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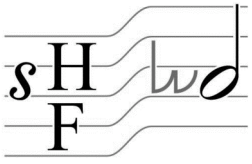

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VOL.1 (SUMMER 2009)

HOW I BECAME A CONVERT: ON THE USE OF MICROTONALITY, TUNING & OVERTONE SYSTEMS IN MY RECENT WORK

Peter Adriaansz

Introduction

Before I set out on a discussion of some of the ways microtonality features in my work, a brief, or maybe not so brief, introduction to my training seems to be called for. After all: being trained in the West, one never *automatically* veers in this direction. I would venture to say that it always implies a choice at some point. In my own case, this choice is a relatively recent one – no more than five years at the most. But as is frequently the case with choices of a fundamental nature, it turned out to be one from which there was little turning back once I had decided to cross that particular threshold. There is definitely a 'before' and an 'after'. The choice, moreover, turned out to have implications, which eventually touched on all domains of musical matter. The world of 'micro'-tonality, with its associations of a small, specialized professional field, in reality turned out to be a world of 'macro'-tonality. In this article I thus intend not only to discuss some of my working methods in varying degrees of detail, but to also touch on some of these broader implications, which both sparked it off and came as a result.

As with most composers trained in the West, my initial education was exclusively slanted towards composition with the twelve available pitches neatly formatted between one octave of the piano. For a relatively long time, this was my universe. Although I was aware of the existence of other systems, with two ethnomusicologists for parents and a fairly extensive knowledge of and love for non-western music, the area of further subdivisions however seemed excessively remote to me and essentially alien to the construction of most of the instruments I was asked to write for. Furthermore, I simply couldn't 'hear' it.

It seemed to me at the time that there were basically three approaches towards microtonality that one could choose from:

1) Microtonality in the form of imported oriental modes or scales;
2) Microtonality as a form of inflection;
3) Microtonality as a form of 'serial pitch-expansion'.

Though definitely sympathetic to the first of these directions, none of these possible approaches succeeded in convincing me entirely though, due to the fact that they were either a) entirely out of sync with the nature of the instruments they were mostly transported onto – resulting in a form of musical tourism to my ears; b) no more than a form of embellishment, or gesture – something which was already *non grata* to my compositional concerns; or c) when pasted onto highly expressionistic scores - as most of them were – too reminiscent of a teeth grindingly out-of-tune Schönberg, seemingly devised for no other reason than expansion for expansion's sake, but without any form of true audibility or inner necessity. All three angles, in my mind, basically constituted *horizontal* attitudes towards pitch – something that definitely piqued my interest, but never succeeded in interesting me sufficiently to pursue in my own work.

So, how *did* I become a convert?

Development 1/Renunciation 1

After finishing my studies in the early '90s, I initially embarked on a more-or-less conventional life as a freelance composer: writing on commission for ensembles and orchestras. The pieces from this period, though often deviant in their own particular way, I would still collectively classify as 'Eurocentric' in nature: implying, in this case, a certain emphasis on 'meaning', with pitch as the main vehicle of conveyance. A key element already present in these early works however was a total absence of 'development' in the conventional sense – something which, I had already discovered, was essentially alien to my nature.

Having never wholeheartedly embraced the linear, historical and basically humanist nature of European culture as the sine-qua-non for 'profound' art that it often made itself out to be, the first major crack in this edifice occurred in the mid to late '90s. Two factors were instrumental to this change in perception, of which one can be attributed to the influence of John Cage and the other to my accepting a job as artistic director of Percussion Group The Hague. Where the poetic severity and constant freshness of Cage's music and thought confronted me with certain philosophical choices, the in-depth introduction to the world of alternate sound sources of the latter - combined with a growing ability to analyze and name the many hundreds of different ways of producing sound - sharpened my ears to a world of possibilities outside of conventional instrumental practice. Listening to and working with the many instruments from all parts of the world – new as well as freshly invented - the innate differences among especially the pitched instruments clearly revealed to me how intimately connected sound, tuning and culture actually were. The simple existence of these instruments revealed to me, at the very least, the presence of cultures in which 'the interval' seemed to have a very different meaning than in the West. Unlike Western intervals, these intervals seemed to be authentically 'alive'.

Having been trained as an organist as well, I was naturally aware of the many battles in tuning systems that had occurred in the renaissance and at the time of the North German organ school. Putting the two together at least brought home to me that there were some highly problematic issues involved with the so-called 'progress' of tuning in the West.

Although my compositional concerns at this point mainly pertained to matters of form, several pieces written during this period clearly betray some of these exotic influences in their instrumentation as well (such as the inclusion of detuned porcelain bowls in the second part of *Music of Mercy pt. 3* (1996) and the fake gamelan in *3-pt. (untampered) Product* (1998), just to name two examples).

In essence, the 'development' in this phase - or 'renunciation' as I'd prefer to call it - (assuming that each development in fact consists of a rejection of something else which has become redundant) - could be defined as an overall renunciation of *hierarchy*, be it cultural (the domination of any particular culture over another – although in practice this eventually meant the demise of any Eurocentric allegiances in my own work) or intra-musical (the domination of any particular musical 'form' over another – in practice: the acceptance of any material entity as able to constitute 'music').

Still, none of this really applied to the area of pitch - supposedly, the entire *point* of microtonality after all.

Development 2/Renunciation 2

Somewhere between 2003 and 2005 a decidedly more fundamental change of perception suggested itself, however. This particular change of mind was fuelled to a large extent by circumstantial factors, the main of which was a growing awareness of the degree to which an overall culture actually dictates its own products – in fact, long before they have even been conceived in the makers' mind.

Although ostensibly remote from the present topic of *microtonality*, it became – nearly depressingly – obvious to me that much of our culture not only seemed to generate *itself* (thus enslaving music, as well as musicians, in my opinion) but also suffered from a form of *listening* - and this is where microtonality eventually comes into play - which on the one hand seemed nearly entirely 'event'-based ('value' seemed to a large extent determined by 'activity') and on the other hand, essentially didn't seem to concern itself with much more than relatively banal style-issues.

There seemed to be a great deal of impatience in this music culture, and what it seemed to say about its overall 'function' (the demand to be entertained through unremitting activity change and 'memory games') I began to find both infantile - in its primary emphasis on narrative and dialectics - as well as not conducive to real concentration. Although this may sound like a roundabout way of getting to microtonality, it nonetheless directly lead to it, since it clearly demonstrated to me the extent to which our hearing was intended to be guided by forms of *comparative, referential, listening* - a form of listening which in my view amounted to little more than an act of collective memory, rooted in history, but which essentially had very little to do with actually using one's ears.

Not only did this bring home to me some of the many surreptitious dangers of pragmatism (the various accepted conventions involved with catering to an existing system), but along with that, the need to redefine for myself what exactly I felt the 'function' of music to be and what exactly it was that I really wanted to hear and felt needed saying at this time.

Though all interconnected to greater or lesser degrees, this development eventually resulted in three areas of research:

1) The areas of open, variable, forms; notated in real-time
2) The relationships between 'sound' and 'time' and
3) The areas of resonance and vibration

In practice, it constituted the renunciation of 'events' in favor of the unadorned, straight line as governing musical principle (though this could also be construed as a natural by-product) and the acceptance of music as a physical part of nature, more closely allied to the sciences than to culture. My ideal in this became the image of a tree, a tree of which one could neither say 'this is a bad tree' nor 'this is a good tree', since it simply was 'a tree'; not much happening from the 'event point of view' (and comparing its virtues to any other tree would seem slightly ridiculous), but nonetheless definitely alive and a thing of beauty on its own terms. Akin to this somewhat simplistic image of a tree simply 'being', music, in my opinion, needed also to simply 'be' and to occupy itself more with acts of revealing than of creating.

Although I had always held the belief that music should strive to reflect itself as much as possible, this resulted in a view of music which became more research-bound than pragmatism-bound and also resulted in working in extended series rather than in individual products. As a composer, I also found myself moving away from purely acoustic composition to the area of electro-acoustic composition; using amplification, live-electronics, psychoacoustics and spatial acoustics as vital parameters of my work.

Eventually all of this led to a decision to 'specialize' and a true plethora of resulting works. But it was mostly within the context of investigating relationships between sound and time that microtonality eventually imposed itself naturally.[1]

[1] A key occurrence, in retrospect, was a meeting in 2004 with the renowned Korean *Kayageum* player Byung-Ki Hwang. Having had the opportunity to immerse myself much more in Far Eastern thought and music in the meantime, Hwang was however the first to draw my attention to an essential difference in approach to sound, between Eastern ears and Western ears. This difference he described in the concept of 'the aftertone': a significantly different approach to the concept of music, where 'the music' doesn't essentially lie in 'the attack' (as is the case in most Western music), but mostly in what happens *after* the attack. The attack itself is viewed as no more than a 'medium' with which to trigger a much more important, often infinitely subtle world of inflections. Considered within a larger context, this concept revealed an immense difference in the respective perceptions between not only sound and time, but also in what seemed to be 'an essence' and what seemed to be merely 'a trigger'.

Discussion of several works 2003 – 2008

In discussing several relevant works from this period – in the form of a kind of chronological progress-report - I have decided to categorize the following paragraphs under two headings: *Sound & Time* and *Vibration, Resonance and Speed*, the two most dominant areas of research in my work over the past few years. I use the term 'research' both literally as well as with caution – and always in the presumption that the reader understands that all research in the area of composition is done with a definite sounding experience in mind, but in many cases is also done for its own sake as well, simply in order to find out how certain phenomena work. In all cases however, this research found its way into the music itself; meaning that 'research' and 'music' are for me one and the same, in the same way that 'notation' and 'music' are one and the same and 'sound' (or 'orchestration') and 'music' are one and the same as well. These three areas are to me the vital cornerstones of composition.

I) Sound & Time (overtone- & ratio-related works)

Relevant works: (No 23) *Serenades II to IV* (2003) (open form; 'live sculpting'); (No 27) *Structures I – XVI* (2005-2006) (chromatic time, variable forms based on overtone series, correlations of time, interval and register, plus size and length); (No 30a) *La Voce di Zarlino* (2006) (vocal form; syntonic comma; modality; ratio rhythms); (No 36) *Concords I – III* (2007) ('irrelevance' of the series; other ways of generating harmony).

Serenades II to IV (No 23)

The first piece worthwhile mentioning in this context is a work called *Serenades II to IV*, written in 2003 for electric guitar quartet *Catch*. Due to the medium's potential for long, sustained sounds, this piece proved something of a breakthrough in several ways, since it forced me to come up with a form of notation which would enable certain 'sound envelopes' to occur. In this way, I would say the work was the first to consciously investigate specific relationships between sound and time.

Having been used to notating 'everything' up to this point, I soon realized that the domain of 'sound', especially sound which required unspecifiable amounts of time for its realization within a live environment, demanded its own form of notation and could never be forced into set time lengths. For a composer who was used to controlling all aspects, determined in no small degree by vital matters of form, this implied a very different approach. Also, bearing in mind that I had been trained as an 'acoustic' composer in the first place, this type of thinking was like skating on thin ice.

In the final section of the *Serenades* (see Figure 1) a procedure was employed for which I coined the term 'live sculpting': a procedure which implied that a) each sound was to be designed 'live' on stage, b) that progress from sound to sound (or from chord to chord) could only occur once each sound or sound shape had been achieved, and c) that all of this had to be done by *ear*. The *musician's* ears, that is. Although never using the term again, this form of music making, through the successive acts of listening, choosing, designing and completing proved not only to be a major ear-opener, but also something I would use extensively in later works.

Also in the area of tuning the piece is worth a brief mention, since it was the first piece to make a tentative, but later rejected, attempt at detuning (arbitrary quarter-tone detuning in this case). Basically consisting of very clear, juxtaposed, chords however, the detuning ended up

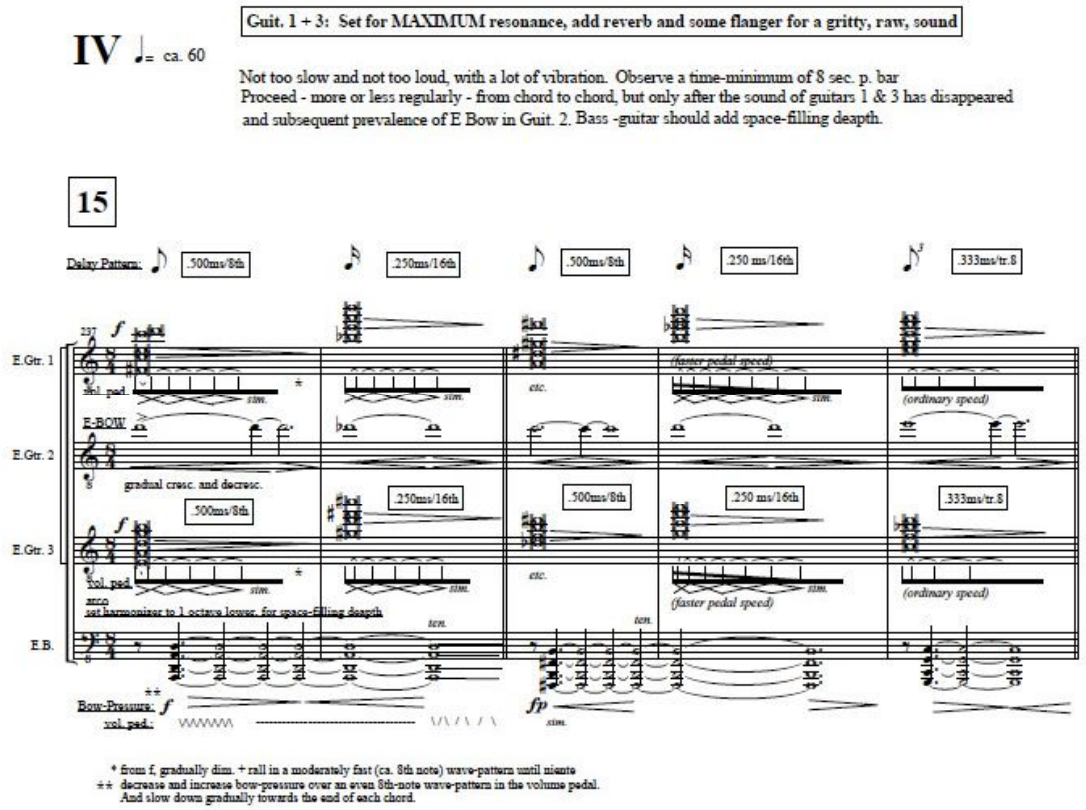

Figure 1: opening of last section of Adriaansz, *Serenades II to IV.* ©AsZoh Press, 2004.

sounding somewhat like the aforementioned example 3 on the first page of this article: 'accidental' – and was thus accordingly rejected.

Structures I – XVI (No 27)

It wasn't until 2005 however that I picked up the thread again. Interspersed by a trio of pieces dealing with 'translations' of mathematical formulas, the first work to continue in this line was a series called *Structures I - XVI:* a collection of sixteen works for unspecified, variable set-ups - from small ensembles to large orchestral forces with or without live delay - lasting well over six hours in total.

All the materials for the individual pieces were derived from the harmonic series and focused strongly on 'time-interval' relationships. The *Structures* were essentially the first to do away with 'events' and to focus entirely on sound production and listening, as well as being the first piece to dispose with individual parts for the players, requiring them to play from the score or from specific group scores instead. The set-up for each of the works was 'variable' (meaning that any collection of instruments could in principle tackle the scores) and was timed by means of a central stopwatch (thereby also disposing of a conductor in the process and restoring much of the responsibility to the musicians themselves). Governed by a painstakingly assembled ground set of 'rules', the players were then left free to enter and choose pitches at their own volition. Inspired by the centenary of Einstein's 'Golden Year' and dedicated to the undeniable pioneer of this form of music making, James Tenney, the works aimed at an essentially 'harmonic' type of music: a type of music in which the perception of Time could be both 'timeless' (through the musicians' free entries) as well as 'tangible'

(through a set of measurable interval-durations). In their preoccupation with the act of listening, the works also aimed at creating a situation in which no obstacles could stand between the musicians and their undivided concentration on the sounds they were producing. Needless to mention, in dealing with the harmonic series the whole field of 'pure intervals' came into focus as well.

Divided into five sets (#27a, #27b, #27c, #27d and #27e), the works explored various ways of mapping overtone-derived chords in space. Within this 'mapping', chords could be produced in either 'linear' or 'non-linear' ways, indicating either a) mono-directional forms - ascending, descending, approaching from opposite directions ('Cross'-forms) or diverging from a central point ('Wedge' forms) – or b) multi-directional forms, which constituted the majority of pieces and indicated that chords could be formed from all points in space at any time. All in all, the various works, whether mono-directional or multi-directional, consisted of two 'types' of music: pieces revolving around the eventual formation of a perfect 'harmonic' chord (i.e. according to the series), or entirely static pieces revolving around 'octave replacements' within limited harmonic ranges.

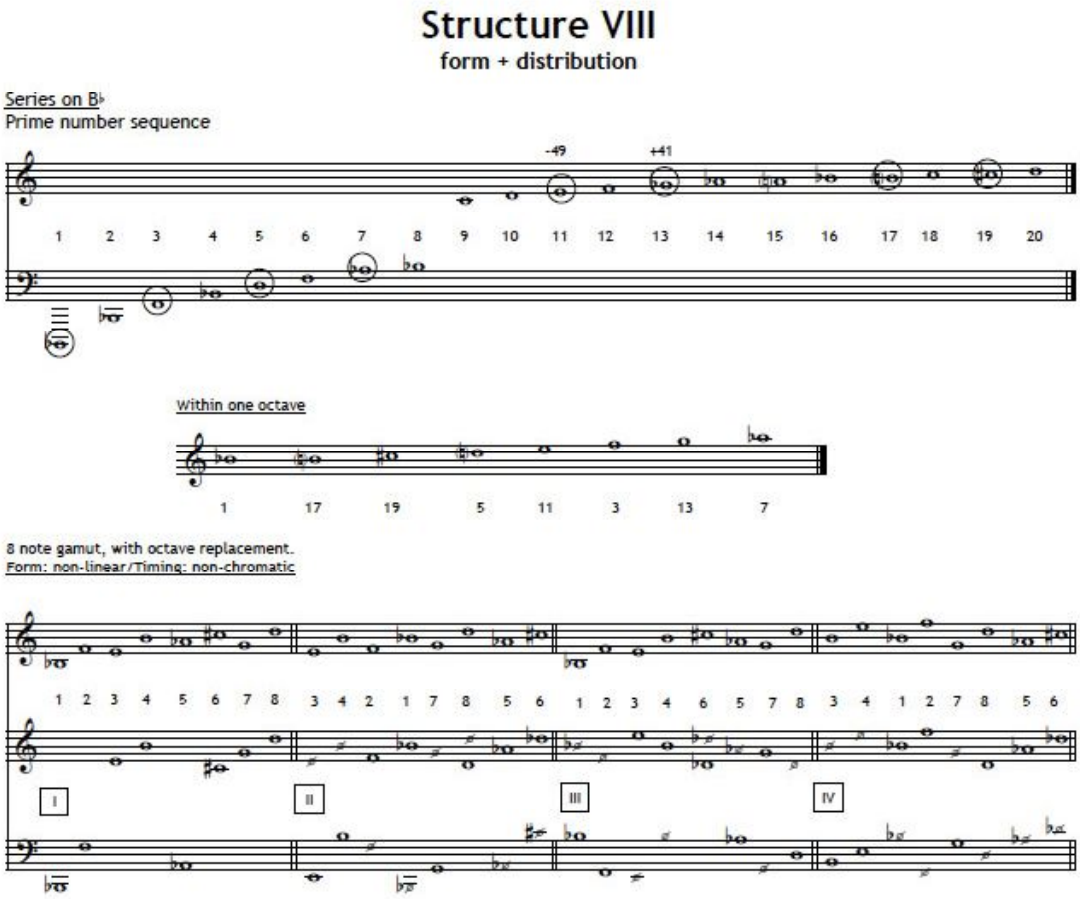

Figure 2.1: form and distribution in Adriaansz, *Structure VIII.* ©AsZoh Press, 2005.

The guiding principle behind all of the works was a 'one-pitch-at-a-time' construction (see Figure 2.1), in which each newly appearing pitch would be linked to the last and, as an interval, would be coupled to set time-lengths. These time-lengths were based on multiplications of the smallest interval (i.e. a minor second interval having a set duration of 20 or 30 seconds, a major second would be twice that length, a minor third three times that length, and so on). When used in this strict sense, I called the division of time 'chromatic'

(meaning, augmentation by one degree at a time and thus reflecting the size of each interval accurately in time; see Figure 2.2). When used in a less strict sense (as was sometimes the case when the size of intervals used would simply take 'too long' to approach strictly – the larger the interval, the longer the time between entrances and the longer the entire piece after all), I would use three different durations (basically short, medium and long) to cover the differences in interval. This I then called: 'non chromatic time'.

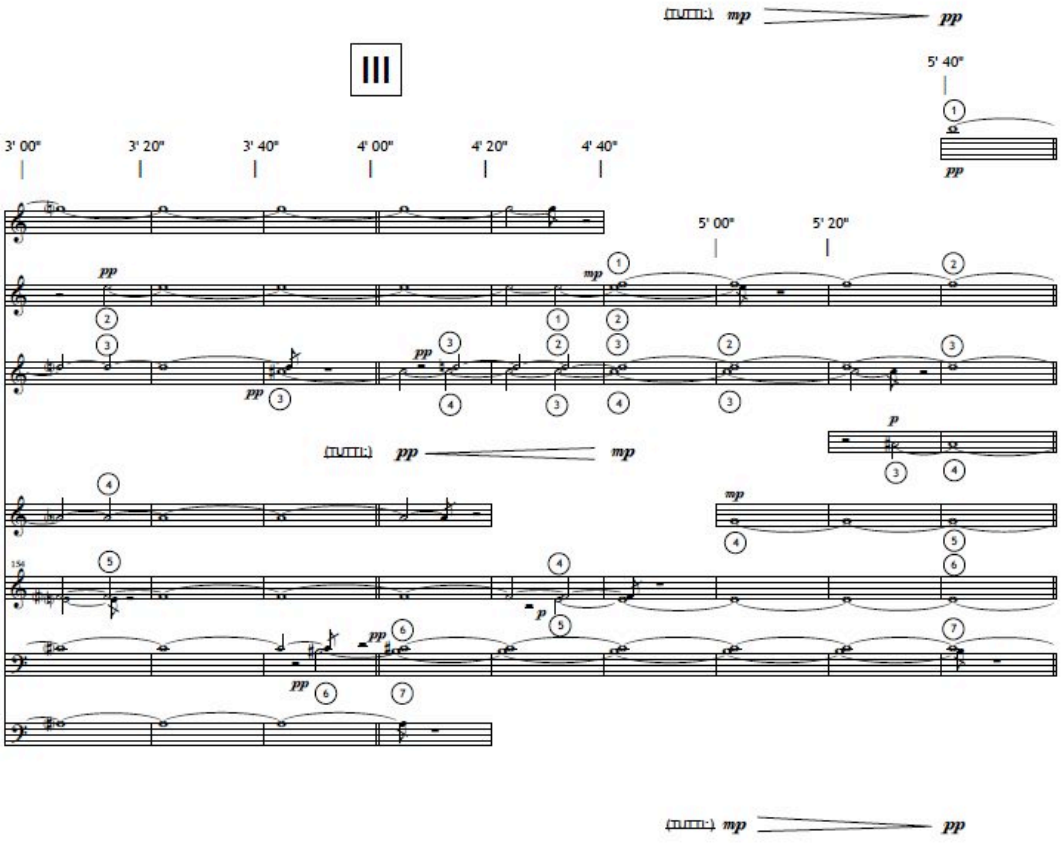

Figure 2.2 extract from Adriaansz, *Structure IX.* ©AsZoh Press, 2005.

The main advantage of this 'time-interval' system was that there existed not only a credible relationship between pitch, interval, register and time (something which was immediately discernable on the page as well – one could actually 'see' the music), but also between the size of the chords used and the overall duration of the piece as a whole (the bigger the chord, the longer the piece obviously). In this way the shortest piece of the collection (*Structure VII,* consisting of no more than 6–voiced chords within a span of an octave-and-a-half) lasts thirteen minutes, while the longest (*Structure X,* with an eventual chord consisting of up to thirty-three voices, spread over a six- to seven-octave span) lasts close to an hour. The 'twenty-second-average' for the smallest interval was based on what seemed to be a 'sufficient' amount of time for a pitched sound to 'sound': less than twenty seconds would reduce a vertical process to a horizontal one, while significantly more would simply be detrimental to one's patience. Even to this, there are limits…

In choosing the actual partials, I eventually found myself departing from only two fundamentals for the entire set of pieces: B flat and E natural (a choice based on the most commonly accessible bass pitches for most instruments). When studying the harmonic properties of either series, I found that both fundamentals more-or-less complemented each other, the higher usable partials of the one being closely linked to the lower ones of the other

(not entirely illogical for a tritone relationship). Partials were then subsequently chosen according to either prime numbers or according to uneven numbers, but never exceeding the 24th partial in practice. Within pieces I would then either a) stick to one basic gamut of pitches, b) exchange and alternate between primes and uneven partials, or even – in a few cases – c) 'modulate' between fundamentals.

Partials however, were never notated as microtones, even in the cases where they obviously *were* 'microtonal'. In an effort to not restrict the availability of certain pitches to specific instruments (and thus seriously limit the sounding potential to 'the same instrument always for the same pitch'), I opted to leave this part open, in favor of constantly changing fields of sound. In practice, musicians capable of producing partials as natural overtones were asked to do so, while others were given the freedom to intonate as they were able and as the environment seemed to imply. This somewhat quirky relationship between equal temperament and non-equal temperament, in reality created a vibrant surface, which, in my opinion most benefited the music.

La Voce di Zarlino (No 30)

A work which followed up directly on some of the harmonic concerns of the *Structures*, but combined these with specific tuning concepts and the use of ratio-rhythms (as well as attempting to deal with the 'lost art' of modal singing), was a work for unaccompanied voices called *La Voce di Zarlino*.

Where the *Structures* derived much of their harmonic wealth from a heterogeneous abundance of instrumental color, the particular challenge of *Zarlino* lay in attempting to transport the principles of the *Structures* ('pure', 'harmonic-based' sound) on to the medium of voices – obviously unable to color with the same kind of richness or diversity, or to hold their pitches for significant amounts of time. Another challenge lay in having to come up with a way in which to treat text within the confines of an unemphatic, un-metered kind of music; music which was essentially antipathetic to forms of 'text setting'.

Intended, curiously, for performance during the Holland Festival for *Old* Music (which had furthermore imposed the theme of *Venice* on its programming) there were obviously several obstacles to overcome. Researching 15th and 16th century Venice however, with a specific focus on some of the modal/chromatic 'tuning battles' that had occurred at the time (the debate between Lusitano and Vicentino comes to mind), an interesting figure emerged in the person of theoretician and composer Gioseffo Zarlino. Aware of the fact that Zarlino was not only one of the main instigators of the eventual Western conversion to equal temperament (and thus somewhat rejected by the modal schools of singing), but that he had spent equally much time on attempting to find alternate tuning systems - through his design of the *Archicembalo,* an instrument which would be able to follow the perfect modal intonation of singers - an intriguing figure imposed himself on the scene. Reading through the entire *L'istitutioni Armoniche* (1558) and the later *Dimostrationi Armoniche* (1571) as well as his famous books on counterpoint and composition (an often extremely arduous task, I might add) I started looking for 'speculative' passages, passages in the form of private opinions concerning the nature and function of music. Though these kind of 'private opinions' were far and few between, a handful of useful texts eventually surfaced, describing not only certain aural observations about sound, but also describing his discovery of the *syntonic comma* (a tuning-dichotomy pertaining to the difference between four justly tuned perfect fifths, and two octaves plus a justly tuned major third, a difference equal to the frequency ratio 81:80, or around 21.51 cents). Wanting to paint a representative portrait of his theories, I decided to use this syntonic comma as a basis for the work and to use the ensuing 'ratio rhythms' as a method for dividing the text over the singers.

In the first movement of this work, I decided to take the five available 'just' fifths, as supplied by one of the readings of the syntonic comma (in the order C-G-D-A-E) and to top the sequence off with two 'illegitimate' tritones on either side. A choice which resulted in the sequence: F#-C-G-D-A-E-Bb (see Fig.3a). Placing these pitches, subsequently, within the

harmonic series on C gave me the order: C-G-E-Bb-D-F#-A, translating into the ratios 1:3:5:7:9:11:13 while 'raising' partials 7,11 and 13 in the score (i.e. not notated as microtones, but definitely hoping for a pure, 'harmonic' result, due to the potential of unaccompanied voices). From this sequence, the entire work is eventually derived (see Fig.3b). Placing the pitches subsequently into two sets of interlocking triads and using the same 'one-pitch-at-a-time' process used in the *Structures* (and then replacing pitches from the sixth new entry on), the work travels through eight transformations of this basic gamut of seven pitches. Due to the numerical relationship between the basic gamut (7) and the order of pitch replacement (every 5), no single chord is thus ever repeated literally (Fig.3c).

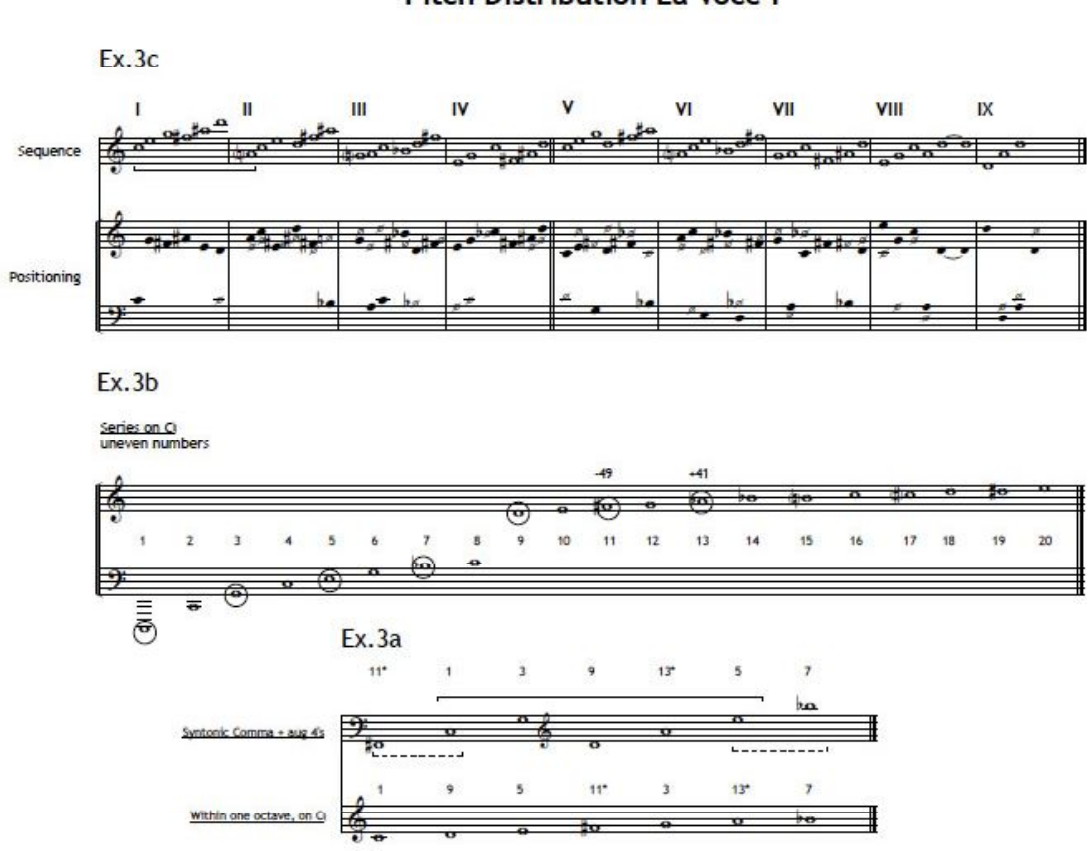

Figure 3 a, b and c: pitch distribution in Adriaansz, *La Voce di Zarlino.* ©AsZoh Press, 2006.

Throughout the first half of the first movement[2] the text is placed as a sort of recitative, in which three different tempi collide with each other, causing the sound to flow incessantly. At the exact half-way mark of the piece, this 'collision' is abandoned however, in favor of simultaneous chord-changes at coinciding points, once every twelve seconds. The text placement for these final six minutes is entirely derived from the harmonic ratios supplied by each pitch. Though often uncharacteristically complicated in its notation - pitting devilish ratios of 11:9:5:4:2 etc. against each other - the use of these ratio rhythms nonetheless cause the music to vibrate according to what one might call its 'natural vibration'. Coinciding with this gradual invasion of staggered homophony, the text - initially slightly out of sync - eventually moves into sync, while emphasizing important communal words in the process. As the

[2] The first movement is based on the perceived 'imperceptibility' of the *Harmony of the Spheres* and several observations about the 'rotation' and 'speed' of the planets.

harmonic gamut is also eventually reduced and more and more of the text starts coinciding, the overall *quality* of sound also becomes more homogeneous, causing the text to 'echo' within itself.

In the third movement of *Zarlino,* this use of ratio-rhythms is taken to an even higher extreme. Based specifically on the 'movimento' (i.e. the 'motion') between 'high' and 'low'[3], the movement literally transcribes harmonic motion in pitch as well as in register, with the faster frequencies consistently on top and the slower ones below (as can be seen from Fig.4, where the numbers above the staff indicate the ratios as they change with each newly appearing pitch).

La Voce di Zarlino thus attempts to paint an entirely 'faithful' portrait of a given topic by deriving all parameters of compositional choice from materials already supplied from the outset; in the process hoping to demonstrate many of the wonderful acoustic qualities which are simply up there 'for grabs'.

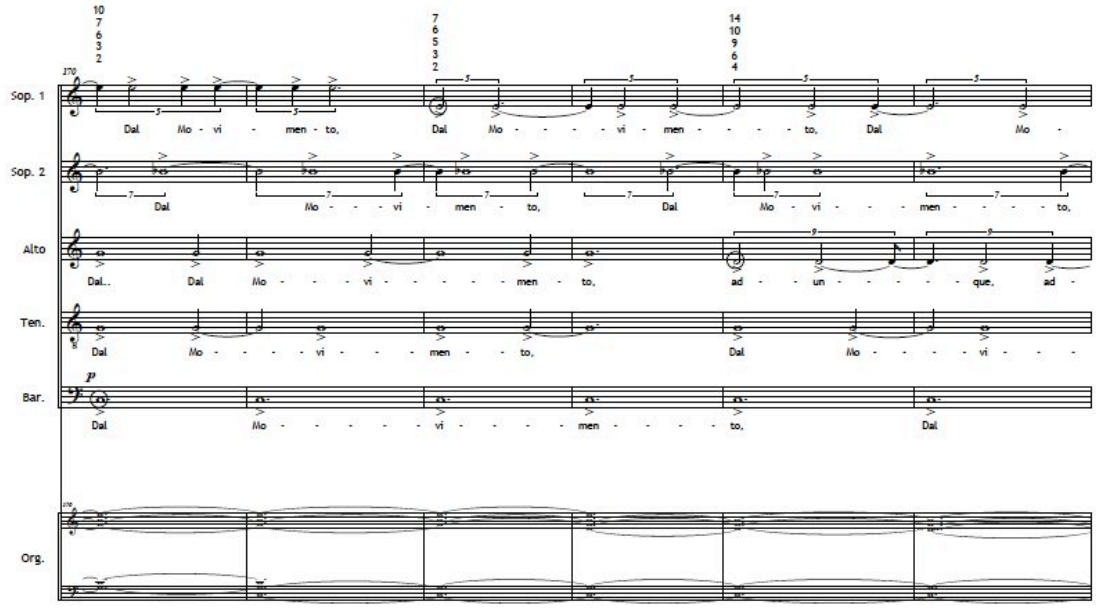

Figure 4: extract from third section of Adriaansz, *La Voce di Zarlino.* ©AsZoh Press, 2006.

<u>*Concords (No 36)*</u>

A final related work, written in 2007 as a kind of afterthought and worthy of a brief mention, is a work called *Concords*. Written initially as a small birthday present, in the form of a 'signature' for the 20th anniversary of the Ives Ensemble, the work later grew out to a full-blown 50-minute work.

Using the same techniques employed in the *Structures*, this work, ironically, proved that one didn't need the harmonic series at all in order to obtain a rich, vibrant surface full of harmonic overtones. In three sections, the work takes the available letters supplied by the name 'Ives Ensemble', and transposes these onto three different harmonic systems: a) chromatic (12 available, equal-tempered, pitches – resulting in a gamut of seven pitches), b) within the series (as many available pitches as are available within the alphabet, resulting in a gamut of

[3] To quote Zarlino: *D*al *Movimento adunque nascono I Suoni & le Voci; ma perche della movimenti alcuni sono equali, & alcuni inequali; & di questi alcuni sono tardi & vari; & alcuni veloci & spessi; pero e da sapere, che dalli primi nascono I suoni gravi & dalli secondi gli acuti.* (Zarlino, *Istitutione Armoniche* II, Cap.11.)

ten pitches – with appropriate microtonal notation) and c) according to prime number pitches of a series (however many letters in the sequential order of the alphabet, and supplied by the name 'Ives Ensemble' concur with prime numbers – resulting in a gamut of 6 pitches) (see Figure 5). From any point of view: an entirely arbitrary pitch-choice, ungoverned by any specifically desired outcome.

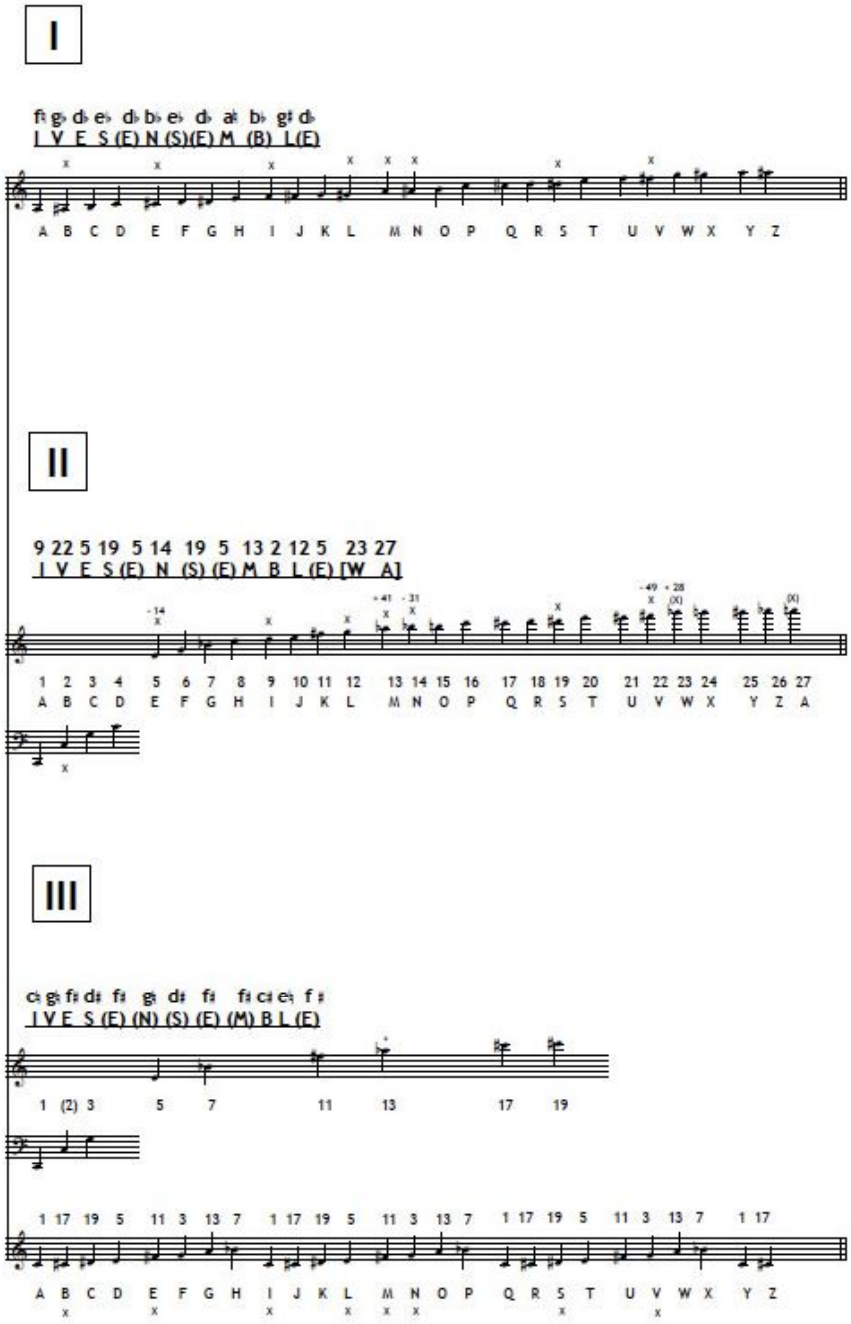

Figure 5: pitch materials in Adriaansz, *Concords.* ©AsZoh Press, 2006.

In practice - though the work was only performed a year-and-half after its composition and my subsequent work had in the meantime already moved away from the series as primary source material - this 'arbitrary' pitch-choice turned out to work just as well as the overtone-

related material. Mainly, I guess, because the many pitch-doublings and the emphasis on sound more-or-less naturally veer in that direction, at least when employing this particular kind of technique.

Conclusion 1

Although with the exception of *Concords* none of these works explicitly notated *micro*tones, working within the harmonic series nonetheless 'automatically' produced them and caused the emphasis to lie on many matters associated with their ratios and with forms of 'pure tuning'. More importantly though, the many 'orchestrated unisons', which are characteristic of quite a few of these works, opened up the entire area of *vibration,* making it an important factor in the overall sound world I was striving for. The conjuring up of this *Deus ex Machina*, the 'true music' behind all of our endeavors, eventually made me define my efforts as an attempt at 'creating conditions in which certain things could happen'. Wanting to understand more of this, however, inevitably meant diving into the smallest increments as well.

II) Vibration, Resonance and Speed (tuning- & microtonality-related works)

Relevant works: (No 35) *Prana* (2007) (concept of 'one pitch generating all'; concept of *Deus ex Machina* + manifest/unmanifest; tuning); Actual microtonality: (No 37) *Waves 5-7* (2008) *(*esp. *Wave 6*; ghost harmonies*);* (No 39) *Waves 11-13* (2008) (periodic entries; 'moving tones'; use of sines); (No 41) *Enclosures* (2008) (very small increments; microtonality and speed); (No 42) *Music for Sines, Percussion, eBows & variable Ensemble* (2008) (microtonality and tempo)

Prana (no 35)

One particularly unrelenting idea that kept on resurfacing through some of the aforementioned works was the idea of 'oneness': the concept of whether or not an entire work could be conjured up through the use of nothing but a single fundamental. That is: what would happen if a (pretty large) pool of musicians were only supplied with one fundamental and then left alone initially to double pitches, then pick up on appearing overtones, double those again, transpose downwards, listen, pick up the new overtones etc. - like giving voice to the *God in the Machine*? How long could the piece last? How long would it remain interesting? What would become audible? In other words: how much could actually originate from *one* thing?

These were some of the questions that occupied me while working on a piece called *Prana*, a large-scale work based on texts from the *Bhagavad-Gita* and St. Augustine's *Confessions.* Premiered in the fall of 2007, this sixty-three minute work for the first time brought together several of my favourite media: electric guitars, percussion ensemble, eBow piano[4] and an ensemble of amplified female singers. (Figure 6.1.)

Prana (Sanskrit for 'breath', or 'life') was also the first piece I would now call 'sacred' in its basic intentions. Having been consistently confronted with various metaphysical properties of sound, it seemed unavoidable to deal with this matter at some point.[5]

[4] The eBow (short for 'electric bow') is a small electro-magnet, originally devised for use on electric guitars, but also suitable for pianos when adapted slightly to fit the wider strings. The device basically excites the strings, causing them to sound for as long as the battery holds out. When combining many eBows, the whole area of sympathetic string-vibration comes into play. The eBows are equipped with two settings: one produces fundamentals and the other overtones. When combining these settings in various ways it is possible to produce overtone-rich aggregates of sound and by exerting different forms of pressure on the eBows it is also possible to alter the focus.

[5] Wanting to limit myself to matters of origin and purely technical matters – and wary about delving into potentially pretence-ridden matters of metaphysics or spirituality - I have decided to refrain from any comments pertaining to these more speculative sides of microtonality, even though these 'metaphysical properties' are often in fact very primary motivations.

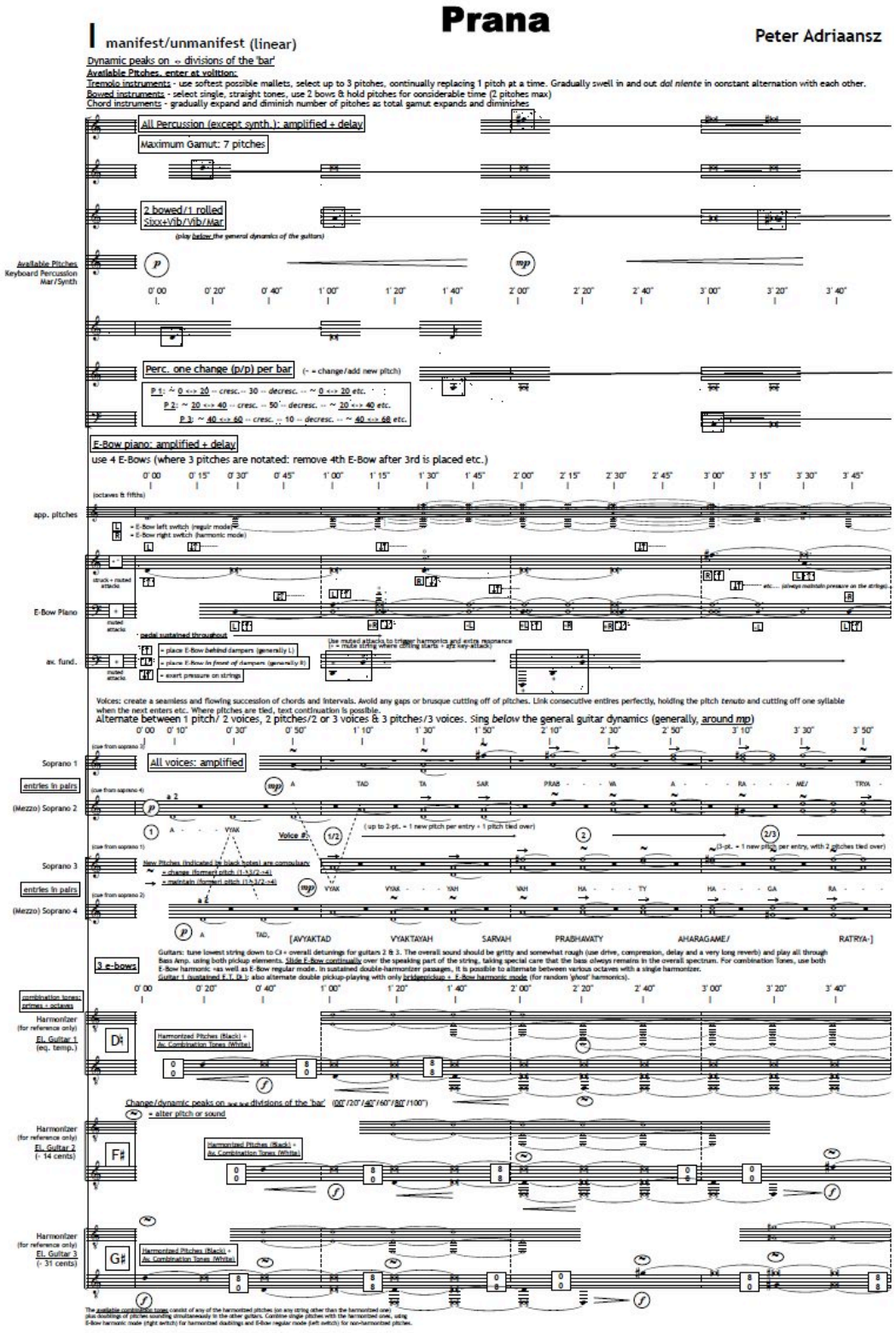

Figure 6.1: opening of Adriaansz, *Prana.* ©AsZoh Press, 2007.

From the outset, two concepts thus dictated the piece:

1) The aforementioned idea of 'unity': a situation in which 'all stems from one';
2) The concept of 'infinity', dealing mainly with Buddhist notions of 'the manifest' and the 'unmanifest' (the 'heard' and the 'unheard', the 'seen' and the 'unseen') as a spiritual parallel to the attempted conjuring up of a *Deus ex Machina.*

In order to achieve this so-called 'unity', the ensemble is – somewhat ironically - *divided* into two different groups, with accordingly different functions. These two groups consist of a *generative* group (consisting of the guitars + eBow piano) and a *responding* group (all others).

Within the so-called *generative* group, the main emphasis lies on the three electric guitars, from which the workings of the entire piece can also be derived. In scoring the parts for the guitars, the *de facto* 'fundamentals' of the piece, two things were very important from the outset: 1) maximum vibration and 2) overtone-rich collections of very deep sounds.

In order to obtain the vibrant sound I was looking for, two of the three guitars were detuned to the 5^{th} and 7^{th} partials (i.e. to the 'flat' major third – minus 14 cents - and the 'flat' minor seventh – minus 31 cents, thus sharing a difference of approximately 15 cents between each of the guitars). This resulted in a collective sound, which not only amplified all natural ratios up to the 7^{th} partial when playing in 'unison', but also guaranteed extremely vibrant beating in the very lowest octaves.

Wanting to also obtain as many overtones as possible, through the use of often extremely low and deep registers, the guitars were subsequently rigged up to a battery of 'harmonizers', special effect-boxes capable of producing multiple intervals when only one would be played (a device comparable to the octave-doubling or mixture stops on an organ and, in fact, used in a similar fashion). In practice, this resulted in not only extending the overall range of the guitars by a good two octaves, but also ended up providing the desired wealth of overtones.

Written in five cyclically connected movements of twelve minutes each – plus an additional three minutes for the central section – each movement of the piece initially 'collects' pitches and then gradually discards them again. Starting from a single guitar pitch, which is then doubled by the other guitars and subsequently 'harmonized', each section gradually splits off into three separate tonal centers, which are then again 'harmonized' before eventually being discarded, one by one, until perfect unison is once again achieved. As each pitch, or pitch doubling, appears, it is linked to a set of gradually notated overtones, which are then distributed over the rest of the ensemble (the so-called *responding* group) in the form of a gamut of available pitches. This distribution is more-or-less governed by the following principles:

- The higher the degree of doubling in the guitars, the wider the amplitude of possible overtones;
- The higher the degree of harmonic variety in the guitars, the wider the overall gamut of possible overtones to choose from.

In choosing their pitches and entries, the percussion is basically 'free' (though gradually accelerating from one entry per minute in Part I to three entries per minute in Part III – and then reversing this process again), while the voices enter and exit - either in pairs or as individuals – according to regular time-intervals. As such, each section of *Prana* – with the exception of the third - gradually builds up sound complexes, which are then deconstructed again, according to a 'natural' appearance of the overtones.

The differences between each section are essentially provided by different interval constellations in the guitars and by gradual changes of register (ascending twice and then descending twice). In this way, the first section creates harmonic gamuts around the

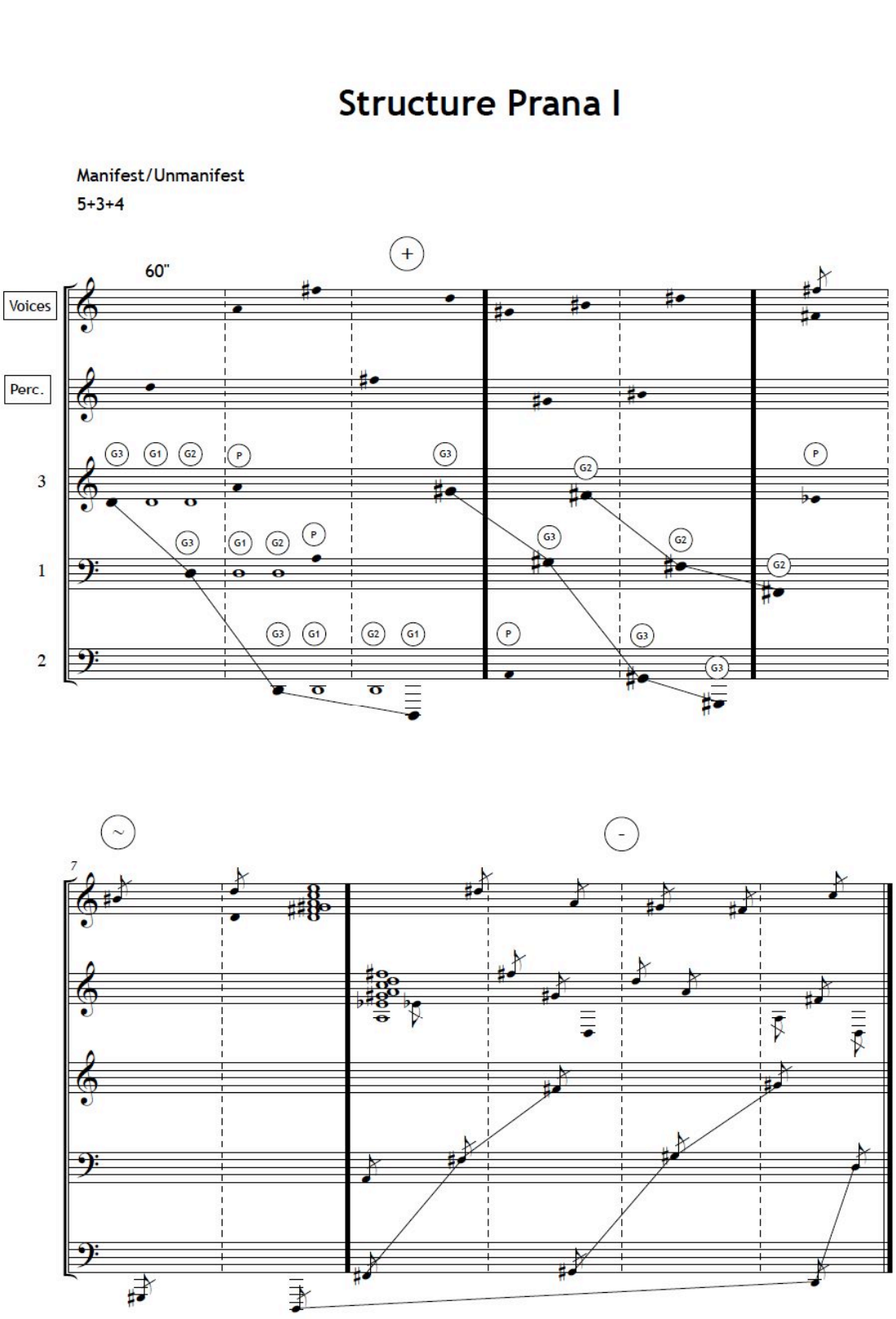

Figure 6.2: representation of the structure of Adriaansz, *Prana I.* ©AsZoh Press, 2007.

fundamentals of D, G# and F# (i.e. major 3rd + major 2nd) (Figure 6.2); the second, gamuts around F#, A# and D (i.e. two major 3rds); the third, gamuts around D, F# and F natural - and eventually Bb (i.e. major 3rd + minor 2nd); the fourth – reversing again – gamuts around F#, A# and D (i.e. two major 3rds again) and the fifth, finally, gamuts around D, F# and C natural (i.e. major 3rd + major 2nd). All in all: six fundamentals for the entire work, linked together via major 3rd relationships. (In the last section, incidentally, the tuning is finally 'correct', with guitars 2 and 3 (-14 and –31 cents respectively) on their appropriate corresponding pitches within the series. An entirely just tuning, resulting, at least to my ears, in a significantly different sensation of groundedness).[6]

As a whole, *Prana* thus seeks to create a vast 'body' of natural sound, through observing and then more-or-less 'transcribing' the workings of the overtones as accurately as possible. In combination with the relatively wide scordatura in the guitars, both factors contribute to an experience, which is often extremely physical in its impact. Also, in the form of the voices' regular alternation of entries and in the uniform lengths of each of the sections, two elements were introduced which were to play an important role in later developments.

Waves 5-7 (No 37)

The next piece in this particular line of works partially carries on with some of the concerns of *Prana* while doing away with some of the others. Where *Prana*, as described, notated all the 'possible overtones', resulting in a powerful vastness of sound, the next, logical, step was to attempt to do away with all of the notated overtones in order to see how much could be conjured up *without* actually notating them – while still obtaining most of the basic power supplied in *Prana*. The first work to do this - and the first work to include an entire section actually *notated* as microtones - was *Waves 5 – 7*, written at the end of 2007 for Ensemble Klang.

This new series of works, generically grouped under the title *Waves,*[7] combines certain features of the *Structures* (most essentially, the concept of chromatic time), but differs from this work in so far as it eventually abandons all forms of overtone-derived harmony and employs both free (variable) as well as fixed (compulsory) elements in the areas of performance as well as orchestration.

Having worked on many amplified pieces by this point, I found that certain elements had become indispensable to the sound I was aiming for. Essentially desiring an environment in which there could always be elements of interplay between electric and acoustic sounds (i.e. between 'eternal' and 'non-eternal' sound), as well as between 'loudspeaker-space' and 'local space', this meant standardizing certain instruments as well, the main ones of which were electric guitar, eBow piano and bowed percussion instruments. But especially the eBow piano had become stock and staple of many of the works discussed so far. To a certain degree this new series sought to magnify specific properties of the eBows, of which their ability to produce *ghost harmonies* - more-or-less arbitrary, but still somewhat predictable, 'twists of fate' - were to me undeniably the most magical, but often hard to observe due to the relative softness of the instrument in combination with other instruments.

Like *Prana, Waves 5 – 7* are similarly scored for an entirely amplified ensemble consisting of fixed, 'generative' parts (electric guitar and eBow piano) and free, 'responding' parts (percussion and an ensemble of winds). Where the eBow piano makes equal-tempered harmonic combinations, using five eBows, the electric guitar is instructed to make similar harmonies, but with free, microtonal intervals, using a loop-station. The use of both instruments in this case, however, is specifically designed to conjure up not only sympathetic vibration but, wherever possible, to allow the so-called ghost harmonies to appear. This

[6] With regard to the often very disruptive detuning of the guitars: in order to stay in tune the singers are required to intonate to the A 442 of the vibraphone. Both percussion as well as the singers are required to form a 'unified tonal front', regardless of the guitars' scordatura. A formidably difficult task, given the often-close interrelationships between some of the fundamentals.

[7] Started in January 2007, with the cycle *Waves 1 - 4*, for eBow piano, sines and pre-recorded material.

phenomenon occurs most noticeably in the central, microtonal, section of the piece, *Wave 6* – where at specific points, and sometimes only under close scrutiny, clear shadow-harmonies can be heard to appear.

Akin to *Structures*, the microtonal parts of *Wave 6* are 'placed-in-time' chromatically (meaning that each progression from pitch to pitch is accorded set time-intervals) and are notated in the form of a harmonic 'gamut' (i.e. collections of available pitches from which the instrumentalists can choose). Unlike *Structures,* however, this process is filled entirely with microtonal intervals, centering around a three-octave B natural, widening out to include either the C natural on one side or the A# on the other. Throughout the piece, the microtonal motion within each separate register occurs in the form of three simultaneous *parabolas* – revolving over or under a central pitch. These three parabolas are subsequently divided over eighth-tones (12.5 cents), sixth-tones (16.6666 cents) or quarter-tones (25 cents) – i.e. according to the interval-ratios 4:3:2. Linked to their 'chromatic' placement in time, this results in the eighth-tone parabolas making two complete revolutions before the section is up; the quarter-tone parabola, one complete revolution; and the sixth-tone parabola, one-and-half revolutions. The overall process in this way corresponds to the equivalent time-proportions of 2:3:4, thus placing 'time-ratio' entirely in sync with 'interval-ratio'. Combined with the aforementioned functions for eBow Piano and electric guitar, the clear beatings, which are inherent to these many close intervals, helped create the right conditions for 'harmony' to surface as well.

In its similar attempt to seduce the *God in the Machine*, *Wave 6* (as well as the entire set) is thus related to *Prana*, but with the major difference that none of the overtones are actually notated, making the overall sound more terse and the appearance of harmony much more illicit. With the arrival, in *Wave 6*, of 'authentic' microtonality based on chromatic gamuts, a new direction had however emerged, which brings me to the following, for the time being final phase of this particular development.

Waves 11-13 (no 39)

Leaving any trace of the series behind us from this point on, the following three works to be discussed are based entirely on chromatic relationships as basis for the harmony and on researching correlations between microtonal motion and microtonal pitch. Though retaining specific elements described before (most notably, chromatic time and the interaction between variable and fixed forms), these works can clearly be grouped together, since they not only feed off one another (a common trait in my working habits), but also immediately extend specific areas of research left untouched in a directly preceding work.

The first of these works, *Waves 11 – 13* – written in March 2008 for the *LOOS electronic acoustic media orchestra* and scored for 'Treble Instruments, Variable Ensemble and Sinetones' - 'simplifies' certain elements of *Wave 6* by reducing multiple-octave microtonal activity to microtonal activity within one single register, but also introduces two important new elements in the form of:

a) 'Moving' tones (supplied by an obbligato sine tone part);
b) regular, *Periodic*, entries.

Where many of the works discussed so far could be characterized by an ongoing 'entering and exiting' of instruments, resulting in a continuous flow, the introduction of these 'periodic entries' was made in order to not only enhance a greater perception of time-development (due to their regularity), but to include observable occurrences of silence as well. Also, in their guise as 'solo entries', the Periodic Entries were intended to obtain a higher degree of intimacy and detail than could be achieved with the thicker – and much more monumental - textures of some of the former works. Allotted to specific solo instruments, designed to stand out from the rest of the ensemble, these Periodic Entries subsequently became another of the so-called 'Fixed' score-elements (meaning that the notated information was obligatory and not subject to choice, as is the case in the 'Free' elements of these scores).

In essence, *Waves 11 – 13* is probably one of the clearest examples of 'Time-Interval' pieces I have written. Formatted into three uniformly long sections of six minutes each, the Periodic Entries (which are in this case equivalent to the overall 'form') subsequently revolve around one specific interval and one specific register per movement.

Thus,

- *Wave 11* consists of a minor second cluster in medium register, divided over two alternating lines of ten equal, 10-cent, divisions (twenty entries in total);
- *Wave 12* consists of a major second cluster in low register, divided over three alternating lines of ten equal, 20-cent, divisions (thirty entries in total) (see Fig.7) and
- *Wave 13* consists of a minor third cluster in high register, divided over four alternating lines of ten equal, 10- and 20-cent divisions (forty entries in total).

As can be seen from the above - and unlike the division of *Wave 6* into eighth, sixth and quarter tones - the microtonal increments in *Waves 11 – 13* are now standardized into an entirely abstract system of either ten or five equal divisions per minor second, using *cents* as the main method for identification. The decision to use decimal divisions of the semitone, signified by cents (instead of quarter-, sixth- or eighth-tone accidentals) was prompted partly by the desire to further subdivide the semitone and partly for practical reasons, since divisions into abstract cents are simply by far the most practical method for musicians to 'visualize' incremental proportions.

The Periodic Entries are then placed into clear 'Cross-forms' for each separate section, centering on pure unisons at the beginning, middle and end of each movement. Due to the combination of the expanding intervallic gamuts and the uniform durations of each movement, the entries subsequently both *speed up* with each section (from once every fifteen seconds in *Wave 11* to once every seven-and-half seconds in *Wave 13*) as well as achieve greater *density* per section, as more and more of the Periodic Entries overlap; thus bringing the domain of 'interval' and 'time' into a very close relationship.

Closely related to this 'Pitch-Time' unity, a second important element of the score lies with the introduction of 'moving' microtonality, in the form of sine tone sweeps. Aside from simple matters of beauty, these pure sine tones were mainly introduced in order to investigate the relationships between microtonal *motion* and time - resulting in a form of microtonal 'counterpoint' in the score - but also in order to give the Periodic Entries something clear to refer against – and thus enhance small fluctuations in sound. This resulted in the constructing of a sine-patch, which combines both of these functions: stationary, as well as moving tones, always alternating one-at-a-time.

Throughout *Waves 11-13* these 'sweeps' are divided over two alternating sine tones, which either approach each other and move away again (*Waves 11* and *13*), or move in ascending or descending forms of parallel motion (*Waves 11* and *12*). Striving for clear, observable parallels between the sines and the Periodic Entries, the sines then mirror these entries as closely as possible, in speed (accelerating per section, by gradually increasing the width of their individual sweeps while simultaneously decreasing the amount of time allotted to each sweep), as well as in register and density.

In this way,

- The sines in *Wave 11* - tuned a minor 2^{nd} apart - move at speeds of 10 cents per 15 seconds, gradually approaching each other and meeting up at the halfway-mark between both sines, before eventually both descending and joining up on the lower of the two sines by the end of *Wave 11*;

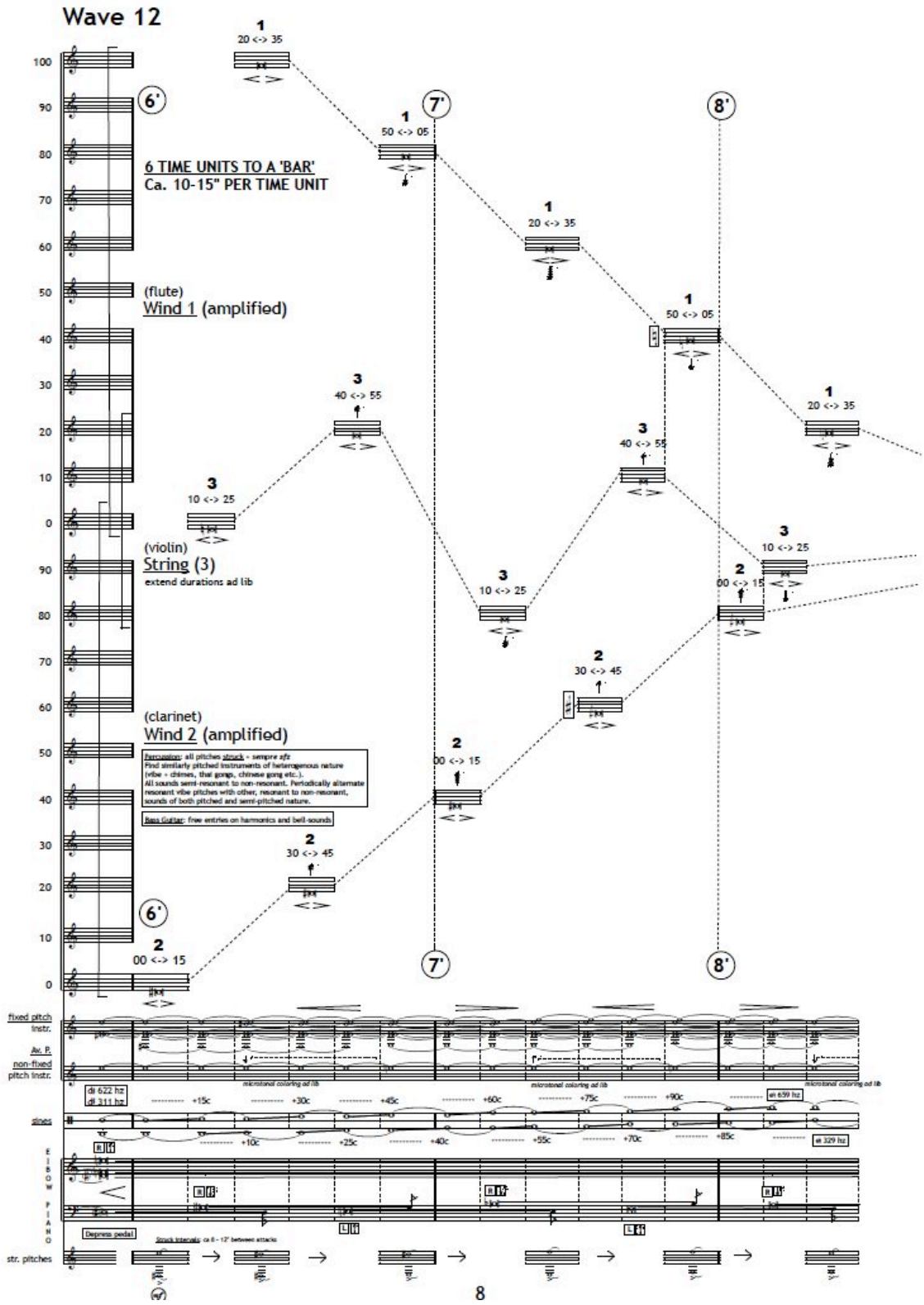

Figure 7: beginning of Adriaansz, *Wave 12.* ©AsZoh Press, 2008.

- The sines in *Wave 12* - tuned in octaves - move in alternating parallel sweeps of 15 cents per 10 seconds, ascending a full semitone by the halfway-mark, before descending again to their original positions (see Fig.7); and
- The sines in *Wave 13* - tuned a major 9^{th} apart (and now doubled in both registers, i.e. four sines in total) – move at speeds of 25 cents per seven-and-half seconds, gradually approaching each other and meeting on a pure octave by the halfway-mark, before moving outward again towards the end.

As can be seen from the above, the sines thus complement the Periodic Entries in all respects: through acceleration (speed), expansion (register) and doubling (density), in this way contributing to a clear one-on-one relationship between both parties.

One final notable feature to be mentioned is the inclusion of extremely low, periodic, sub tones, contrasting with the overall range of the rest of the ensemble. Introduced, in fact, while working with the bass player of LOOS, this 'sound-chasm' became a recurring feature in subsequent works.

Enclosures (No 41)

The second of this trio of microtonal works, *Enclosures*, was written in the summer of 2008 for Trio Scordatura. This twenty-minute work, scored for voice, viola, MIDI-keyboard and sinetones, takes several features from *Waves 11-13* - most notably the 'interval expansion' per part, as well as the elements of Periodic Entries and Fixed vs. Free parts - but focuses to a far higher degree on investigating the speeds of extremely small microtonal increments. In this case: increments as small as $1/50^{th}$ of a semi-tone. Superimposing various forms of clear logic in its construction, this leads to a work which is often highly complex in the area of microtonal reflection.

The decision to investigate this particularly minute area was actually prompted by a pragmatic problem I ran into when trying to deal with the instrumentation of Trio Scordatura: an instrumentation which included a MIDI-keyboard capable of any increment under the sun. A wonderful contraption, one might think, but in combination with the sine-tone patch I was intending to use, I found myself confronted with two very similar-sounding instruments, both capable of infinite sound and both capable of any increment imaginable. Part of this 'problem' was initially solved by giving both instruments entirely different functions: allotting the functions of *constant motion*, with static dynamics (only perceptually growing or decreasing due to matters of density) to the sine tones, while allotting the functions of *graded motion* and amplitude swells to the MIDI-keyboard. With the sine tones in constant motion however – and needing at least one instrument to stay as close as possible to the original chromatic gamut, for purposes of tonal focus – this meant that only very minute increments could be portioned out to the keyboard: a pragmatic solution, eventually resulting in no less than ninety-six separate tuning preparations for the keyboard.

'But are any of these infinitely small intervals actually *audible*?'… one might be tempted to ask. (In so far as this obvious question hadn't already surfaced several times in the reader's mind by now). To this I can only answer: as an isolated pitch-event, 'most probably not'. But in the form of long successions of regularly increasing or decreasing increments, gradually changing bit by bit, most definitely 'yes'. What one tends to hear first and foremost however is not a *pitch*-event, but simply the sensation of something speeding up or slowing down.

Which brings one of the not-so-hidden topics of this article up to date again:
'Pitch' and 'speed' are intimately connected and clearly discernable in the smallest of increments (so why even concern ourselves with matters of *rallentando* and *accelerando?* It's all there already…).

Divided over three uniform movements of 7 minutes each, the parts for voice and viola in *Enclosures* essentially conform to the formats used in *Waves 11-13*, i.e. 'Periodic Entries' consisting of two to four contracting or expanding lines - with forms of 'unison' at beginning,

Enclosures

Peter Adriaansz

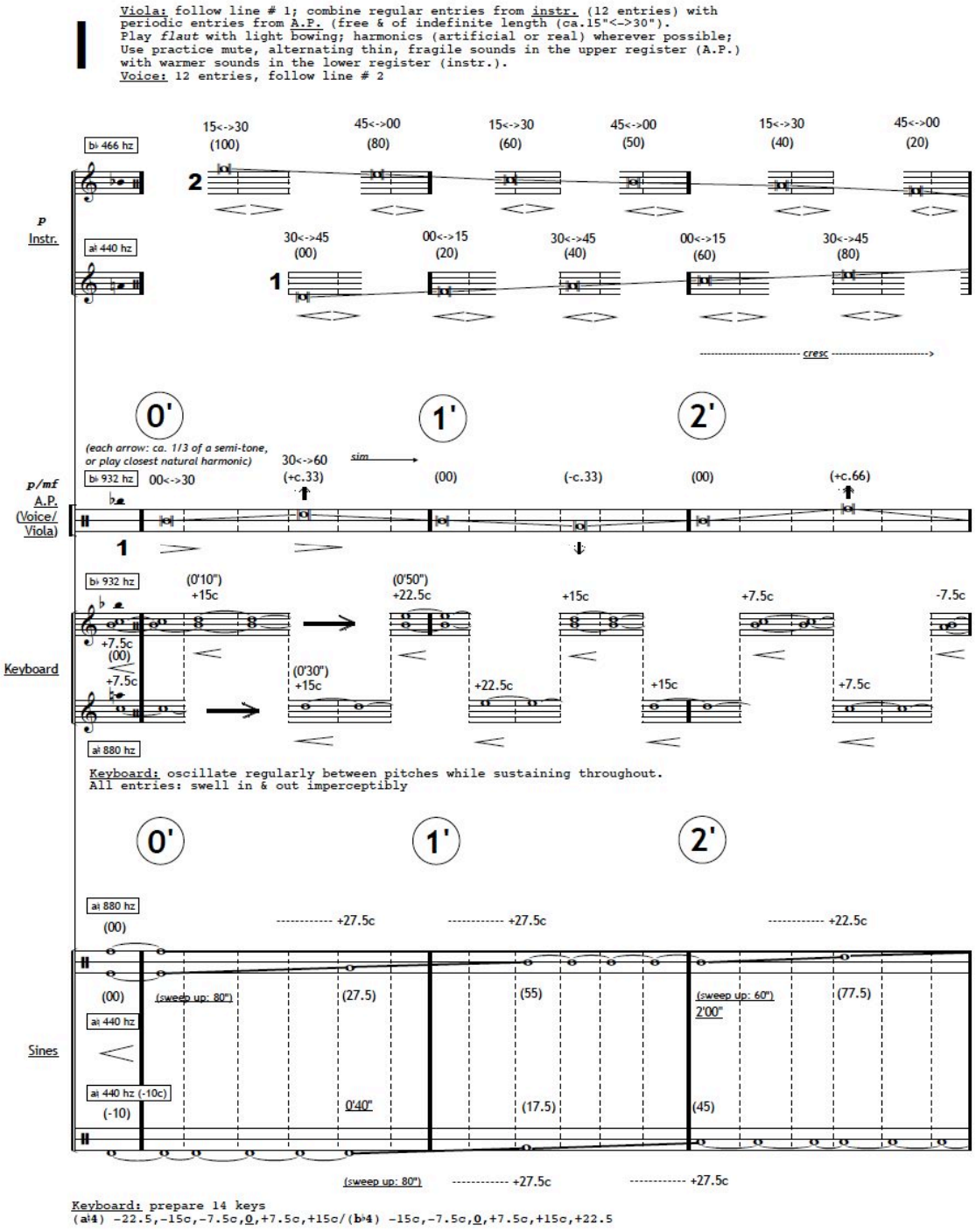

Figure 8: opening of Adriaansz, *Enclosures.* ©AsZoh Press, 2008.

middle and end – which are divided over gradually expanding chromatic gamuts in different registers. The microtonal subdivisions are similarly based on increments of 20 cents (*Enclosure 1*), 10 cents (*Enclosure 2*) and combinations of 30- and 10 cent-divisions (*Enclosure 3*), with the time intervals between entries again accelerating from once every fifteen seconds in the first section, via once every ten seconds in the second, to once every seven-and-a-half seconds in the third. Aside from the Periodic Entries, the two instrumentalists are also supplied with a gamut of 'available pitches', in the form of parabolic curves, which are placed in registers outside of the 'main' register and from which they can choose and combine at will.

The parts for keyboard and sines are however a good deal more complicated than in the former work and can actually only be explained by looking at each section as a whole.

Conceived in such a way that each member of the ensemble – i.e. (1) Periodic Entries (voice + viola), (2) keyboard and (3) sines - *encloses* the amplitude of one or more of the others,[8] each of the sections basically allots different increment values to each of its members. These values then remain consistent throughout the entire section. In this way, in the first section for example – divided over two semitones in two octaves and written in perfect mirror form - the Periodic Entries 'enclose' the sines in the lower register, while the keyboard 'encloses' the sines in the upper register. Though partially an abstract construction, this has the Periodic Entries moving at 20-cent intervals, the sines at 10-cent intervals and the keyboard at 7.5-cent intervals, though each of the members has different overall interval-widths in which to work (see Movement I, Figure 8).

Each member of the ensemble then proceeds through time in a different way, with the Periodic Entries moving in *linear steps* in the lower octave, the keyboard in *parabolic steps* in the higher octave ('over', for the first half of the movement and 'under' for the second) and the sines, starting as an 'out-of-tune' octave with the two lower pitches tuned 10 cents apart, gradually sweeping up over an entire semi-tone and approximately half of a semitone before retrograding this process for the second half. In this way, the sine tone part is a particularly complicated entity, since it concerns itself more with preserving specific amplitude-widths in relation to very precise speed divisions than with simple motion through time.

Throughout the remainder of the piece, the basic features described above – linear motion vs. parabolic motion, mirror forms vs. linear forms and, often wildly differing forms of 'amplitude enclosures' - remain intact, though subdivided and orchestrated differently for each section.

With keyboard increments eventually ranging from 2 cents and 5 cents in the final section, via increments of 7.5 cents in the first, to increments of 10 cents and 25 cents in the central section, each of the three sections ends up having an entirely different character, with the central, second section obviously standing out as the most 'microtonal' of the three due to the 'large' 25-cent increments.

Only in the last section, however, is the true topic of 'speed' fully revealed, when the keyboard passes through a gradual, linear, expansion of 2-cent intervals. Accumulating a string of twelve such consecutive 2-cent steps by the halfway-mark – against two static pitches - and then reversing the process, the section first speeds up dramatically, before winding down again, demonstrating clearly how microtonality and speed are interrelated.

Thus, even though partially using identical forms to those used in *Waves 11-13*, *Enclosures* eventually ends up sounding significantly different. This is due partly to the more limited setup - with fewer instruments allotted to the periodic entries than in *Waves 11-13* and a thus more horizontal, 'melodic' feel to the work - but is also due, and in a very significant way, to the special interaction between sines and MIDI-keyboard.

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[8] Meaning that each amplitude is 'surrounded' by a different, larger, amplitude – hence the title. A rule, which incidentally also applies to matters of register.

Music for Sines, Percussion, eBows & variable Ensemble (No 42)

The final piece to mention in the context of these three microtonal works is a work called *Music for Sines, Percussion, eBows & variable Ensemble,* written in the summer and fall of 2008, for ensemble MAE. As the title indicates, this work not only allots a role of importance to the sine tones, but also to the percussion, a role, which in essence deals with the relationship between microtonal motion and 'tempo'. Where *Waves 11-13* thus dealt primarily with 'time' and 'motion' and *Enclosures* with 'speed', *Music for Sines, Percussion, eBows & variable Ensemble* deals primarily with the areas of 'pulse' and 'tempo'. Though obviously related in many ways, each of these three works thus deals with fundamentally different aspects of microtonality.

Divided into five sections of uniform length (six minutes each, lasting 30 minutes in total) - and including all of the main ingredients discussed in the three preceding works - these five sections expand gradually, in a sort of jagged wedge-form (up one octave, down two, up three, down four etc.), while highlighting different registers and shape combinations with each new section. The more the piece moves away from the center, the larger the overall range and the more complex its figurations become. In the area of register, this work stands apart from the former two with the inclusion of both low and very low sections, thus giving the work a much 'darker' atmosphere than the two preceding works.

Since the activity of the Periodic Entries basically complies with most of the procedures described earlier – only now centering on wider interval constructions consisting of major-second gamuts – I will now mainly focus on the two most obviously deviating features of this work: the sines and percussion.

As for the Sines:
Constructed around varying combinations of major second aggregates, the sine-tones move at minute increments of $1/100^{th}$ of a semi-tone in the first section (i.e. increments of 1 cent) to $1/20^{th}$ of a semi-tone by the last (i.e. increments of 5 cents), while passing through the intermediary increments in the connecting movements (i.e. 2 cents, 3 cents and 4 cents respectively), hereby causing the overall sensation of tempo to either speed up or slow down depending on the register of each section. In this way, the sines automatically deal primarily with *pulse* - since 'motion' is as good as inaudible over extremely small increments. As a result, the motion of the sines is entirely *graded,* moving step-by-step through expanding and diminishing incremental loops and changing always at exact points in time.
In three of the movements, Movements I, III and V, these graded increment-changes are also accompanied by long, gradual sweeps.

In this way,

- The 'pulse tempo' for section 1 (1-cent increments in medium register) is basically 'slow' (lying between tempi of MM 10 and MM 30),
- The pulse tempo for section 2 (2-cent increments in high register) is basically 'fast' (lying between tempi of MM 42 and MM 328, with a central tempo of MM 126),
- The pulse tempo for section 3 (3-cent increments in low register) is basically 'slow' – yet slightly faster than section 1 (lying between tempi of MM 16 and MM 37),
- The pulse tempo for section 4 (4-cent increments in very high register) is basically 'very fast' (lying between MM 69 and MM 552, with a central tempo of MM 184) and
- The pulse tempo for section 5 (5-cent increments in very low register) is basically 'moderate' (lying between tempi of MM 12 and MM 72) – yet quite violent in its beatings.

As can be seen from the above, no 'absolute' relationships can thus be derived from tempo and register, since these are highly dependent on the width of the increments used.

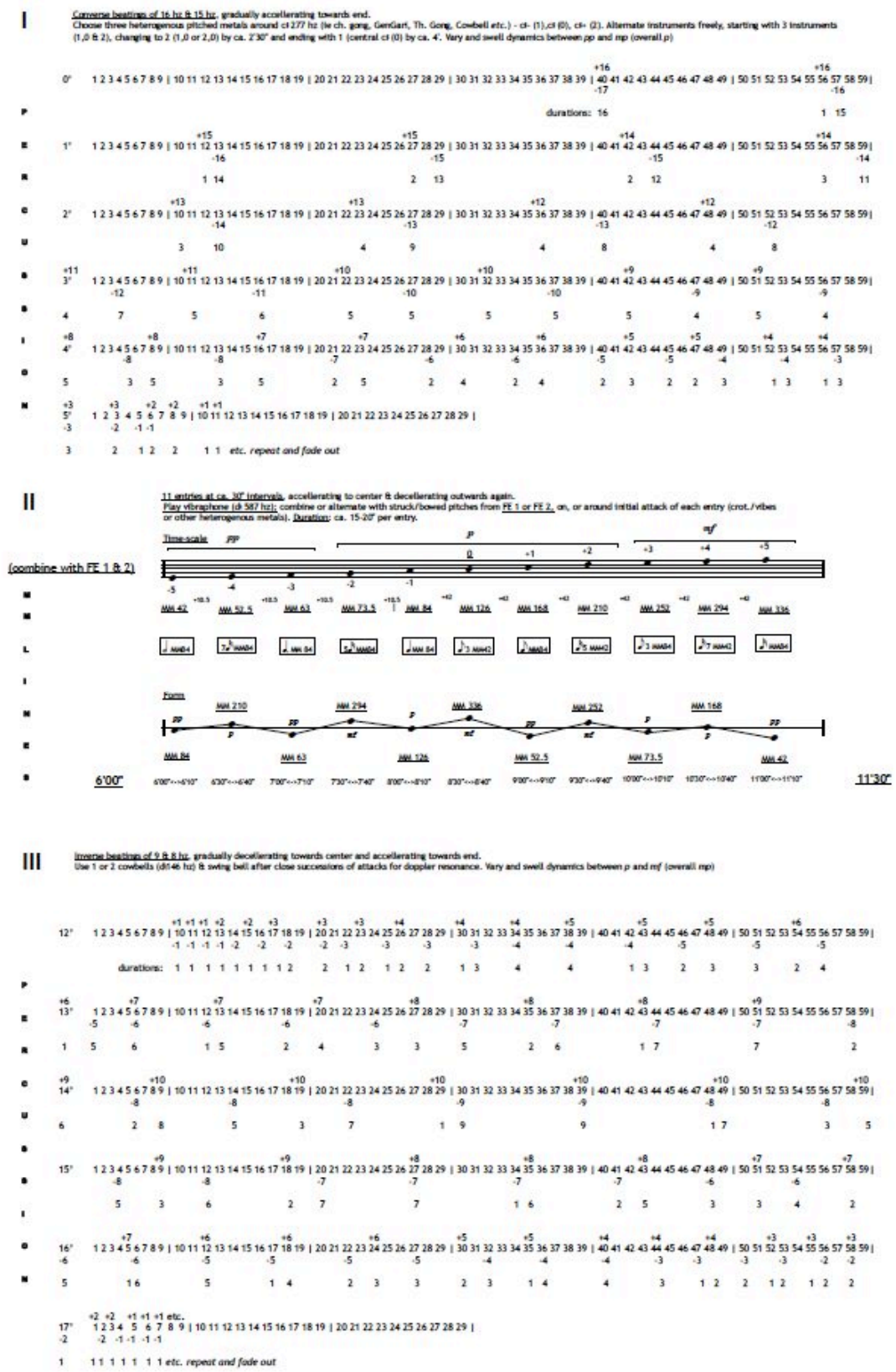

Figure 9: percussion material in Adriaansz, *Music for Sines, Percussion, eBows & variable Ensemble.* ©AsZoh Press, 2008.

The percussion part (see Figure 9 for Movements I to III) subsequently seeks to either highlight or complement some of these tempo properties. Constructed around specific lines from the Periodic Entries, the percussion essentially 'mirrors' the inherent beatings of these particular lines as they approach each other or move away from one another; but does this in two different ways:

a) As a simultaneous conversion of Hertz to Pulse, creating either converging or diverging, but always, *linear* attacks in relation to the lines it mirrors;
b) In the form of *Free Entries*, again based on a gamut of Hertz conversions, but creating *a-linear* attacks in relation to the lines it mirrors.[9]

In the first of these forms, the percussion moves through a series of gradually accelerating or decelerating attacks, which move either in *parallel* with the lines it mirrors (through copying the Hertz values of either line as they descend or ascend), or *a-parallel* with the lines it mirrors (through a retrograde of the same Hertz values). So where, for example, in the first section d 294 Hz and c 261 Hz gradually approach each other, the percussion, on c# 277 Hz, will play the corresponding attacks of 16:17 (in the form of one attack each 16 or 17 seconds) and gradually accelerate to 1:1 (in the form of one attack per second), thus *converging* as the two outer lines also meet up. And where, in the third section, Eb 156 Hz and C# 137 Hz gradually converge on D 146 Hz, the percussion will play the inverse attacks, through gradually decelerating from 1 attack per second to attacks of 10 against 9 - parallel to the Hertz difference between the adjacent pitches, but essentially *opposing* the outer lines' approach.

In the second form, the percussion entries are notated in the form of a 'Time Scale' of metronome markings - again derived from the Hertz motion of one specific set of intervals, but multiplying its tempo-proportions on both sides, with both higher as well as lower tempi. In this case however the percussion is free to enter at choice, thus creating a more random form of rhythmic counterpoint.

Through the interaction of *attack* (percussion) and *beat* (sine waves), *Music for Sines, Percussion, eBows & variable Ensemble* thus seeks to shed light on some of the more rhythmic aspects of microtonality.

Thus, summing up: as can be seen clearly – and this is something I hope to have demonstrated throughout the discussion of these final three works – everything, from time to motion and from speed to pulse, is derived from a simple, and sometimes not so simple, analysis of inherent microtonal properties.

Practice, Performance & Listening

Concerning the performance practicality of all these, often minute microtonal increments, I ought to point out, finally, that the musicians are never expected to intonate perfectly, for the simple reason that it is virtually impossible. They *are* however expected to approximate 'as well as possible'. Designing the scores in such a way that the role of the musician can in fact only exist by virtue of concentration (and, due to their variability, can actually only be accomplished in close collaboration), a far more important issue in this respect is the element

[9] Demanding an enormous amount of research, first calculating the placement of the increments and then having to convert each increment to its appropriate tempo (thus jumbling together seemingly logical, yet in practice highly *illogical* combinations of proportional numbers (the increments), sequential numbers (the metronome) and exponential numbers (hertz), *Music for Sines etc.* inadvertently ended up dealing with Stockhausen's attempt to *serialize* 'tempo' as described in his article *Wie die Zeit vergeht*. Having initially had the, somewhat logical, thought that each octave could, in theory, be twice as slow or twice as fast as its prime, I soon discovered that this could never be the case however, because tempo could never be derived from pitch, but only from pulse. Thus: no pulse, no tempo. Though sympathetic in its concept, Stockhausen's attempt to serialize tempo in the same way as pitch – by according specific tempi to specific registers, accelerating upwards - therefore turned out to be scientifically untenable: fast tempi can occur as easily in the lowest registers, as slow ones in the highest. A well-known fact of course, yet not to me.

of active *listening*. Listening, not only to one's own sound, but also to the sound of the others as well as that of the total environment – and then responding to this. This, in fact is the most important parameter of anything discussed up to this point.

It is also in this area, the area of 'listening', that I encounter some of the most common errors associated with the topic of microtonality, and especially the area of microtonal reflection; the main one of which can only be described as mistaking medium for matter. This 'error' (and it can really only be typified as such) occurs all too easily if one only listens to microtonality as a form of either 'pitch' or 'pitch development', or as a form of 'extended pitch technique', instead of focusing on the impact it tends to have on its environment: a form of listening which ultimately takes place on a secondary, transcendent, level. Unfortunately, this kind of listening, with ears trained to be on the constant lookout for meaning and often highly suspicious of what are sometimes derogatorily termed mere 'vibrations in the ether', is still quite paramount.

All it takes though, is a simple twist of the head…

The key to this music, in performance practice as well as in the concert hall, in my opinion, lies essentially in the ability to perceive its function as 'medium'. Akin, for example, to light refracting off mist: viewed from certain angles one sees nothing, but by turning the head slightly (an exact parallel to turning one's head when listening to small, interfering, increments through loudspeakers) a rainbow will often appear - seemingly out of nowhere.

In my own case, working with microtones does not occur out of a sense of purist tuning, or out of a desire to extend our tonal systems, but stems foremost from a fascination with their acoustic properties, both in thin as well as in thicker textures. Where the thinner textures tend to lead to the production of exquisite ripples in sound – like light briefly reflecting off a diamond – the thicker textures can lead to the summoning of harmony; and it is mostly from these pre-occupations that I use microtones.

Conclusion 2

Thus, the key issue to all of this, my so-called 'conversion', is that a particular essence of microtonality was only revealed to me through the medium of 'sound'.
Not through its horizontal properties, not through modes, scales or tunings, but mainly through its *vertical* properties. For me it ended up having everything to do with pulsation, resonance, vibration and speed, each of which was already imbedded in the DNA of any small interval. Coupled to my belief (see 'the tree') that everything is already embedded in everything – and that 'music' simply *is* - this was like discovering the atom: the kernel which caused all to grow and seemed to epitomize a way of listening, which eventually could lead to a real – and, in my opinion – necessary form of concentration.

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