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Modes, Spectra and Intuition

Abstract. The subject of this paper falls within my compositional research and is focused on the combination of folk modes and several kinds of harmonic and non-harmonic spectra, used as prime pitch material to develop various structures. This paper will present the realisation of several compositional attempts to extend these two different sound worlds in order to find or invent methods by which modality can be extracted from spectrality and vice versa, in an artistic framework. Spectral music material has been mostly generated using some algorithms, created in IRCAM's OpenMusic Software. Here, it should be underlined that one of my main artistic concerns has been to achieve a functional balance between the computer and the intuitive choices.

To clarify the ideas mentioned above, extracts from the following works will be presented:

- *Talus* (2007) for Piccolo & Tam-tam;
- *Octaphonia* (2008) for Chamber Ensemble (Fl. Cl. Pno. String Quintet);
- *Echosymplokon* (2009) for Symphony Orchestra;
- *Inertial Motion* (2010) for Chamber Ensemble (Fl. Ob. Hrn. Vln. Vlc. Pno.).

All of the presented compositional principles will focus on the melodic shaping, the rhythmical quantification and the organisation of texture and timbre.

Keywords: spectral music, modal music, Manos Panayiotakis, contemporary composition.

1. Introduction. Developing a personal code for communication

Since the very beginning of the recorded music history, the art of composing has always been an infinitive artistic research on means to express. At the very first chapter of Olivier Messiaen's monumental treatise *The Technique of my Musical Language*, music is defined as a language where every composed melody has "to speak"[1]. In fact, by using this specific verb, Messiaen opens a Pandora's box for the contemporary compositional thinking, irrespective of diversiform techniques and styles. Hence, Messiaen's words raise the fundamental argument: Is Composition a language? Comparing any compositional language to any speaking language, "expression" and further, communication can clearly be perceived as a common target of the two, and "sound" as the common medium to achieve this. Composers are very often self-challenged to choose, to set or even invent a personal sonic code, as a form of communication with themselves and with the audience. Greek composer Jani Christou, in his stage work "Anaparastasis III – The Pianist" (1968), deals with a pianist's anguished, infinitive and sometimes fruitless effort to communicate both with his instrument and with his audience[2]. Having been born and having grown up in a country with strong Eastern tradition and at the same time having been significantly influenced by the West, it would be inevitable for my compositional language to remain untouched by such a cultural background. Elements of Eastern influence are evident in my works through the use of various folk modes for the organisation of the melodic and harmonic material. At the same time, the predominantly western spectral idiom, developed during the last decades of the twentieth century by French, Romanian and Finnish composers, has strongly affected my compositional thinking by triggering the following artistic questions:

- How could several simple mathematical formulae be used to generate both modal and spectral primary music material?
- How could these two sonic environments interact with each other and be artistically manipulated to construct contrasting textures and diversiform structures?

2. *Talus* for Piccolo & Tam-tam (2006)

Talus for Piccolo and Tam-tam was composed in York, in 2006. It is one of my most representative examples regarding the use of modal scales as primary music material[3]. The initial objective of this work was to create a sonic image of the ancient Greek myth, where the robotic giant, Talos (in Greek: *Τάλως*), duells with Jason and the Argonauts on the island of Crete. Due to the illustrative concept on which this piece was initially based, the majority of its parameters, such as melodic lines, rhythm and timbre, were organised in a completely intuitive way, far from any kind of numeric formalisation.

1 Messiaen, Olivier, and John Satterfield. 1956. *The technique of my musical language*. 1st Volume. Paris: Alphonse Leduc, p. 13.

2 Christou, Jani. 2001. *Anaparastasis III – The Pianist*. Athens: Seirios.

3 Panayiotakis, Manos. 2008. *Talus* for Piccolo & Tam-tam. Ancona: Berben Publications.

For the shaping of *Talus*' **melodic lines**, three different modes were used:

- a nine-tone scale, which consists of two identical tetrachords plus a semitone and a tone:

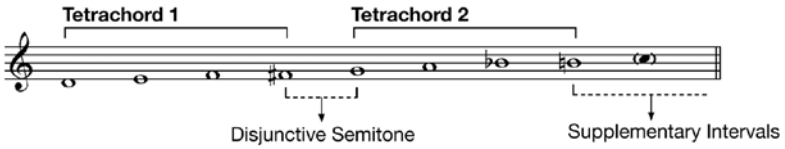

Figure 1. *Talus*, mode 1

- a quasi-chromatic, also nine-tone scale, where smaller intervals contribute to achieve more tensive textures:

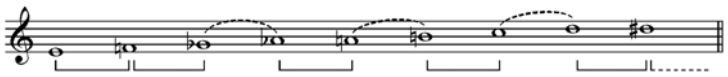

Figure 2. *Talus*, mode 2

- a half pentatonic-half chromatic mode, which was used for the last part's textural dematerialisation:

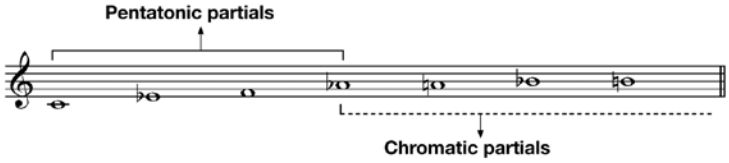

Figure 3. *Talus*, mode 3

The **structure** of *Talus* deals with two distinct sonic groups. The first one consists of pure timbral sonorities, based on extended techniques by both instruments. The table below lists the timbral material used by instrument:

Piccolo	Tam-tam
Whistle-tones	Chain
Pitch-bending	Scraping
Breath-tones	Various Mallets
Ghost-tones	Hit on Stand
Flutter-tongue	Contrabass Bow
Multiphonics	Wire-brushes on air

Figure 4. *Talus*, table of timbres

Gestures based on the modal pitch material, as it was previously illustrated, comprise the second sonic group of this work. At this point, it should be highlighted that a number of additional "pivot" sections were incorporated to the main structure, in order to transform the one sonority into the other, and, thus, to enable a smooth transition between the contrasting parts. In addition, the monophonic tonal relationship of Tonic and Dominant (Pitched D and A respectively) was used in order to escalate the tension between the very beginning and the middle part of the work. After that, there is no return to the initial D. The piece concludes with A flat, a pitch so close to A which at the same time brings almost nothing of the Dominant's tension. The figure below illustrates the structural and timbral overview of *Talus*:

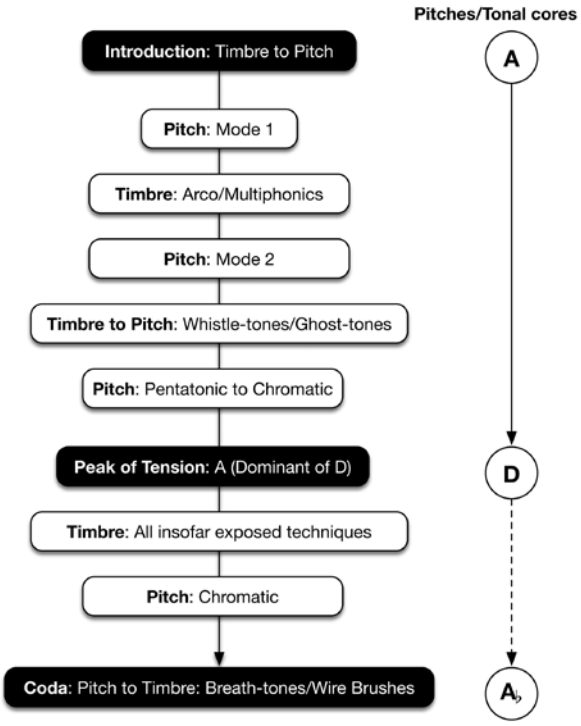

Figure 5. *Talus*, structural plan

3. *Octaphonia* for Chamber Ensemble (Fl. Cl. Pno. Str. Quintet)

The next work *Octaphonia*, raises another compositional question: How could the partials of a folk mode be found within the partials of a harmonic spectrum?

The primary melodic material is comprised by a pentatonic scale, extracted from a recording of a Greek traditional song. As shown in the illustrations below, the scale consists of all the pitches on the black keys of the piano. Pitch F sharp appears lowered by one quarter-tone at the descending form of the scale. The organisation of the harmonic material is based on a six-part chord, which includes all the above-mentioned pitches. The registers are arranged according to the order in which each pitch appears in the harmonic spectrum of pitch C sharp.

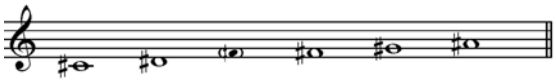

Figure 6. *Octaphonia*, pentatonic scale

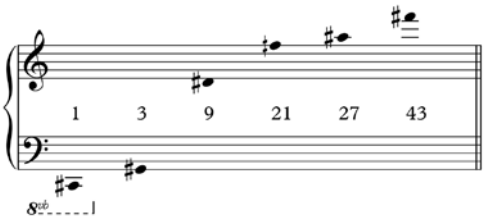

Figure 7. *Octaphonia*, harmonic spectrum

This pentatonic scale constitutes the basic pitch material. It has been developed through simple algorithms, created in IRCAM's OpenMusic Software. Frequency Interpolation and Frequency Shifting are two of the preeminent spectral techniques, on which the above-mentioned algorithms were based on. Depending on the character of each part, this fundamental material is used to shape melodic lines, to build chordal blocks or transform into other modes inverting the intervalic ratios.

The next figure exemplifies a spectral expansion of pitch C sharp to the chord shown in Figure 7. The expansion was made by dividing each distance from pitch C sharp to each partial of the chord into ten equal parts:

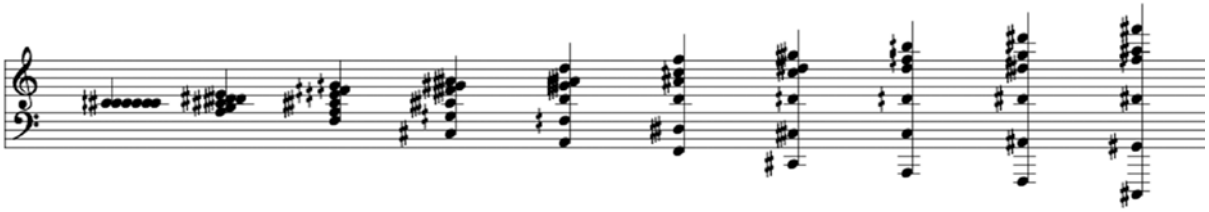

Figure 8. *Octaphonia,* Frequency Interpolation

Apart from Frequency Interpolation, the Frequency Shifting technique was applied to random partials of the pentatonic scale. Here, an arithmetic series of Hertz were added to and subtracted from a partial in order to achieve a palindromic expansion of a microtonal, moving cluster. In addition, the modal material was expanded by transforming the pentatonic scale into a new, eight-note mode. In particular, the new mode occurred after creating a new 5-note mode by changing every major second to minor third and vice versa, which was finally incorporated in the original scale.

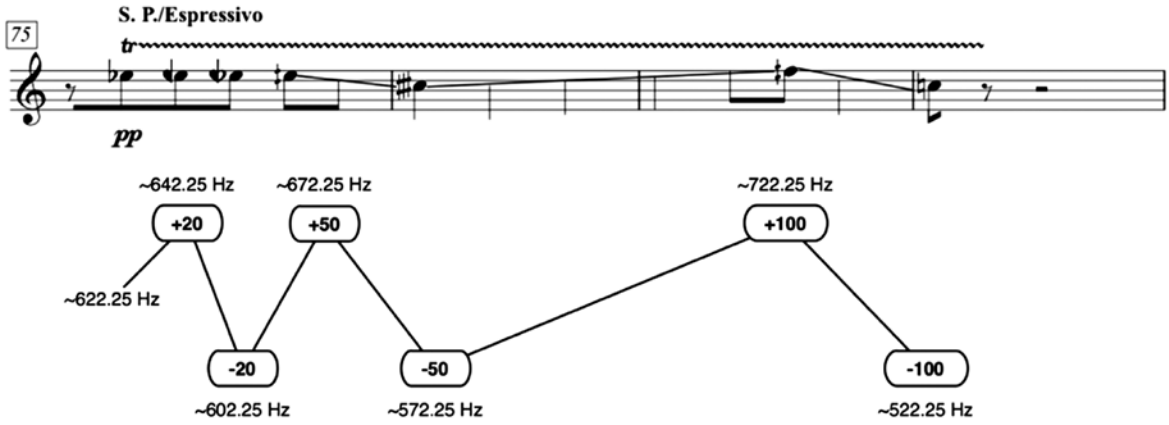

Figure 9. *Octaphonia,* Frequency Shifting

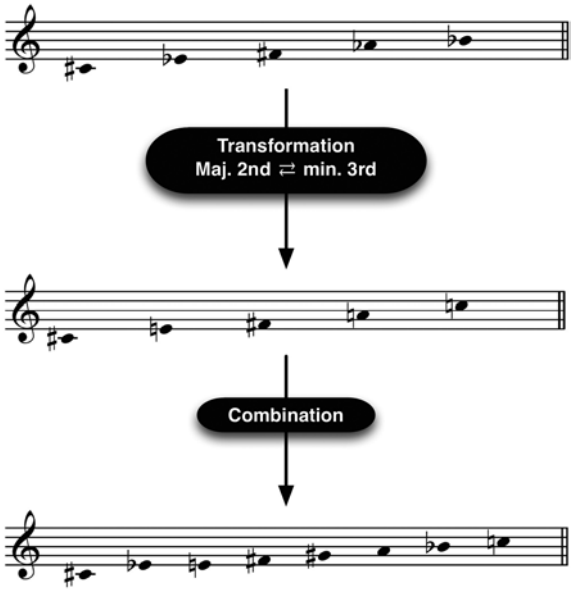

Figure 10. *Octaphonia,* inversion of intervallic ratios

The outcome of the elaboration of this primary material has been a variety of contrasting textures, which control and modulate the tension of the work. The figure below illustrates the forms and the development of the music material along with *Octaphonia*'s timeline:

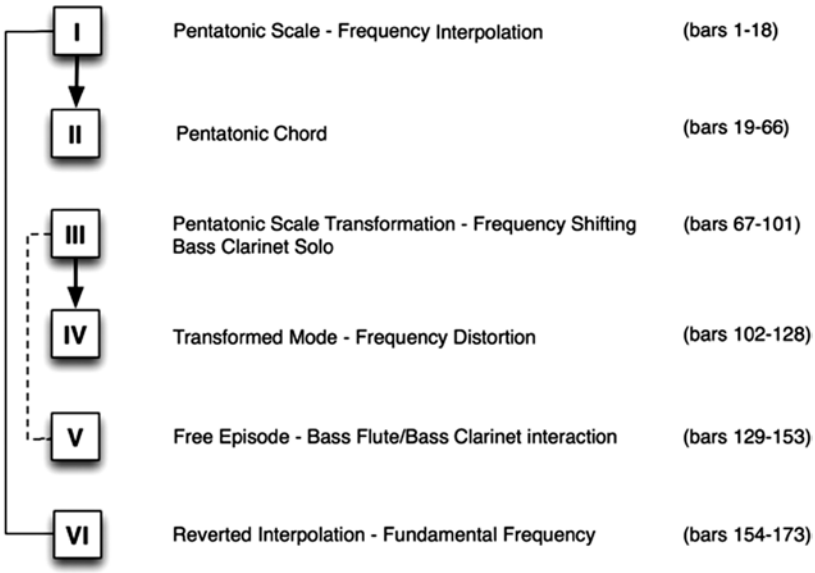

Figure 11. *Octaphonia*, structural plan

The technique of controlled improvisation has been an essential tool in the development of the texture during sections III and IV (bars 67–128). The performer is asked to improvise by performing the pitch and rhythm material notated in any order. This technique starts from free key slap gestures by the flute in Bar 73 and is gradually developed through free upward gestures, to reach the completely improvised section in bars 126–128, which allows free gestures, rhythms and dynamics. During those bars, the texture reaches its most compact form.

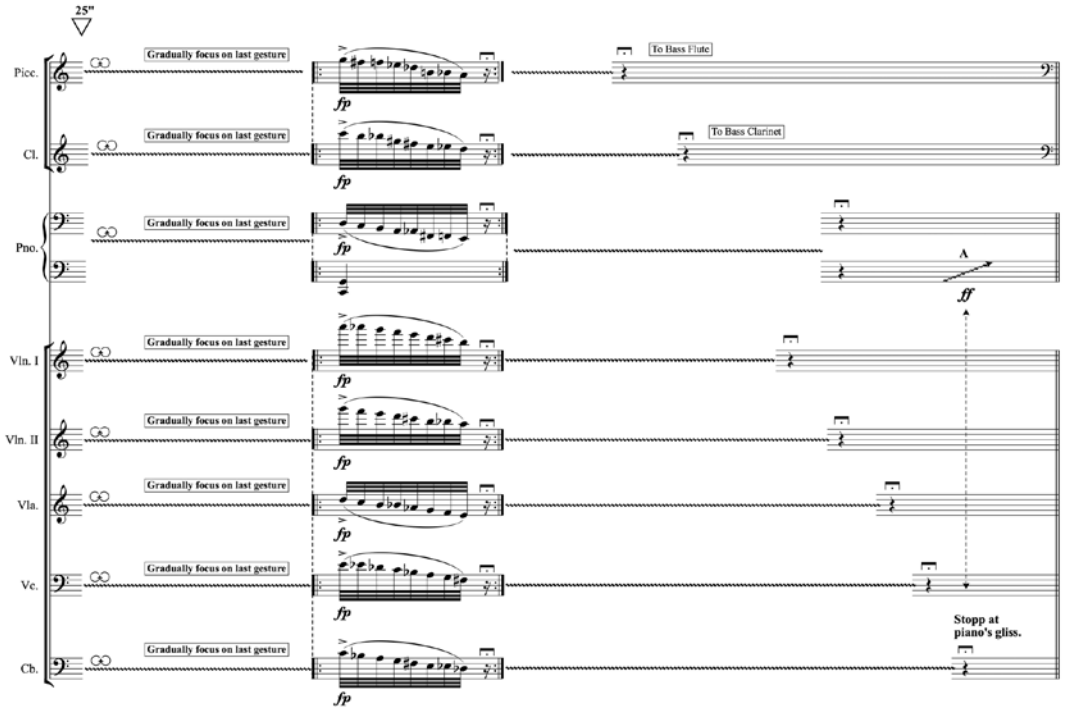

Figure 12. *Octaphonia*, improvisation part

4. *Echosymplokon* (2010) for Symphony Orchestra

The next compositional principles to be presented in this paper can be found in my work *Echosymplokon* for Symphony Orchestra, which was composed during 2009–2010 and premiered by the Vienna Symphony Orchestra at the ISCM festival, in Vienna, in 2013. The word "Echosymplokon" means *sound complexity* and is based on the Greek words *ήχος* (=sound) and *συμπλοκή* (=complexity or conflict) referring to the contrasting textural ideas used to form the harmonic and timbral plan. The work examines the interaction between static and kinetic textures, which are presented alternately, thus modulating the harmonic density, the dominant registers and the orchestral timbre. The orchestra is used as a large instrument with many faces, providing different environments each time, from solid harmonic surfaces to "empty" sonorities.

In contrast to *Octaphonia*, the modal material of this work was generated through simple algorithmic processes, based on the spectral material. The Phrygian mode (starting from E natural) was used as a starting point. Two algorithmic principles were applied in order to transform the initial scale into two different modal pitch-series. In the first series, every partial of the scale, which is a triangular number (1, 3, 6, 10 and 15) was "approached" by semitone, resulting in a new, periodical, two-octave mode which consists of an E aeolian and an E minor-melodic mode in consecutive order:

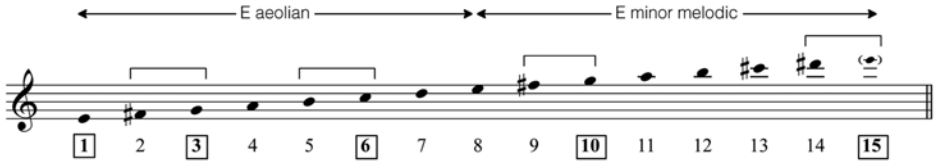

Figure 13. *Echosymplokon*, mode 1

More specifically, the primary pitch material of *Echosymplokon* consists of a harmonic spectrum, filtered by a triangular-numbers arithmetic series. The opening of this work is structured with a number of rising chords, which were based on the above-mentioned spectrum and on additional pitches, generated with the Frequency Interpolation technique:

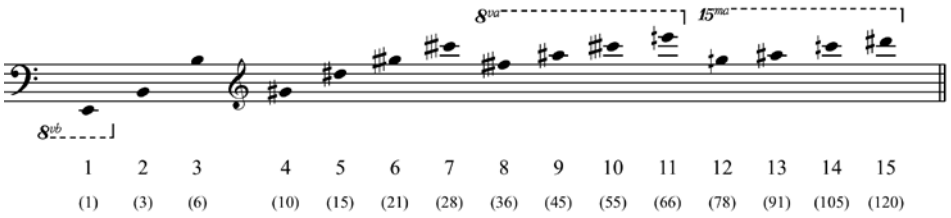

Figure 14. *Echosymplokon*, harmonic spectrum

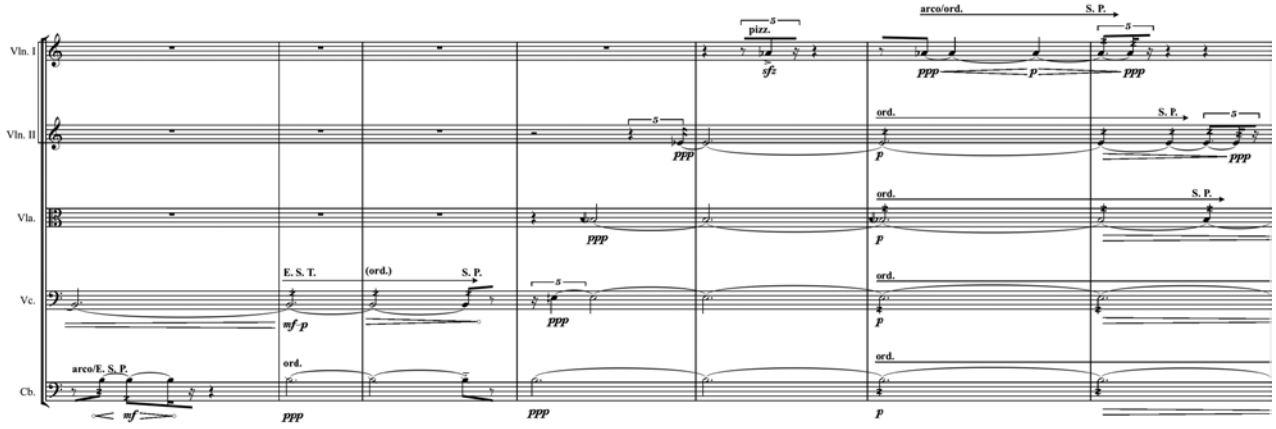

Figure 15. *Echosymplokon*, Frequency Interpolation

In the second series, all triangular-numbered partials were approached by tone. Thus, this algorithmic process returns a non-periodical, endless modal scale:

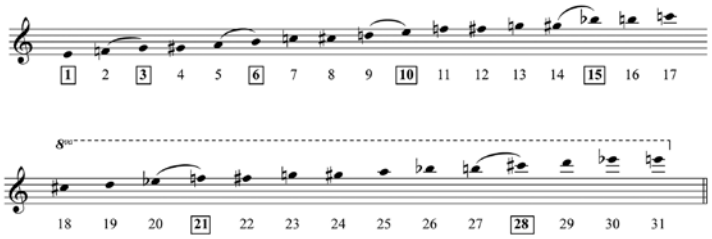

Figure 16. *Echosymplokon*, mode 2

These two modes were used in various combinations for the elaboration of the music material, in order to construct the most energetic passage of the work. The harmonic texture changes to fast contrapuntal passages where several modal gestures are developed by all instruments. By decreasing the number of instruments, the speed and the dynamic tension are gradually released to a 'bare' orchestration passage (bars 131–154), performed on the two extreme ends of the orchestra by piccolo and contrabass. This sonority acts as a 'negative form' of the tutti passages.

5. *Inertial Motion* for Chamber Ensemble (Fl. Ob. Hrn. Vln. Vlc. Pno.)

Inertial Motion was composed in York in 2011, as the last work of my PhD portfolio[4]. The tittle comes from the respective cosmological term, which means 'constant velocity motion' or 'motion free from any force'. In contrast to the previously-presented works, Inertial Motion's main idea was based on a minimalistic approach to the texture organisation. In particular, two single pitches, G_3 sharp and E_6, were used as fundamental pitch material to develop the texture and the structure of the whole work. Along the lines of *Octaphonia* and *Echosymplokon*, the expansion and elaboration of this minimum pitch material was based on a number of algorithms, created at OpenMusic Software. The structure of *Inertial Motion* was organised according to three contrasting types of textures. The first, is characterised as "Smooth" due to the sustained pitches, which form a, not to tensive, harmonic surface. Here, the mathematical formula of the Frequency Modulation technique was repeatedly used in order to generate additional pitches, which were produced by the algebraic sum and difference (in absolute values) of the two initial frequencies:

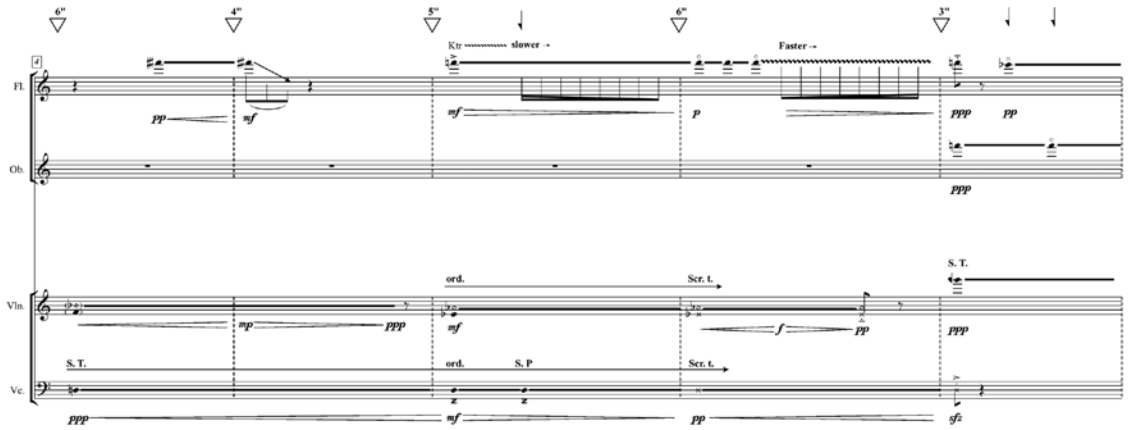

Figure 17. *Inertial Motion*, Smooth Texture-FM

The second type of texture is described as "Angular" and consists of randomly created upward modal gestures, which gradually increase the work's overall tension. Here, the components of a chromatic cluster, which marks the end of the first part of the work were used as starting points for an algorithm which returns random modal gestures by the algebraic addition of various intervallic ratios. It is worth noting that in specific parts of *Inertial Motion*, the above-mentioned modal gestures were elaborated and expanded using the formula of the

4 Panayiotakis, Manos. 2011. Portfolio of Music Compositions (PhD Thesis). York: the University of York.

Doppler-Fizeau Effect. Figure 18 demonstrates an analytic description of this particular algorithmic process, while Figure 19 shows a few bars of the particular passage. In particular:

1) a random pitch from the cluster is selected;
2) a series of random intervals is generated and added to the previously-selected pitch;
3) the gesture is transposed and put in a random register (later, the generated registers determine the instrumentation of each gesture);
4) all the partials of the above-created gesture were Frequency-Modulated through the Doppler-Fizeau Effect mathematical formula.

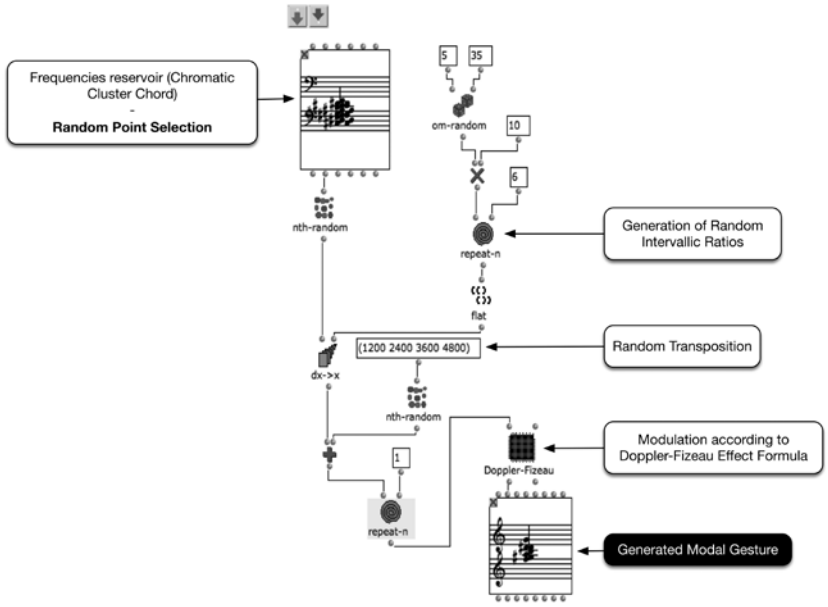

Figure 18. *Inertial Motion*, Angular texture Algorithm

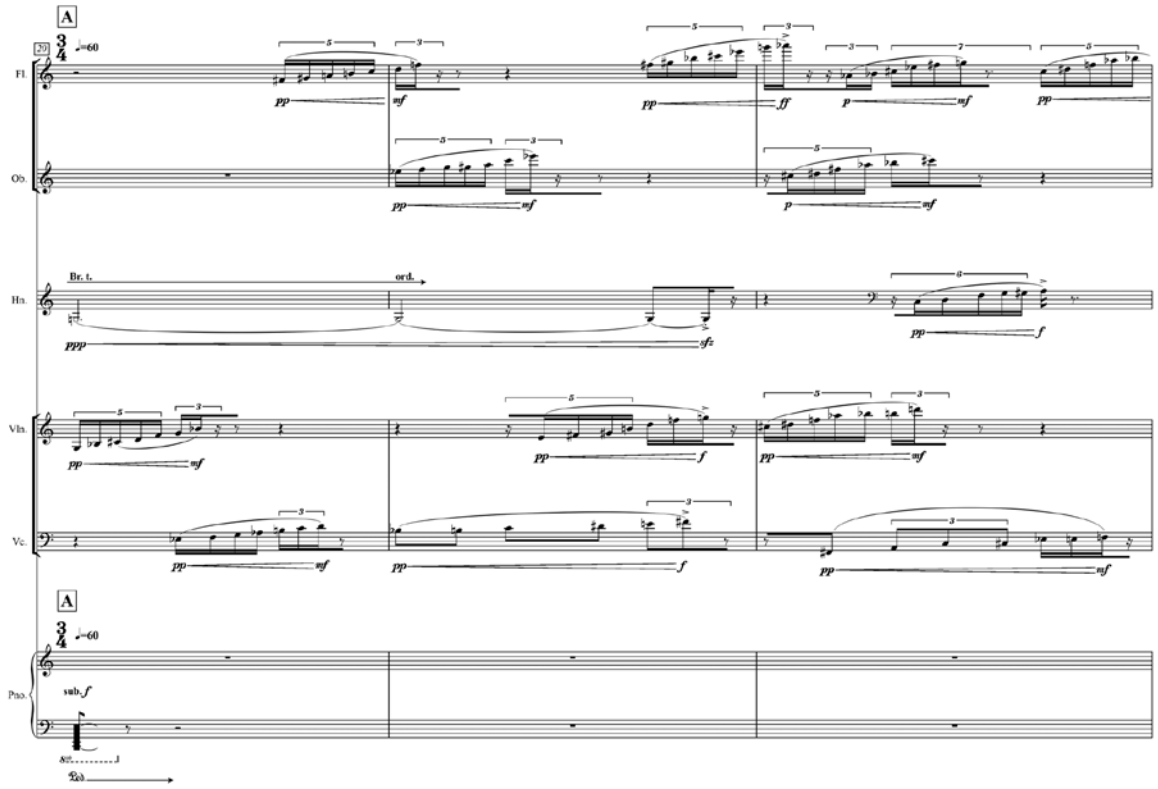

Figure 19. *Inertial Motion,* Angular Texture on the score (b. 20–22)

The third type of texture is described as "Granular" and it mostly consists of percussive and pizzicato sounds. This sonority appears at the final part of *Inertial Motion* in order to achieve a dematerialisation of what was previously heard. The pizzicato material of the two strings was based on random three-note gestures, created with the Doppler-Fizeau Effect formula as follows:

1) a spectrum was produced by Frequency-Modulating two smaller clusters;
2) a random pitch was chosen and substituted the variable F0 of the Doppler-Fizeau Effect formula.

Figure 20 shows a typical passage, extracted from the epilogue of the work:

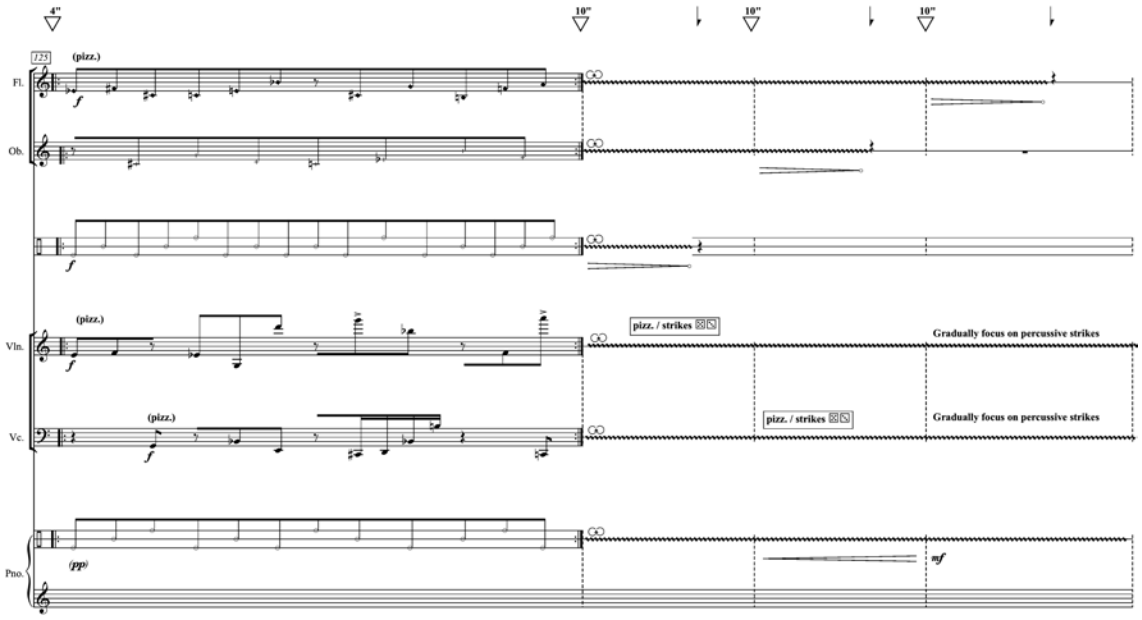

Figure 20. *Inertial Motion*, Epilogue

In conclusion, I would like to state my own answer to a couple of questions which are often raised by many contemporary music composers and analysts:

"Why does a composer chose methods, such as the ones listed in this paper, instead of others which might include no formalisation? At the end of the day, is a compositional methodology audible?"

I am almost sure that the majority of the composers has at the same point used the verb "to work" in order to summarise the outcome of his/her compositional process. "*This works*" or "*That does not work...*" My personal view has been formed in accordance with the fact that, irrespective of style, a music work consists of two elements of fundamental importance: the *audible outcome*, which is finally perceived by the audience's ears and the *inaudible methods to achieve it*. There are, undeniably, plenty of ways for a composer to create and organise a particular sound. Thus, each of us chooses those, which "work" according to our personal taste. As soon as a music work leaves the composer's desk, it is possible to be listened, analysed, interpreted and evaluated in as many different ways, as the number of the different listeners. Maybe some perspectives see eye to eye with the ones chosen by the composer, or maybe not. History ultimately will determine if each piece of art finally "works" or not. In the meanwhile, any contemporary composer should continue looking for innovative methods to "express" themselves and to "communicate" with both his work and his audience.

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Modusai, spektrai ir intuicija

Santrauka

Straipsnio tikslas – ištirti tokius kompozicinės praktikos būdus, kai modalumas yra siejamas su spektriškumu, ir atvirkščiai. Dar konkrečiau – argumentuoti kompozicinę idiomą, jungiančią šiuos du atskirus garsinius reiškinius. Gilinantis į minimus procesus, paties autoriaus buvo sukurta nemažai kūrinių, kuriuose tiek intuicija, tiek algoritmai buvo derinami komponuojant muzikinę medžiagą. Spektrinės muzikos generavimui ir formavimui pasitelkti algoritmai buvo realizuoti su *IRCAM OpenMusic* programine įranga. Kalbant apie intuityvų kompozicinio proceso aspektą, medžiaga buvo plėtojama žingsnis po žingsnio atsakant vis į tą patį klausimą: „Ką aš noriu girdėti toliau?“

Tokio komponavimo proceso, kai taikomos dviejų krypčių operacijos (modusų kildinimas iš spektro, ir atvirkščiai), išdava buvo išradingų faktūrų ir struktūrų susiformavimas. Ši estetinė nuostata yra demonstruojama ryškiais pavyzdžiais ir ištraukomis iš šešių kūrinių, sukurtų 2006–2010 metais.