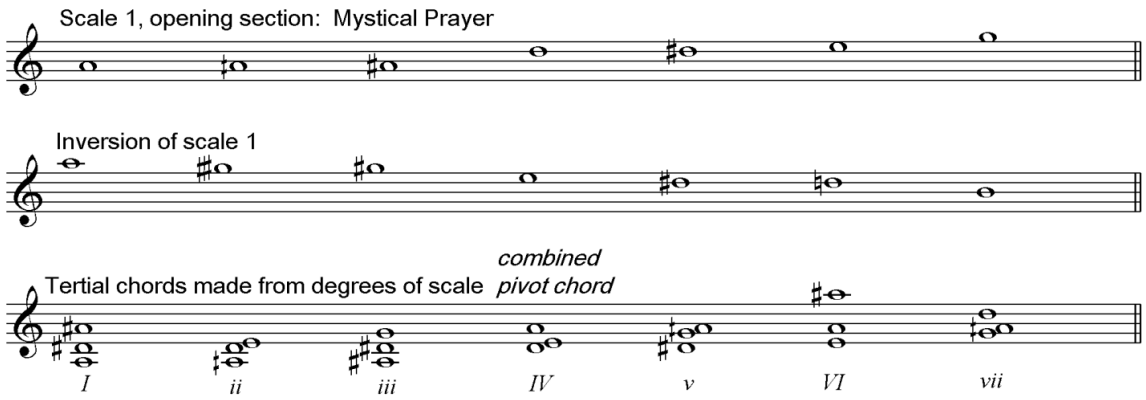
I) A,A#,D#

II) A♮, D,E and so on (see example in notation)

The scale is also inverted to reflect[128] the 'undertone series' thought to have been used in ancient Greece by scholars Kathleen Schlesinger, Maria Renold and composer Elsie Hamilton.

Inversion: A, G♯,G#,E,D#,D,B,A

[127] The most famous skolion being that of the Seikilos Epitaph which is reproduced in most music textbooks like Grout, *A History of Western Music*, p. 15.
[128] This inversion is not the undertone series, it should be considered as a spiritual reflection.



In both versions of this scale there is a common chord, A,D,E which I have used as a pivot and reference point throughout the piece as well as the note A (ideally this should be A=432hz and the piece to be played at this frequency of tuning) which has mystical properties, a relationship to nature and suits the concepts of the text which has so many references to light[129]. In the structure of the time signature the pattern of 3/8, 5/8,8/8 is used often reflecting the number sequences from the Fibonacci series, but for the most part the time signatures were chosen in this section to follow the rhythm of the text. The words in this section come first and the music highlights the text. At first the choir sings in harmony, but at measure 14 the sections sing in with polyphony stating different lines of the mystical prayer in an independent manner. The woodwinds weave an individual counterpoint to the vocal melodies while the strings hold the harmony together with a conjunct bass line. In the movement of the melodies I have tried to be as smooth as possible. I have avoided large jumps for the most part and have tried to keep quarter tone movement in a manner which is step wise and melodic. The vocal lines should be sung as legato as possible and to highlight the text.

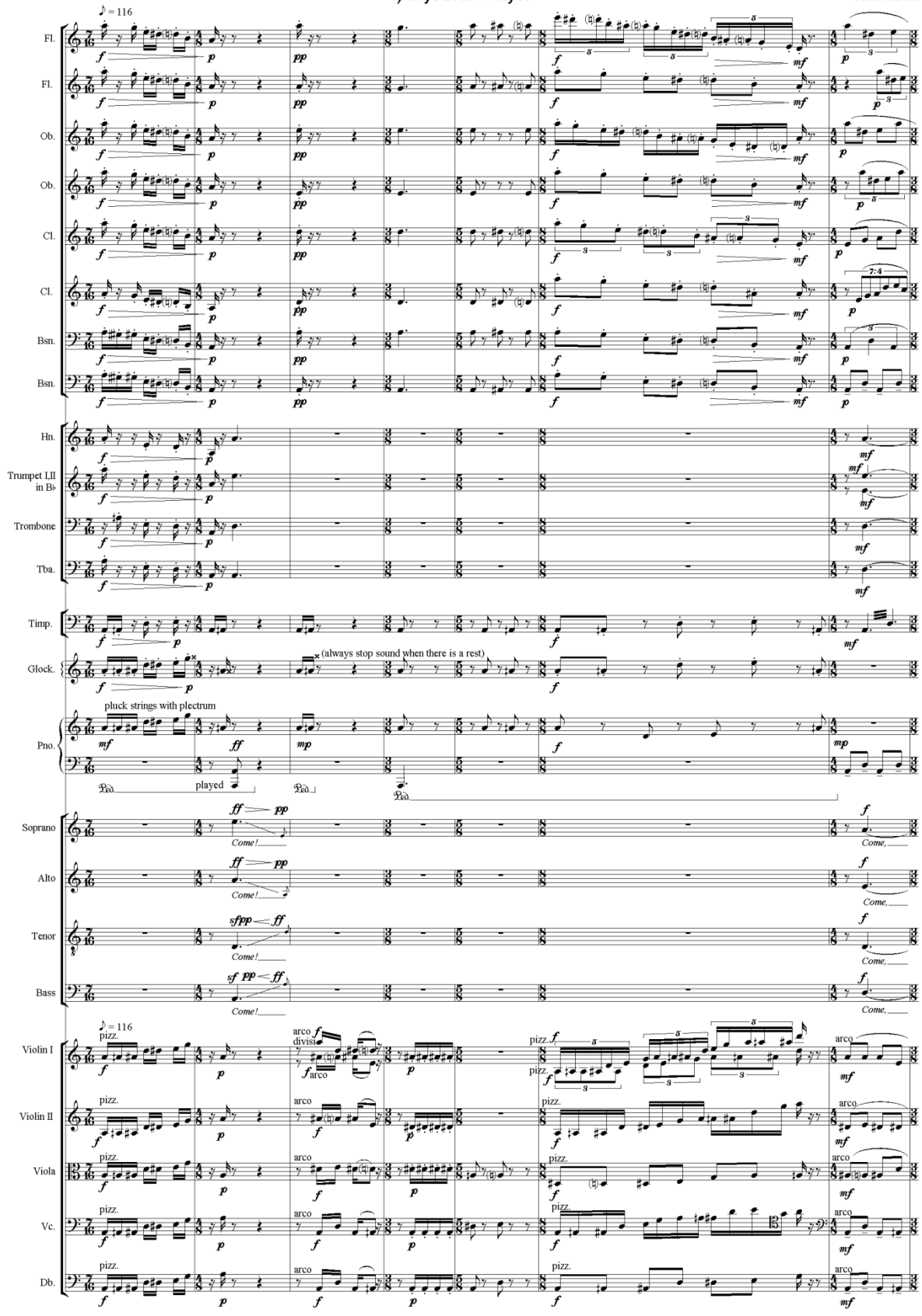
[129] explained more fully later in text

Divine Eros

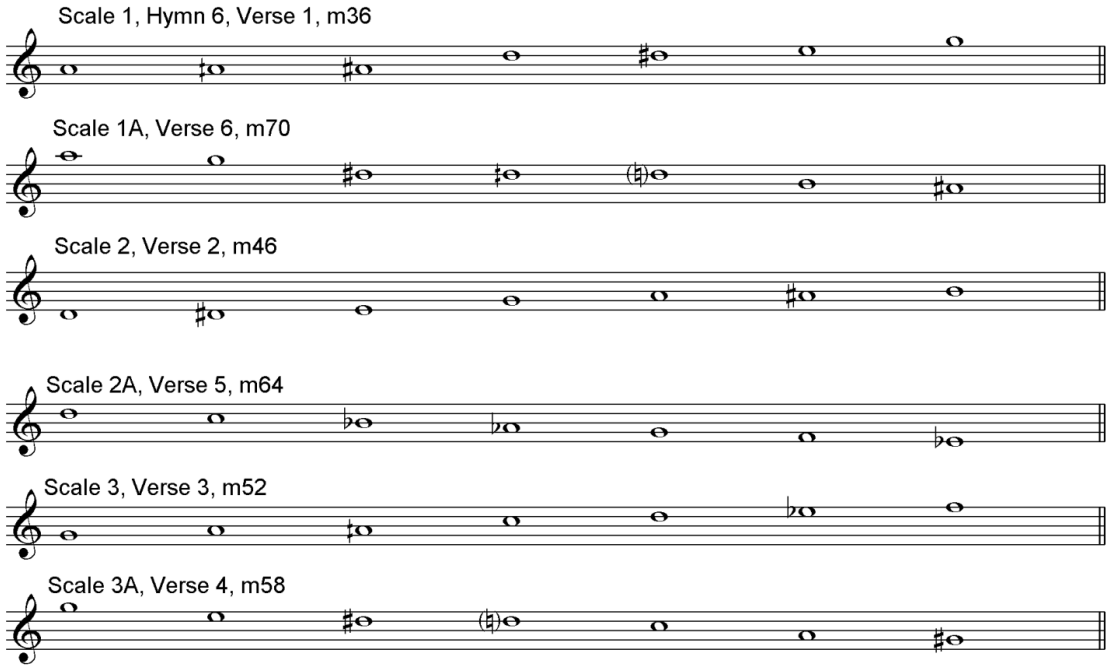
St. Symeon translated by Daniel Griggs

I) Mystical Prayer

Coreen Morsink



Section II, Hymn 6: How are You both a fire gushing forth

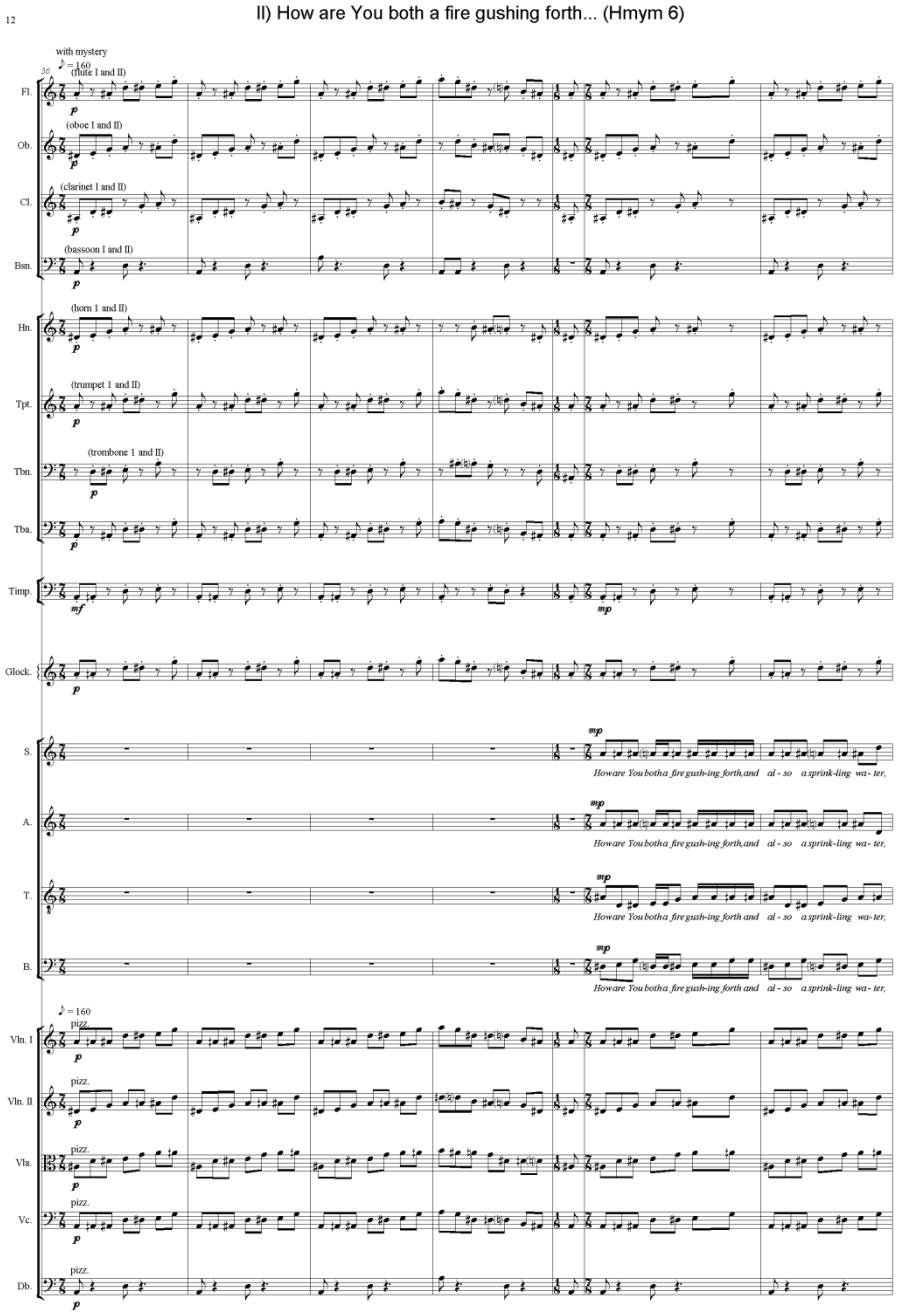


Section II uses a series of 6 scales (labelled 1, 1A, 2, 2A, 3, 3A as above) with the chords relating to each degree of the scale. 7/8 time signature is used as there are seven degrees of the scale. There is a four bar introduction which repeats the seven note chord pattern based on scale 1 three times followed by scale 1A which is the descending version of scale 1. A measure of 1/8 punctuates the sentence prior to the first statement of the choir “How are You both a fire gushing forth, and also a sprinkling water”. This follows the same structure as that of the introduction- 4 bars of 7/8 followed by a single measure of 1/8 with the same chord pattern and scales. The instruments that are capable of playing quarter tones more easily play the whole melody while the other instruments play only the notes that are commonly played on orchestral instruments like oboe etc. This forms a texture similar to that of gamelan music where main instruments play the complete melody and the others only play on certain notes of the melody.

At measure 46 Verse two is sung with scale 2 and scale 2A in a similar manner, using the scale with chords. This time it is only the choir and strings heard to

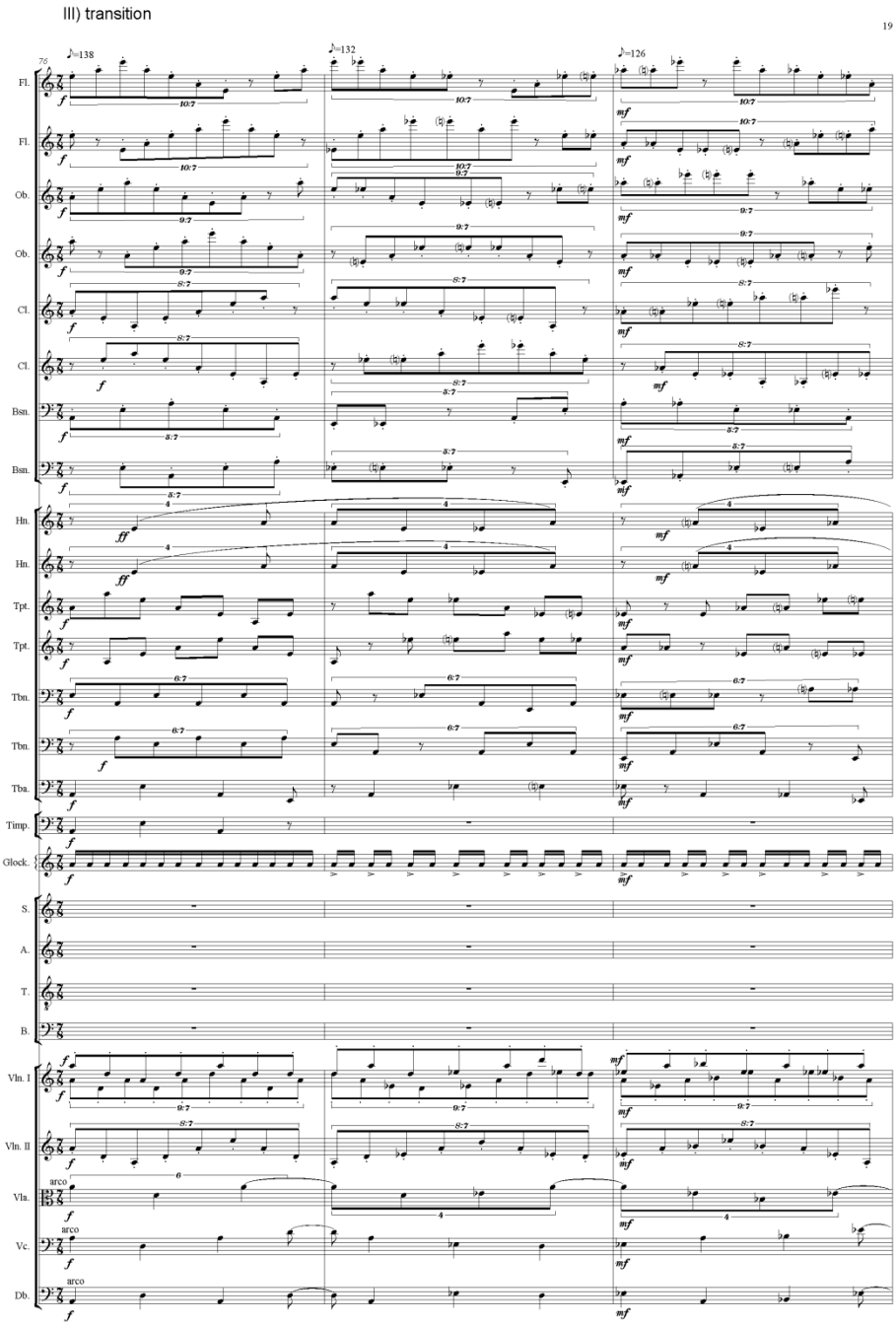
create a softer colour. At measure 52 verse three is sung with scale 3 and scale 3A. The woodwinds weave a ‘complex’ pattern in the background like the leaves rustling in a gentle wind. The brass punctuate the main melody and chords are played by the strings and sung by the choir.

At measure 58 verse four is sung to the accompaniment of scale 3A ascending rather than descending with the last bar being part of the notes from scale 3. Measure 70 closes the movement with scale 1A ascending with scale 1 descending.



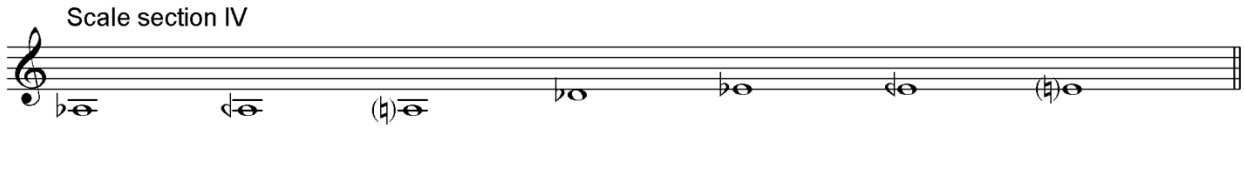
Section III: transition (no text)

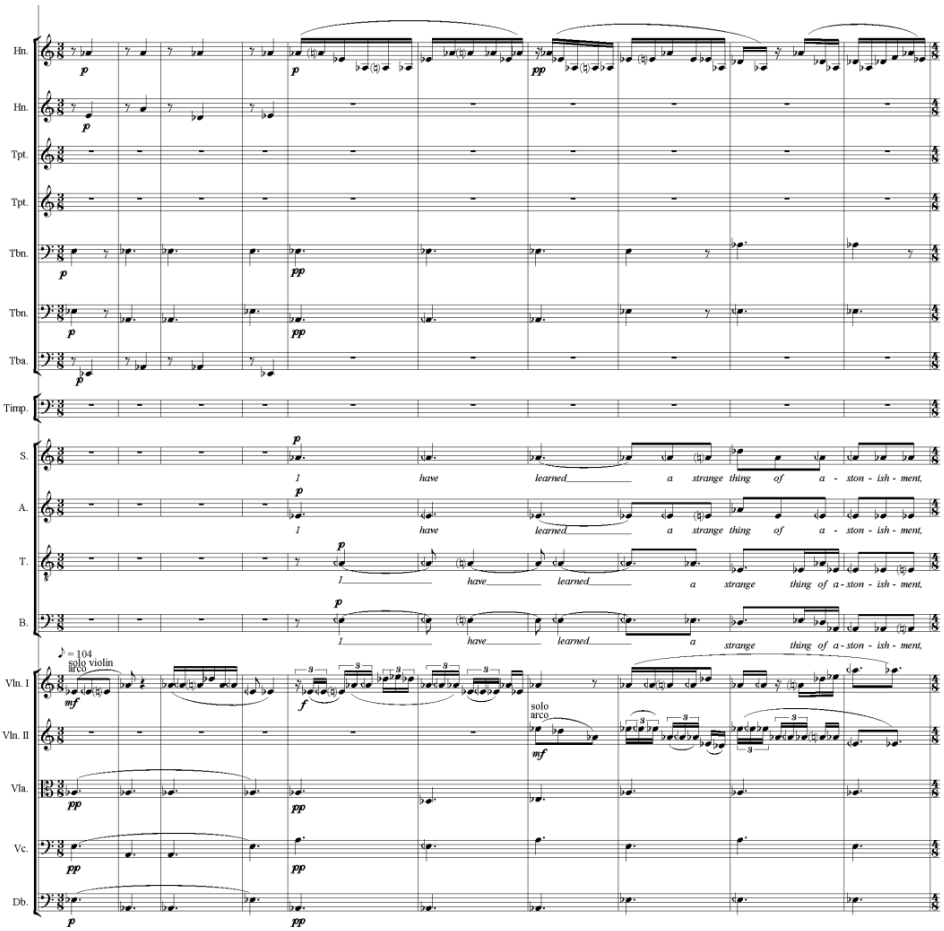
Section III is a chordal transition starting with the overtone/undertone chord in staggered rhythmic patterns with a centre on A. Each measure of 7/8 changes its chord mixture until the section modulates to the scale used in section IV.



Section IV: I have learned a strange thing

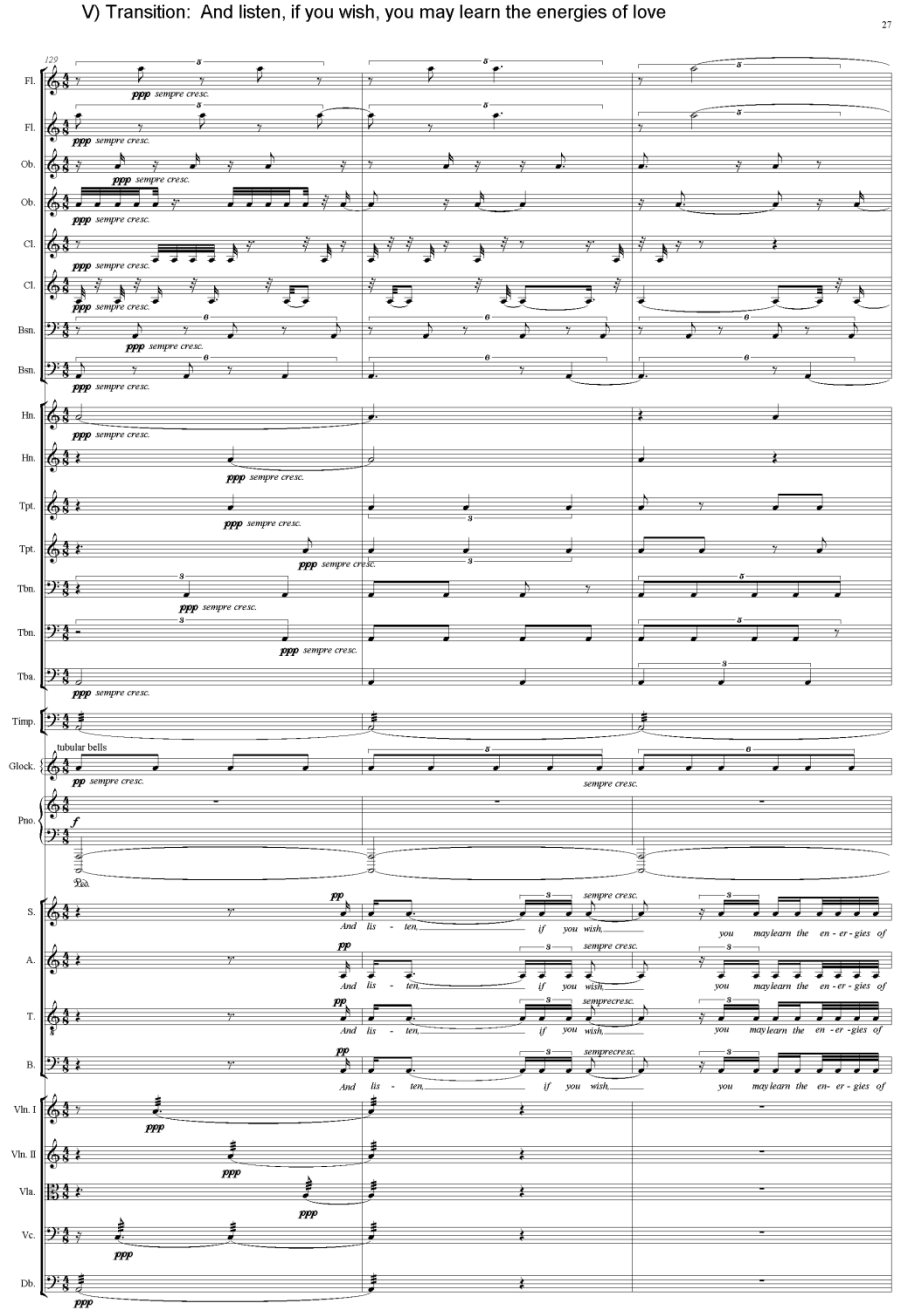
Section IV is a more sombre reflection on the text “I have learned a strange thing…” This very beautiful text is quite different than that of St. Symeon’s other hymns in that it reflects on our earthly sorrow and bewilderment when someone we love dies. A new scale starting on A flat is used in this ternary-like movement with a modulation in section B to the tetrachord E flat, E natural, F, A flat, with a solo soprano accompanied only by 3 woodwinds. The return of the section IV scale ends the movement fortissimo exclamation.





Section V: And listen, if you wish, you may learn the energies of love

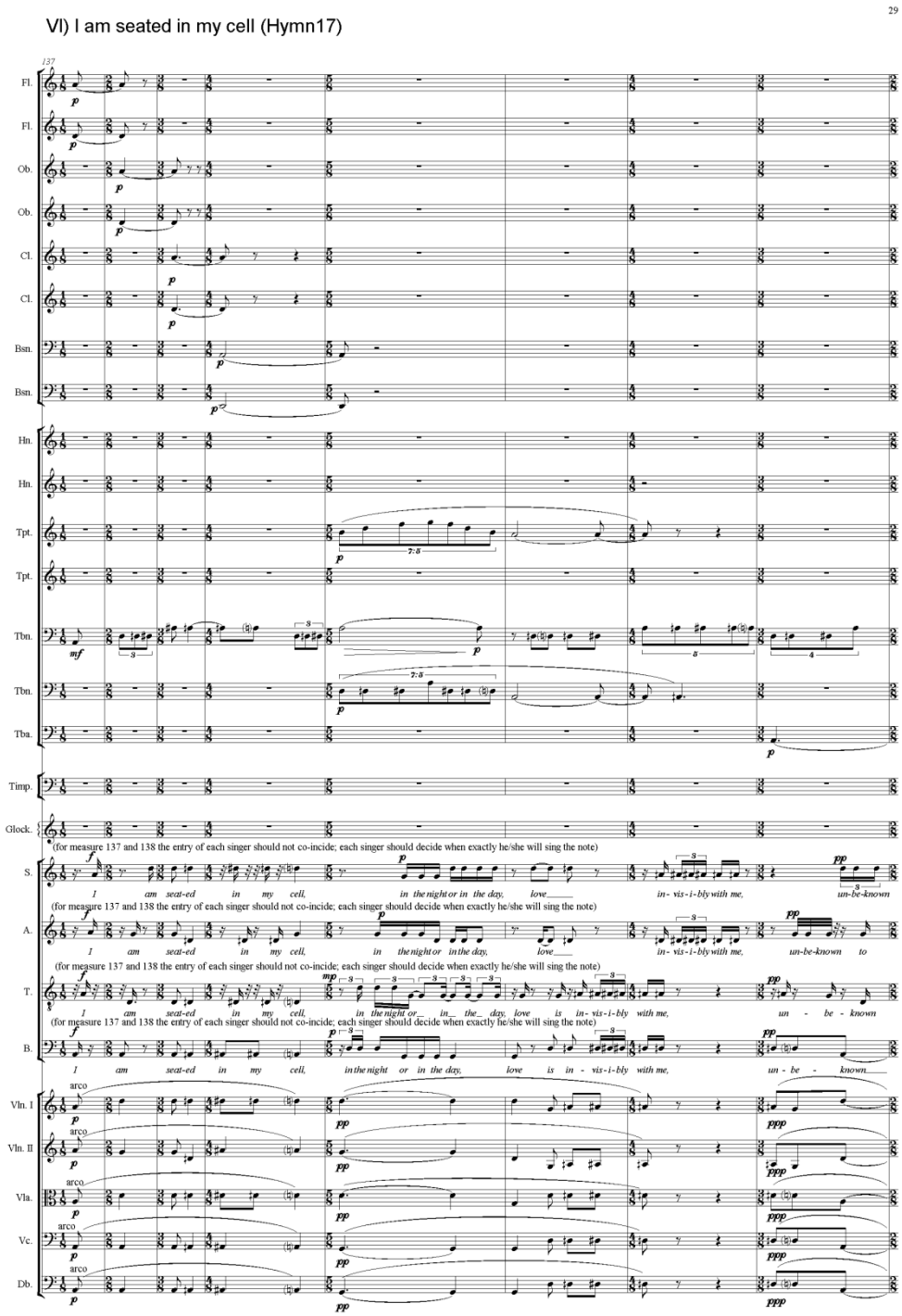
Section V is from Hymn 17 and uses only the note A as a reflection of light in the manner that Rudolf Steiner wrote that the note A=432hz is the equivalent of light[130]. The note is used in different rhythmic patterns to create a shimmering effect.

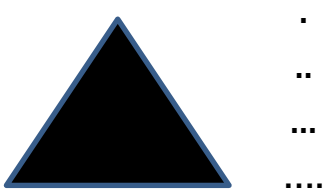


[130] Renold, *Intervals, Scales, Tones and the Concert Pitch c=128,* p. 69. Steiner's references to c=128=the sun and page 81 reference to the related A=432 as equalling the sun.

Section VI: I am seated in my cell

Section VI uses a structural system based on the Tetratyks having a sequence of bars 1/8, 2/8, 3/8, 4/8 which adds up to 10/8. Each section of 4 bars adds up to 10.





a triangle of dots representing the tetraktys

Pythagoras, according to legend, recognized that intervals could be numbered by ratio after "he heard hammers of different sizes pounding on an anvil at a blacksmith shop"[131]. Although this story is probably not true, it is most likely correct to give Pythagoras (born on Samos, mid 6th C BC) credit for putting emphasis on the concept of identifying ratios in musical intervals.

The Pythagoreans believed in the purification of the soul and aimed towards an "unblemished divinity"[132]. The number ten was considered to be the most beautiful and pure described as the tetraktys: 1,2,3,4 which added up to ten.

> "…and by 'tetraktys' they mean a number which, being constituted out of the first four numbers, fits together the most perfect number, as for instance ten: for one and two and three and four becomes ten."[133] -Sextus Empiricus, Adv. Math

Ten was also the number of visible planets (at that time) and sun and the remaining universe and 'counter-earth' (Sun, moon, Mercury, Venus, Earth, Mars, Jupiter, Saturn, and the sphere of the fixed stars plus the 'counter-earth'[134]) if one combined these together. Thus this piece uses combinations of the tetraktys and also combinations of numbers adding up to ten.

The Scale A, A𝄲, A#, D, D𝄲, D# is the base with chords of perfect fourths formed in the choir and orchestra. A polyphonic verging on heterophonic texture is formed in the choir. The movement ends with a recapitulation of the 'theme' of section II.

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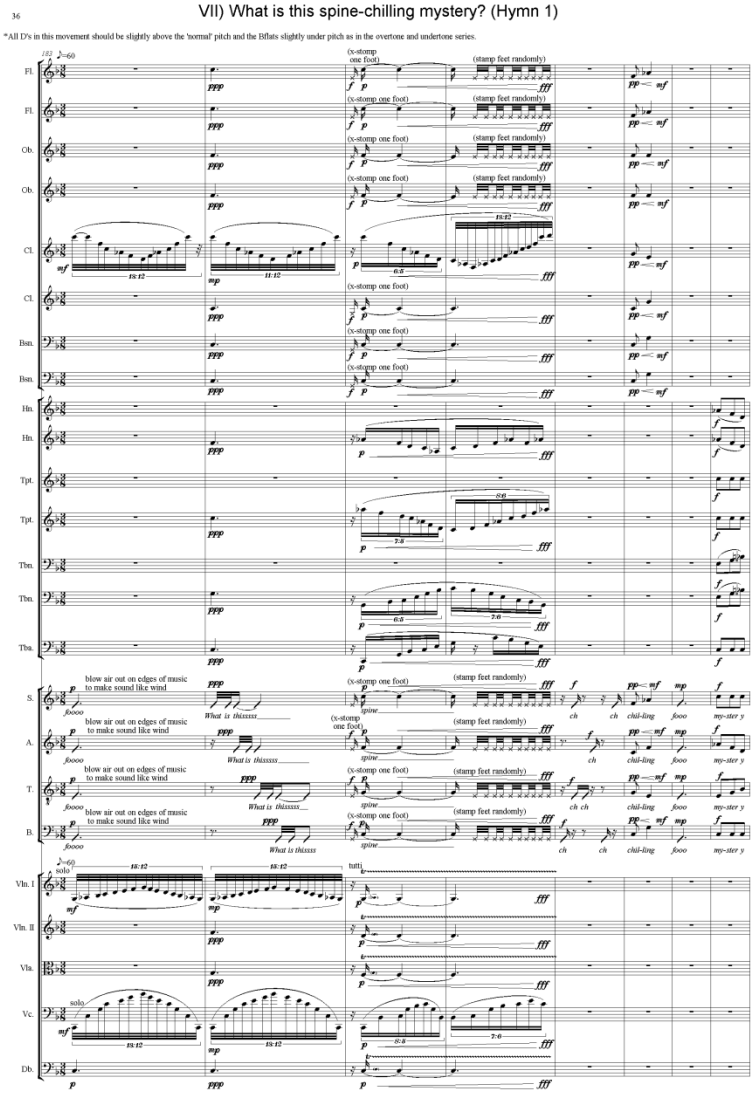
[131] Grout, *A History of Western Music*, p. 8.
[132] Barker, *Greek Musical Writings: II Harmonic and acoustic Theory,* p. 28.
[133] ibid., vii.94-5, p. 30.
[134] http://en.wikipedia.org/wiki/Counter-Earth

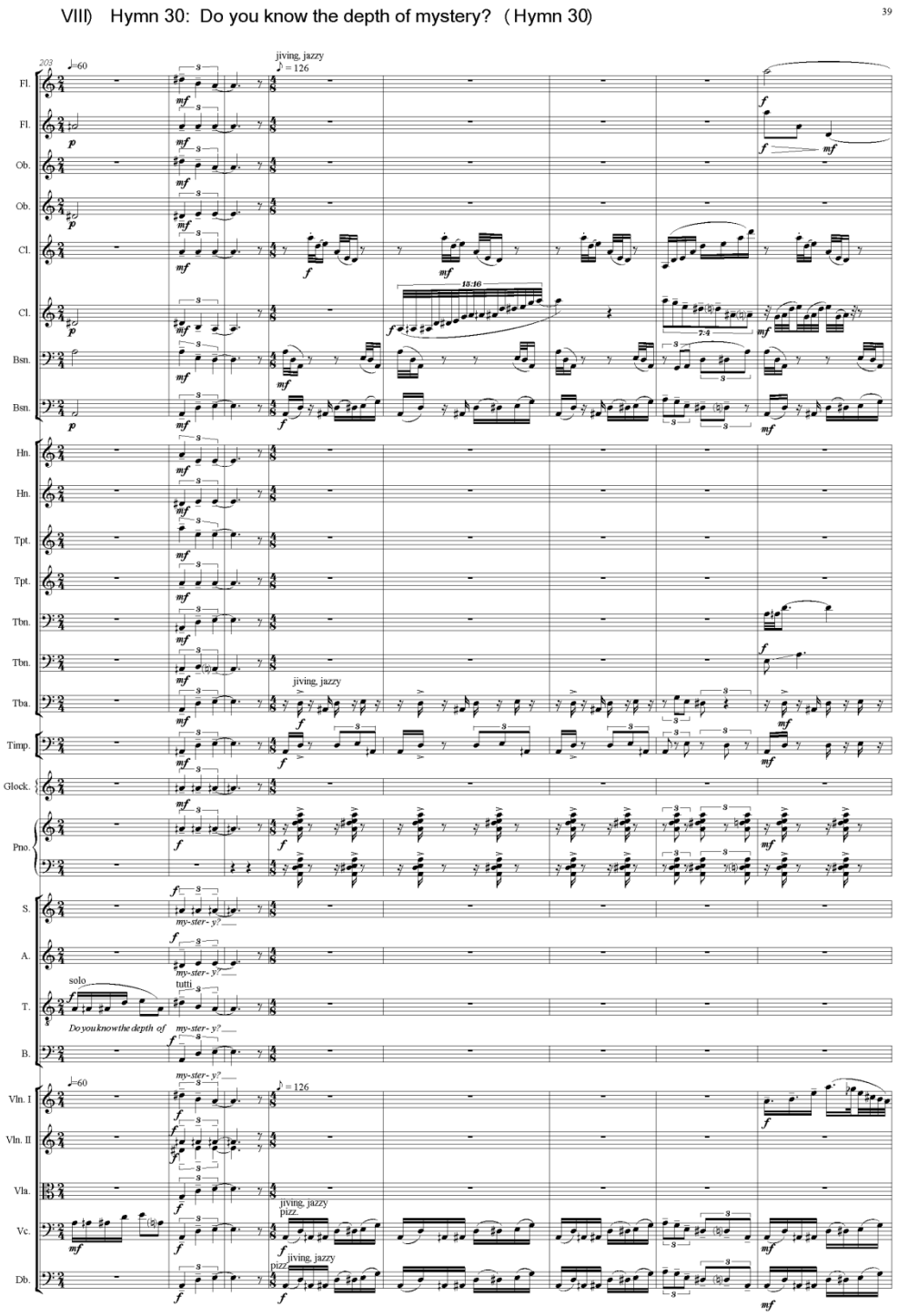
Section VII: What is this spine-chilling mystery?

Often in his hymns St. Symeon refers to a ‘spine-chilling mystery’. Thus this section reflects a sense of surprise and mystery in the vocal effects imitating the wind and thunder in stomping of feet. The intonation of certain notes are outside of the well-tempered tuning to use the overtone and undertone real notes of the series. In this way the D’s should be slightly above the ‘normal’ pitch to be part of the undertone series and the B♭’s slightly lower as part of the overtone series. The movement should last 60 seconds reflecting calculations of our heart beat and breathe in relation to the duration of the second and minute and that 1 second is the length of 1 vibration per second.



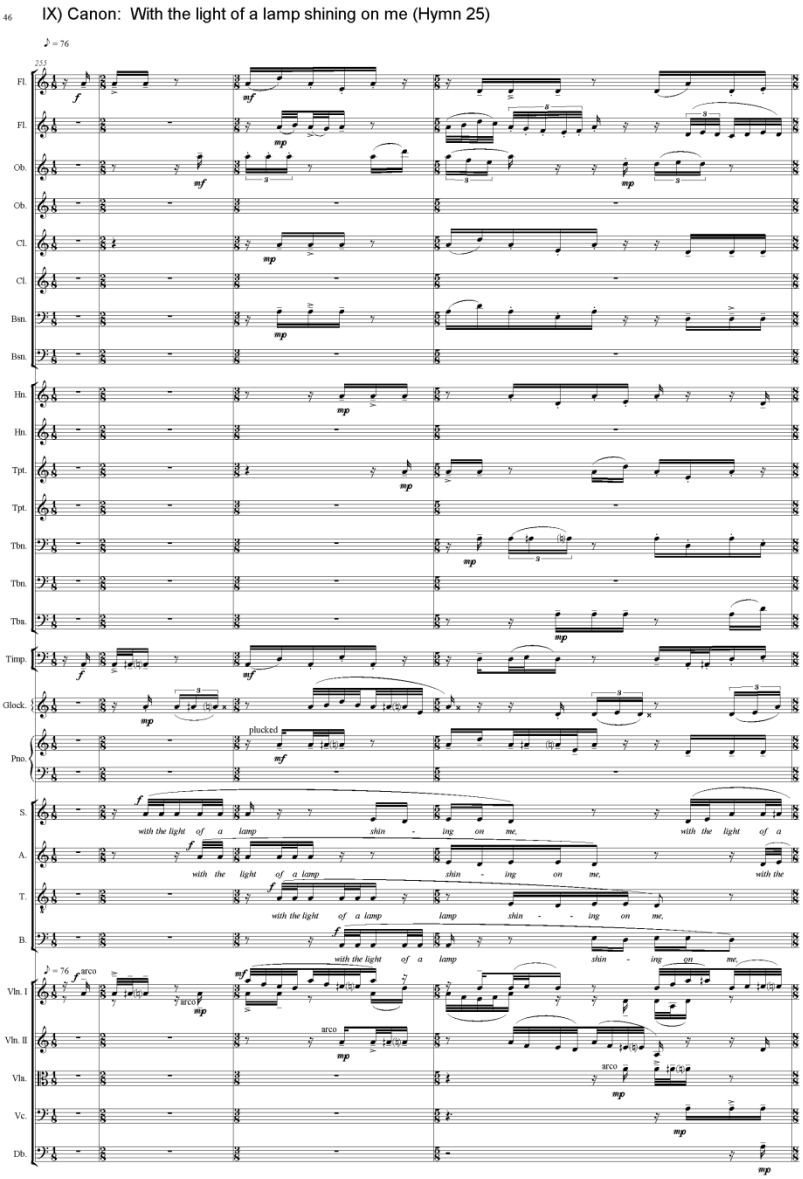
Section VIII: Do you know the depth of mystery?

Section VIII starts with a tenor solo like a gospel call and response hymn and continues on with a jazzy bass line with piano chord punctuating accents and the woodwinds playing interjections in a minimalistic manner. Scale one is used in this movement with the choir using chords as in the opening movement.



Section IX: With the light of a lamp shining on me

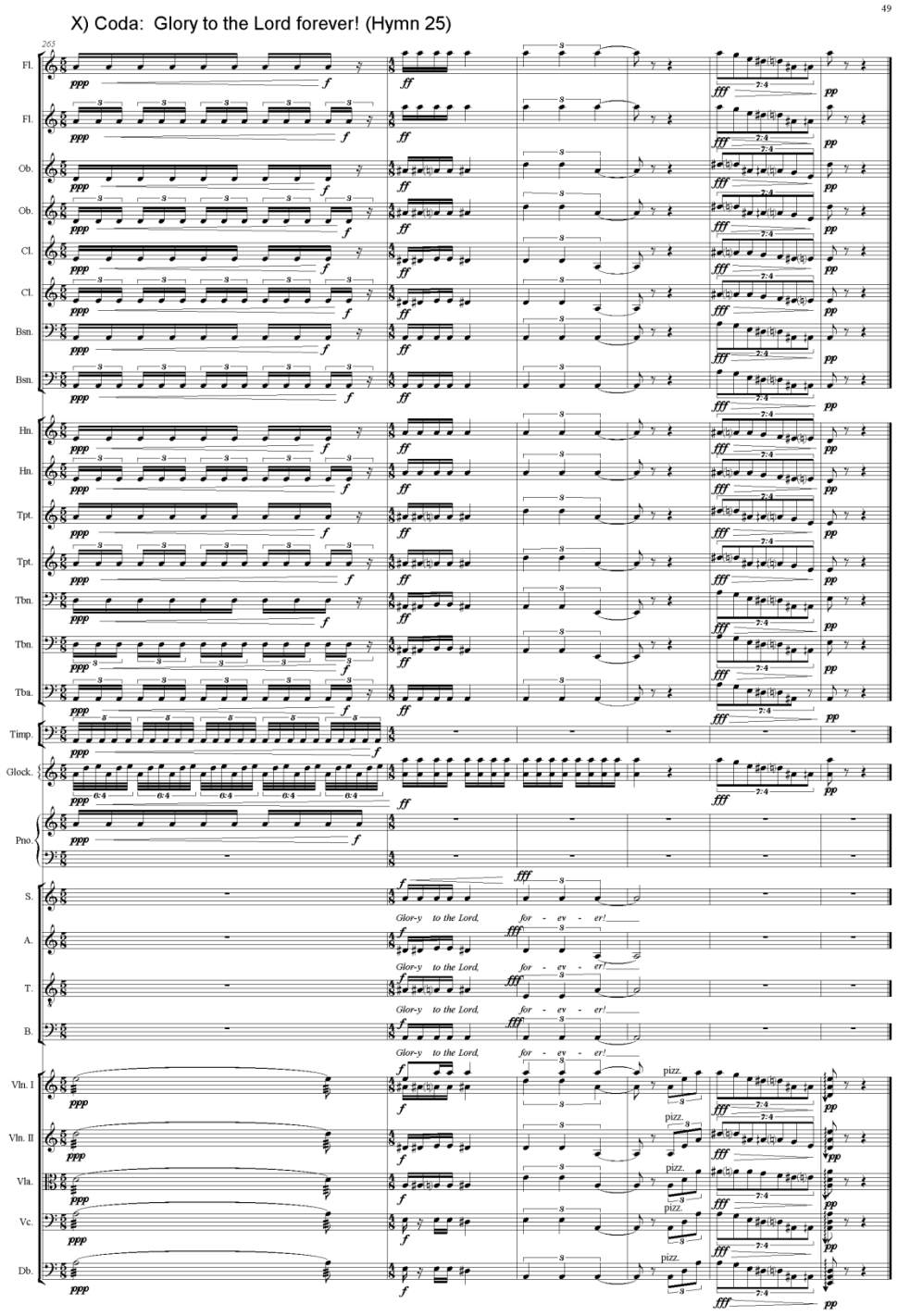
Section IX is a canon based on the theories of Luca Bianchini who has discovered a matrix pattern in the works of Renaissance composers[135]. With his permission I have used one of these matrix patterns to form a canon of numerous parts using the overtone/undertone chord. This is the simplest canon possible in unison without transpositions of the original melody. The melody starting in the flute is repeated until each instrument enters with the melody with various variations and ornamentations.



[135] See article by L. Bianchini (2011), "Wolfgang Amadé Mozart", ItalianOpera, http://222.italianopera.org/

Section X: Glory to the Lord forever!

A short coda ends the piece with the overtone/undertone chord, chords based on scale one and a final descending chordal scale as in section II declaring as did St. Symeon in quotation from the New Testament, “Glory to the Lord, forever!



6.8 **…catharsis…**
for organ solo

dedicated to Dr. Kevin Komisaruk,
written specifically for organ Opus 33, Knox College Chapel, University of Toronto

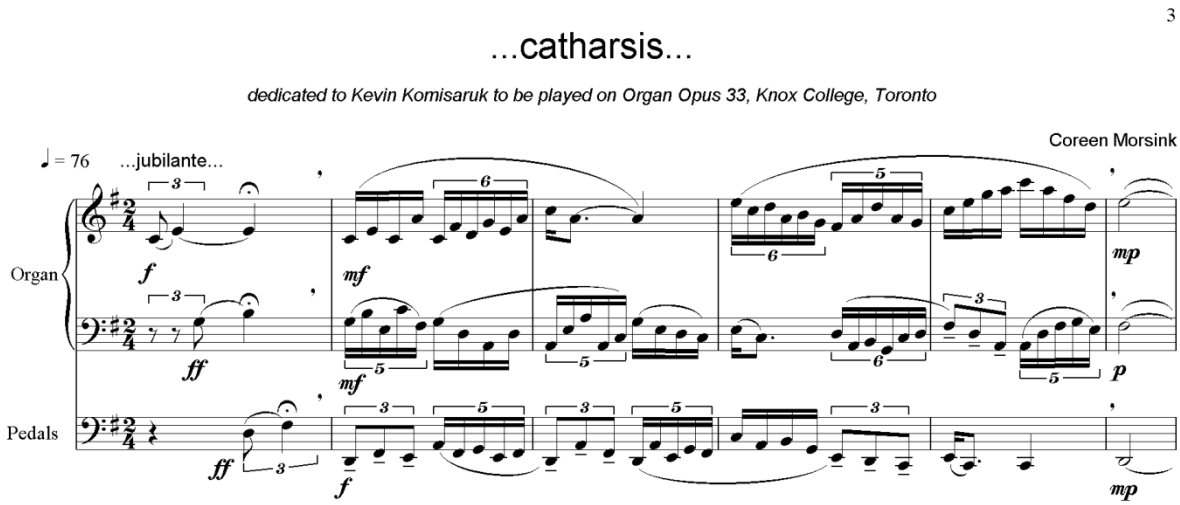
'Catharsis' (κάθαρσις) means to clean, purge or purify. This composition explores the pure and impure intervals of mean-tone temperament in a similar way as the other pieces of this portfolio explore the purity of perfect fourths and fifths of ancient Greece. The comparison of pure and impure intervals is like the search for balance and self-understanding necessary in order to reach the state of catharsis.

…catharis… , is dedicated to organist Kevin Komisaruk, and explores the problems we have both struggled with during our many years of friendship. His suggestion was for me to write a composition specifically for the Opus 33 organ at Knox College Chapel at the University of Toronto which was the main organ he performed on at the time we talked about the creation of this piece. The uniqueness of this organ is that it is tuned to modified fifth comma meantone temperament after Herwin Troje's research in eighteenth's century Swedish temperaments[136]. The organ is quite new having been built in 1991 under the direction of expert organists such as John Grew, Bengt Hambraeus amongst others, and has three manuals and 32 stops. As well it has the fortune to have 'mixtures' which allow a full octave of the same sound colour before the next octave starts instead of only having 5 notes of the same colour which many organs only have. The possibility of writing for such an instrument was slightly frightening, but at the same time awakened my imagination.

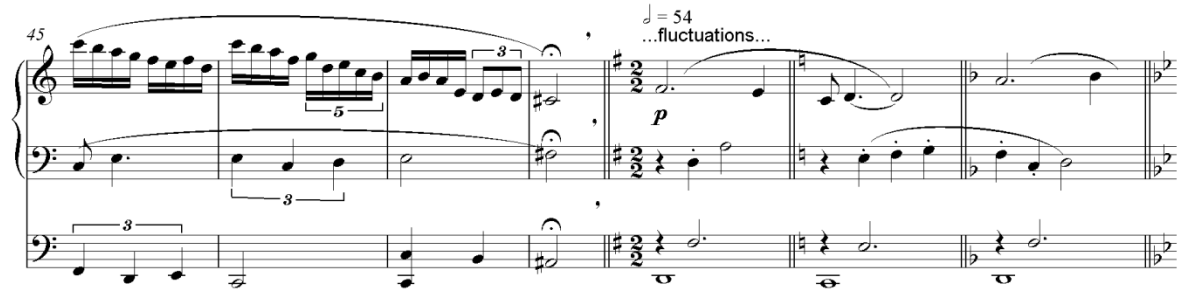
The approach I took in writing *…catharsis…* was to concentrate on the thirds that sound sweet and contrast them to the sour thirds. In this manner, my compositional approach is much the same as in my other compositions based on genera with perfect fourths and fifths. It is based on a philosophy of intervals which are pure and impure. These delicious thirds are the delight of meantone temperament but cause the thirds which have sharps or flats to have a disturbing crunch, almost like finding a rotten mouthful of a succulent orange. The piece reflects on traditional organ pieces with a jubilant fanfare opening but then travels

[136] http://www.orgelwolff.com/knox.htm

through the different keys, sometimes even bar by bar changing in order to emphasize the differences in the tuning of each key.

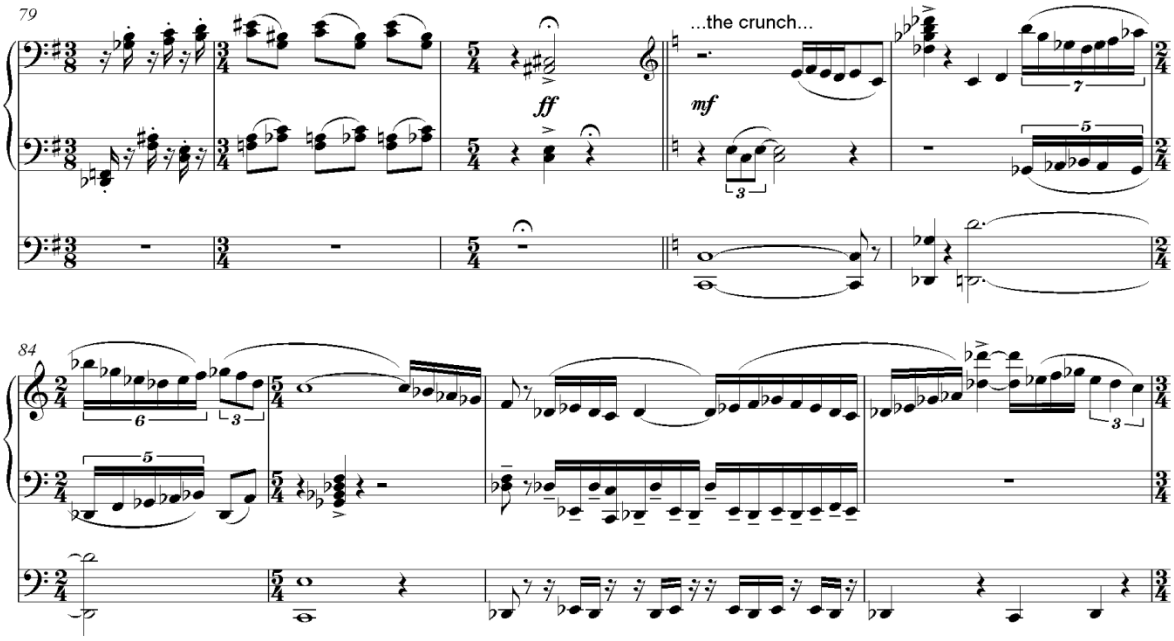


The section with the caption *…fluctuations…* shows the attempt to play with changing keys which would be terribly pronounced in the modified fifth comma meantone temperament. This, unfortunately would not be heard on an organ tuned to regular well-tempered tuning. The organist would then have to use great imagination to choose timbres which would reflect the changes in tuning.



…the crunch… and *…changes in attitude…* are sections which travel in two directions with the pedals trying to act as a mediator between the two arguing characters. Each pair of staves has a different key which clashes with the partner: for example C major at the same time with G flat major. This has a disastrous effect and then the pairs try to compromise; C major moves to G major and G flat major moves to D flat major… but the contrasts still exist. Finally G flat major goes through the circle to reach C major but by that time C major has moved on to a different key- a parallel to life in that we try to reach out to one another but often

end up moving completely in a different direction with only glimpses of the same conclusions.

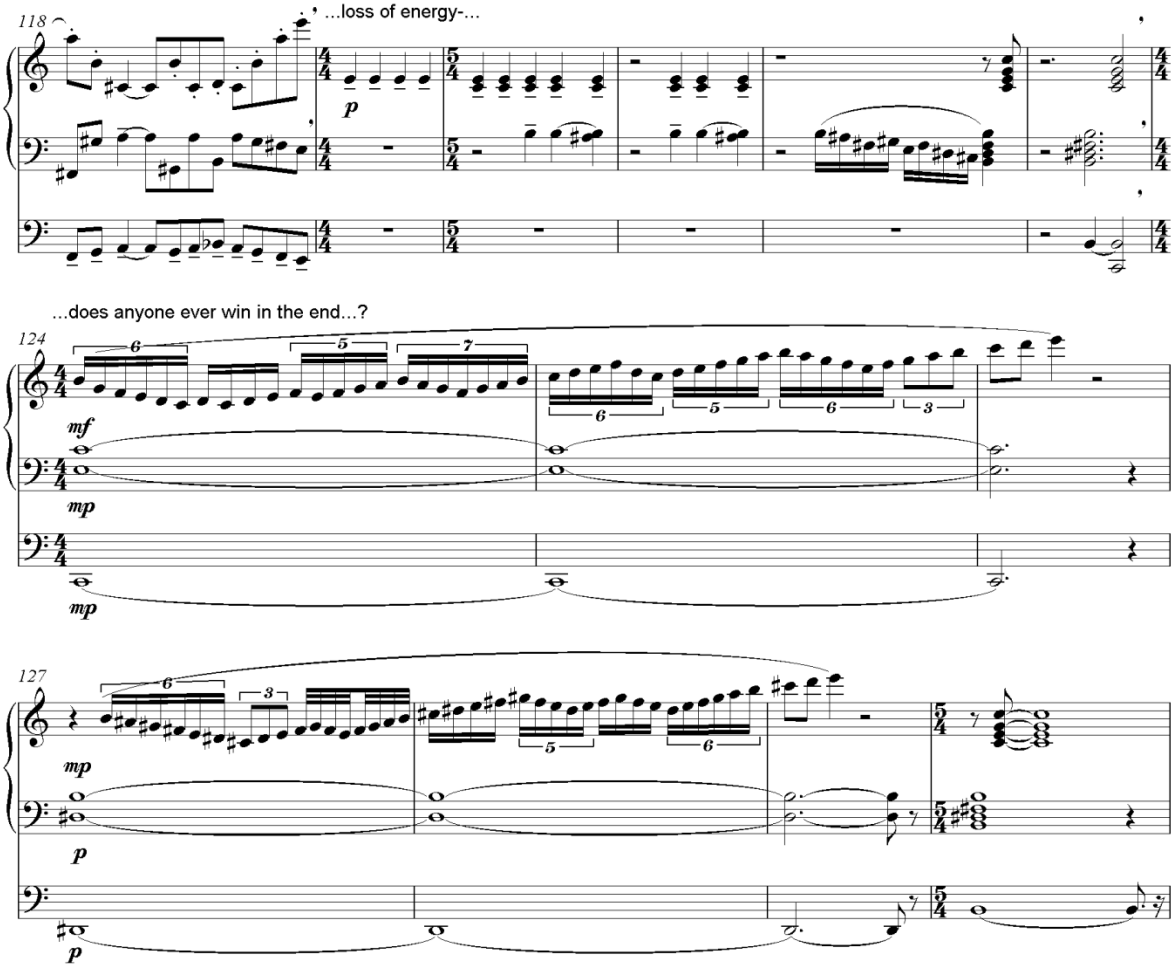


One last factor prompted the captions written above each section such as *…in the park…* or *…the crunch…*[137]*.* This was the problem of how to describe dynamics and sound colour on the organ. Kevin suggested that it is better to leave that to the organist, especially since each organ has its own characteristics. Instead of writing specific dynamics and stops to use he suggested that the general mood be described in words. Thus the piece became almost like a poem, describing the journey through problems, the attempt of people in relationships to find solutions and the endless arguments that never seem to solve anything, such as the caption*…does anyone actually ever win in the end…?*

Does the piece actually reach a final state of catharsis? In some ways yes, as the final section is a repetition of the opening section, this time leaving out the F sharps in order to have purity of the thirds. But there is always that feeling of the

[137] this title is also dedicated to my piano student Katerina Diamantopoulou who didn't like the title of one of her piano pieces (the Church Organ) and changed it to "The Crunchy Orange"

past problems, anguishes and sourness- the taste of the bitter orange never really leaves our senses.



…catharsis…

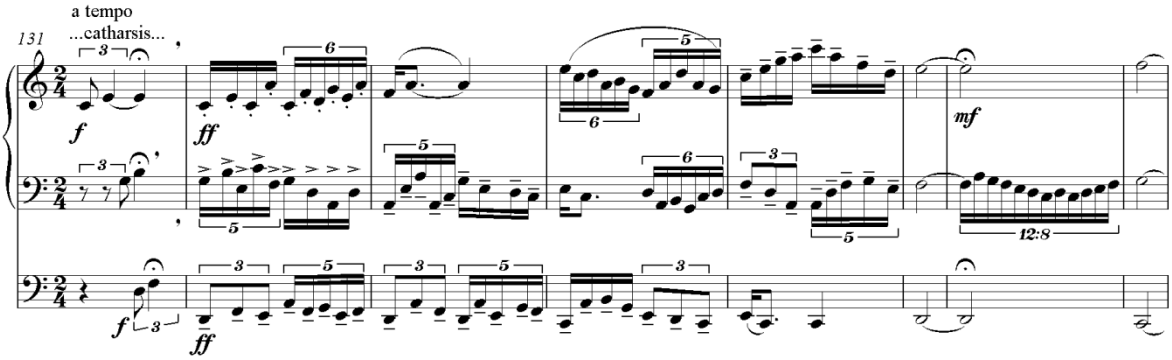


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Chart of A=432hz vs. A=440hz Survey

	Recording of "Andromache" by Coreen Morsink for Quarter-tone Alto Flute, played and recorded by Carla Rees	**Lecture by Coreen Morsink, October 15th, 2011, DEREE – The American College of Greece at the Second Athens Composer/Performer Conference for PhD Students**	**Total responses given in: 26 Signed:14 Anonymous: 12 No difference: 6 Difference in 432 which makes the piece better: 19 Negative difference: 1**
	Name	**Comment on 440**	**Comment on 432**
1	Roger Redgate	Sounds quite rich	Flute has more of an ethnic quality to timbre
2	Jerry Wigens	No difference	No difference
3	Kelvin Thomson	No difference	No difference
4	Enrico Bertelli	No response	Nasal, wooden, breathy, softer, more "ancient" -432 revisions are more accommodating and smooth
5	Tom Jackson	Peaceful, moved, relaxed	Slightly on edge, less peaceful
6	Maritetta Kandilaki	No response	Seemed more natural, liked low sonority
7	Ryan Molloy	Fantastic piece! Microtones, inflections really transport the music to a different realm	Sounds 'incorrect' for this instrument, perhaps just adjusting to the flatness after 440hz
8	M. R. Greggores (name unclear)	etheral	Richer, more eastern, earthier
9	Madeleine Georgopoulou	Thinner sound	Relaxing, deeper/fuller sound
10	Dahlgren Ekonomidi (name unclear)	More optimistic	Saddened, towards less "sane psychology"
11	Ersie Kalomori	No response	I prefer the lower pitch, it is much more tragic and atmospherical- it fits better in ancient greek music/the result was really amazing!
12	Ben Isaacs	lyrical	Maybe more resonant

13	Edmund Hunt	No response	Perhaps more organic/natural in feel (yet slightly disconcerting to hear an alto flute playing a bit lower than it's standard range) – greater resonance (thus harmonies seemed to resonate differently, creating a different effect)
14	Leslie Jones	Rich and bright sound, full	Darker, somewhat sadder
15	anonymous	No response	More lively, more interesting
16	anonymous	Very Greek and emotional	More moving- a more "painful/pained" sound
17	anonymous	No response	More suitable to the piece/an indigenous approach -different atmosphere was produced
18	anonymous	No response	Depth in sound, shorter climaxes
19	anonymous	No difference	No difference
20	anonymous	soothing	Slightly more edgy- constant suspense
21	anonymous	calm	Emotional, even more touching, dynamic
22	anonymous	No difference	
23	anonymous	No difference	
24	anonymous	Played faster	I felt more the ¼ tone intervals, more expressive, relaxed, distinctive
	anonymous	No difference	
25	anonymous	It was depicting in such a good manner the ancient Greek environment and the roots of the story behind Andromeda *(I presume this person meant Andromache!)*	It sounded much more mysterious. I prefer it than the other

Emails and Written Skype conversations

Email: Dr. John Baily

On Thu, July 21, 2011 10:43 am, John Baily wrote:
>>>>> Dear Coreen
Don't know about this 432 business. The recording was made in Palermo in 2002. I don't know how we got in tune, electronic tuners were not so common then. So if we're in 432 it was not by intention. No matter, perhaps we gravitated naturally to that pitch, for reasons you imply.

Written Skype conversation, Nov. 6, 2011 with Dr. Luca Bianchini

I'd be happy of course if you would add my article about matrixes in your thesis
[06/11/2011 15:02:51] Luca Bianchini: I found this matrixes system when I was at the University, in 1987 I was studying Palestrina's first book of masses and I was wondering how composers such Palestrina could compose in horizontal way without an orchestral score disposition of the parts
[06/11/2011 15:04:40] Coreen Emmie Rose Morsink: it's really fascinating! it looks so complicated...but as you explain it's so simple
[06/11/2011 15:05:10] Luca Bianchini: yes, but the more cokmplicated things are the most difficult to find :) Luca Bianchini: and I think it is the secret of 1400 poliphony
[06/11/2011 15:05:35] Luca Bianchini: just a sequence of 135
I'm happy you like this ancient system
[06/11/2011 15:07:05] Luca Bianchini: I think it was known by Guido D'Arezzo
[06/11/2011 15:08:41] Luca Bianchini: This system was orioginated in Greece
[06/11/2011 15:09:00] Luca Bianchini: I'm sure also in the Seikilos Epitaph there are such Matrixes
[06/11/2011 15:09:50] Coreen Emmie Rose Morsink: hmmm...interesting idea, to use that epitaph with a Matrix...or the orestes...
[06/11/2011 15:10:26] Luca Bianchini: yes, because you see just the horizontal melody ... but this melody is just a development of a vertcal combination of fifths
[06/11/2011 15:11:10] Coreen Emmie Rose Morsink: they were so clever back then, it makes sense that they also understood polyphony. interesting that i've only thought of heterophony in ancient greek music
[06/11/2011 15:12:26] Luca Bianchini: I also know that there was an etherophony, but the music itself contains intervals and these intervals are the same , it changes only the reference point
[06/11/2011 15:13:26] Luca Bianchini: I think the matrixes system was born with the seven notes in the perfect system of ancient greeks
[06/11/2011 15:14:03] Coreen Emmie Rose Morsink: fascinating. it puts a whole new perspective on ancient greek music
[06/11/2011 15:14:27] Luca Bianchini: yes, and tell us that poliphony is not a discovery of 1100
[06/11/2011 15:14:39] Luca Bianchini: it is the same system
[06/11/2011 15:15:34] Coreen Emmie Rose Morsink: it's true, there is such a focus on perfect 4ths and 5ths and modes- there is no reason to think that they weren't using polyphony- numbers were everything back then

[06/11/2011 15:15:54] Luca Bianchini: you're right
[06/11/2011 15:16:18] Luca Bianchini: this system was intended to be used with the non temperato system
[06/11/2011 15:16:54] Luca Bianchini: and ended I think when they use the Cromatical madrigals in 1500