

The Poles of Jupiter

Special Project

MUSI4016 Composition Portfolio and Commentary

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Composition as Research

The culmination of my studies and research with regards to the MRes in music I have been undertaking has taken the form of a thirty minute-long electronic and acousmatic suite in two movements. *The Poles of Jupiter* stands as the product of just over a year of experimentation, research, collaboration and investigation into a range of styles and genres of microtonal music. This journey began around a year ago, when I decided to pursue an approach to microtonal composition that had enamoured and stimulated me for several years. I have taken tremendous influence from composer and musician Easley Blackwood Jr., and his work, particularly the 1982 suite *Twelve Microtonal Etudes for Electronic Music Media*. I have also been composing myself throughout the year also; this underpinning approach to composition as investigative research - with a critical and considerate lens - has propagated the work I have produced as part of my MRes Music studies I have undertaken at the University of Nottingham. This commentary is intended to accompany the two movements of *The Poles of Jupiter*, *Tempest* and *Jovius* respectively, and elaborate on the research-oriented compositional process behind them. I shall initially elaborate upon a short set of tangible research questions I have attempted to address and explore through my work, which have consequently informed the music I have produced as a result. I shall also consider influences, collaboration, and significantly, the technical aspect of producing this electronic music - as you shall see through a few of the research questions.

Research Questions

- What results are yielded by a consistent and calculated superimposition of different tuning systems?
- How can the dissonances and tensions afforded by these tuning arrangements be explored in a succinct, nuanced, and satisfying musical manner?
- Can I construct a custom temperament which factors in all of the aforementioned tuning systems, and compose seamlessly with it?

- How can the level of timbral and dynamic control afforded by working electronically mould this microtonal music into a resonant, ethereal, and turbulent sonic experience - befitting, for example, the eponymous poles of Jupiter?
- What is important to consider and work towards when realising this music in an acousmatic space?

To reiterate, the music that I have composed so far this year for both the Specialised Studies I and Specialised Studies II modules was an experimental and research-driven endeavour; the initial point of inspiration was provided through my aim to emulate Blackwood's *Twelve Microtonal Etudes* and their exploration of a series of alternative equally-tempered tuning configurations (ranging from 13 equally-spaced notes per octave, to 24).¹ I have already summarised what drew me to investigating these works more closely beyond just their stimulating tonal and harmonic discrepancies:

Easley Blackwood's prime directive with his seminal *Twelve Microtonal Etudes for Electronic Music Media* (1982) was to explore alternative equally-tempered tuning systems via a wealth of established and canonical musical tropes and formats - thereby democratising the alien sounds of microtonal harmony with recognisable cues. The unique intervallic relationships intrinsic to each tuning system are worth great attention and experimentation; I would liken the broadening of notes beyond 12 tone equal temperament to an artist having access to more of the infinite colour spectrum.²

A year of research and practice around this particular school of microtonal composition, upon which I have since expanded with the influences of other composers and ideas, has aided invaluable in giving me a developed and refined harmonic palate - which I had already decided I would pursue further after my studies have concluded. Indeed, the central harmonic and tonal concepts that underpin all of the supplementary musical developments I have had the opportunity to explore through *The Poles of Jupiter* (such as spatialisation, sound design and synthesis, and spectromorphology) have remained notably consistent with the compositional practices of Easley Blackwood and his peers. The manner in which these

¹ Blackwood Jr., Easley (1982) - *Twelve Microtonal Etudes for Electronic Music Media*, Op. 28, New York, G. Schirmer

² Birch, Liam (2022) - 'Specialised Studies II: Composition Pathway Essay', University of Nottingham, pg. 1

dissonances created by alternate tuning systems can be employed to 'augment the [harmonic] tension and thereby amplify the release'³ has been exceedingly refreshing to me, and has opened up many avenues for tonal exploration. Blackwood elaborates:

All these tunings produce intervals that are extremely discordant; and in some, there are no consonances whatsoever. But even the most discordant tunings contain at least one modal substructure that is harmonically coherent; and this, along with the particular ease of modulation afforded by equal tunings only, makes such tunings especially interesting regarding the possibility of new musical styles based upon forms in which thematic elements are set apart by different keys or modes.⁴

Once a level of comfort and familiarity had been established for myself within the compositional realms of alternative equally-tempered tuning systems, I naturally found myself wanting to push the boat out further, so to speak - whilst remaining tethered to Blackwood's principle of accessible microtonality which is still crucial to my musical goals here. This leads me to address my first research question, which is perhaps the most significant in terms of the compositional process itself, i.e. the selection of the notes.

Superimposing Equal Temperaments

The dissonances and harmonic clashes caused by a deviation from Western tonal norms (i.e. the abscondment from 12 tone equal temperament) can further be explored and utilised to a seemingly infinite, fractal extent through the superimposition of mathematically distant equally-tempered tuning systems. Analysing the mathematical properties and relationships of different potential temperaments, both in relation to each other and also in relation back to 12-EDO (Equal Divisions of an Octave), provides preliminary insight into their levels of consonant compatibility. Having worked with both 16-EDO and 17-EDO in the Specialised Studies I and Specialised Studies II modules respectively, I decided I wanted to start with an equal temperament with more notes. It is important to note that, despite all mathematic discrepancies between potential temperament configurations and 12-EDO, as the number of equal divisions of the octave rises, the spaces between the notes grow smaller and indeed

³ Birch, Liam (2022) - 'Specialised Studies II: Composition Pathway Essay', University of Nottingham, pg. 3

⁴ Blackwood Jr., Easley (1991) - 'Modes and Chord Progressions in Equal Tunings', *Perspectives of New Music*, Vol. 29, No. 2, pg. 166-167

closer to the human threshold of pitch distinguishability. This meant two things when I was considering my first EDO configuration (31-EDO) during the conceptual stages of my composition process: despite being a prime integer and therefore sharing no common notes with standard 12-EDO, 31-EDO's note configuration allowed for more scientifically consonant intervals and harmonies than 12-EDO 'according to the principles of just intonation - an approach in which [synthesised] pitches are [more closely] matched to the overtones of the harmonic series'.⁵ However, the wealth of notes available with 31-EDO that are relatively far more distant to the harmonic nodes can also be utilised to create much more unsettling, uncanny 'wolf intervals' - and indeed, the correctly nuanced balancing of the consonance that is closer to the harmonic ideal than 12-EDO and the dissonance that is so much further from this ideal than Western ears are used to processing in music today can yield far more dramatic, emotive, and stimulating tonal colours. Once again, these augmented dissonances make for a more fervid tension - and therefore a more satisfying resolution; the range of intervallic relationships can be infinitely expanded upon once one accepts the limitations of 12-EDO.

As mentioned before, exploring the musical potentialities of one equally-tempered tuning system can provide myriad harmonic points of interest - and in order to go further with this, one can implement the simultaneous voicing of disparate tuning systems. Although I began composing *The Poles of Jupiter - Tempest* with a 31-EDO tuning system, the first semblance of tuned pitches heard in the final mastered piece at around 00:26⁶ are through a synthesiser tuned to 14-EDO. Around the 01:00 mark, a group of synthesisers begin to sound at 31-EDO, followed by a more pad-like synthesiser at around 01:24 tuned to 39-EDO. These are the three equally-tempered tuning systems I composed with throughout both movements of *The Poles of Jupiter*, the remaining system I constructed myself (with the logistical aid of some collaborators) based upon the idea of superimposing and combining these systems, which shall be explained in more detail when my third research question is addressed.

With regards to the implementation and calculated refinement of the unique clashes and harmonic quirks presented by the superimposition of 14-EDO, 31-EDO, and 39-EDO respectively, a case must be made around the nuance and finesse that only comes with

⁵ Withington, Andrew (2020) - 'Just Intonation: A Basis for Enhancing Choral Intonation', *The Choral Journal*, Vol. 60, No. 7, American Choral Directors Association, pg. 26-41

⁶ Birch, Liam (2022) - 'Tempest', *The Poles of Jupiter*, Unpublished

research-driven practice and discipline as a composer. It would not be a particularly difficult undertaking to simply run amok with the exciting new opportunities afforded by microtonal harmony - producing eerily discordant messes and swathes of sound with little to no regards to other important musical practices and qualities. It is easy for inexperienced composers - I myself as an example I am familiar with the work of - two become overwhelmed with the alien sounds created by these alternative tuning systems, and therefore find themselves somewhat lost in a sea of 'crunchy' dissonances. Conversely, it may appear difficult at first to find a practical and accessible application for notes beyond the remit of a standard Western piano keyboard. Without a disciplined and careful approach, as is readily applied with more traditional music tuned to 12-EDO, one risks alienating the general audience with unpleasantly harsh dissonances handled improperly. Of course, it could be the case that a composer is actively seeking such dissonances in order to sate a thirst for the uncanny - to write music intended to disturb and panic audiences. But microtonal music has a lot more potential than the somewhat common Western perception of simply being purposefully 'out of tune' music.

Extensive research into the influential microtonal works of composers in a similar position to my own (i.e. raised in a Western musical idiom with harmonic and tonal conventions and 'rules') gives an inspirational insight into the largely untapped potential. I say untapped, not because significant compositional and performative work has not been done with microtones - quite the opposite is true - but because there is still so much more to innovate, to explore, to experiment with. Blackwood is among a select few American composers active in the 20th and 21st centuries I have looked into, whom all have had unique and stimulating approaches to microtonal music, but with certain similarities in terms of their final goals with the new music. When interviewed by musicologist and writer Douglas Keislar, these composers all shared their views on what interested them the most around composing with microtonal and non-standard tuning configurations. Blackwood commented on the aspect of 'finding conventional harmonic progressions, or at least coherent progressions found by extensions to the analogues [of non-standard tunings] in the more familiar tunings'.⁷ John Eaton, notable for his microtonal work with operas, has said that 'microtones permit a greater variety of harmonic and melodic motion, which in opera helps delineate and define

⁷ Keislar, Douglas (1991) - 'Six American Composers on Nonstandard Tunings', *Perspectives of New Music*, Vol. 29, No. 1, pg. 176-211

character'.⁸ Lou Harrison, who worked to great lengths with Just Intonation in a ultramodernist style, placed heavy stress upon 'real intervals' with 'whole number ratios [which] grab [the listener, and are] beautiful', and in contrast, the 'fake intervals like those of equal temperament' pale in comparison.⁹ Ben Johnston, who notably collaborated with Harry Partch, Darius Milhaud, and John Cage, commented on the acoustic applications of microtonal music, such as 'when [the] instrumentation contains a lot of winds, the timbral changes make the piece an interesting box of surprises. To get the intonation, the players might use alternate fingerings, lip the notes high and low, or pull out the barrel of the instrument, all of which change the timbre.'¹⁰ Joel Mandelbaum, who has composed extensively in 31-tone equal temperament due to its close approximation to just intonation, explained how 'extending the consonance to the seventh partial provides a fascinating means of enrichment [...] and retains traditional consonance and dissonance, unlike atonal music, which has to abolish the old to arrive at the new.'¹¹ And finally, William Schottstaedt does indeed comment upon the dissonant potential of microtonal composition, 'the unusual sounds, the intense dissonances in particular, such as the squeezed minor seconds and stretched fourths.'¹² With the responses from this interview in mind, and indeed the works composed by its interviewees, it is clear to see how broad the potential presented by such an expansive and liberating abstraction from 12 tone equal temperament is - and I truly consider myself enveloped by this potential, willing and eager to pursue more compositional opportunities with microtones and non-standard tunings.

Great care and refinement has to be carried out in order to compose convincing music with these microtonal configurations - it was important to me and my compositional aims to avoid overwhelming listeners with unresolved, unsightly dissonances. There are several aspects of the production of this electronic music I had to closely monitor in order to prevent this from occurring, some of the more technical ones I shall address in detail with my final two research questions. Summarising the influences of these composers (mostly Easley Blackwood) I would say that an effective approach to keeping harmonic, tonal, and melodic within both a composer's control and an audience's comprehension would be to maintain

⁸ Ibid.

⁹ Ibid.

¹⁰ Ibid.

¹¹ Ibid.

¹² Ibid.

some conventional and recognisable elements of musical structure and tonal/harmonic standards - as a grounding tether for listeners. I established this for myself early on in my studies this year, and it seems to have worked effectively.

Constructing a Custom Temperament

As mentioned in the third research question, a number of stimulating and complex questions arose when I started to compose with simultaneous equal temperaments - namely a question of cohesion and continuity around more closely combining these temperaments, in order to, for example, create one synthesiser patch that could handle the temperaments superimposed over one another. I soon sought consultation and collaboration from a few sources in order to help me to both conceptualise and technically realise a potential temperament in this manner. Indeed, the superimposition of distinct equal temperaments (which happened to be configured with coprime integers like 14, 31, and 39 - i.e. they share no common factors) would yield a noticeably unequal temperament encompassing them all. I was quickly reminded of the need for and establishment of a standardised (in Western circles, 12-tone) equal temperament in the first place; 'baroque musicians employed a variety of unequal temperaments [...] with individual keys exhibiting unique characteristics, the more frequently used diatonic keys featuring purer 3rds than the less common chromatic ones',¹³ a common example of an unequal tuning system, meantime temperament, often resulted in distinctively discordant intervals such as wolf fifths when modulating to the opposite side of the circle of fifths. This predicament had a workaround for me, however, as with many of the cacophonous tendencies and pitfalls intrinsic to composing with microtonal tunings - it became apparent that with the correct approach (and to some extent, restraint), these discordances could be an advantage.

With regards to the technical genesis and realisation of electronic microtonal music - especially considering the fact that I intended to supersede my previous works over the course of the year by not only fluctuating between temperaments within a single piece, but also combining them all together - it was necessary to seek out more specialised and advanced software configurations in order to sequence and synthesise this music efficiently and effectively. I had previously been working with Dynamic Tonality's Hex sequencer,

¹³ Bartel, Dietrich (2015) - 'Andreas Werkmeister's final tuning: the path to equal temperament' - *Early Music*, Vol. 43, No. 3, Oxford University Press, pg. 503-512

patched into their The Viking synthesiser through an internal MIDI transporter, loopMIDI, and then recorded the resultant .wav stem files and mixing them in a separate digital audio workstation (DAW), Cakewalk by Bandlab. This worked sufficiently, with significant effort and work to making the softwares all work together in synchronicity, for my aims at the time - but with a more ambitious undertaking for my Special Project it was clear I was going to need to come up with a more efficient, streamlined, and powerful composing method with regards to the software. This would also give me an opportunity to look into another school of microtonal composition entirely - a more recent phenomenon, more intrinsically tied to the softwares and methodologies I had been familiarising myself over the course of my studies.

Around the end of the 2000s, a clear and self-defining community of composers and electronic musicians were breaking new ground in the worlds of electronic dance music (EDM) and intelligent dance music (IDM). The stylistic and conceptual characteristics of microtonal EDM seemed to align with my own compositional goals, and I began to take great influence from these composers' approaches towards both microtonal music and electronic music in general.

There is a certain consistency in aesthetic and thematic allusions among this community of artists [...] exploration of harmonic space is the central theme, as described by the relationships inherent in the tuning system itself, and the metaphorical exploration of the supercontinent [...] it is the maintaining of stylistically familiar ground that clearly sets these [microtonal EDM] artists apart from contemporary microtonal composers.¹⁴

Admittedly, I feel Easley Blackwood (especially when listening closely to *Twelve Microtonal Etudes*) is a strong exception to this apparent swearing-off of 'stylistically familiar grounds' altogether among contemporary classical composers - I feel I have explained how this quality attracted me to Blackwood's work in the first place. The careful and calculated striding through the uncanny valleys between familiarity and unfamiliarity noticeable in Blackwood's microtonal work is something he has in common with these microtonal EDM composers, and sets him apart from Ben Johnston, for example, who '[did not] like applying a non-traditional tuning system to a traditional style [... because to him] the notes [sounded] wrong, because the gestures, structures, and idioms are familiar from a different tuning'.¹⁵

¹⁴ Hart, Adam (2016) - 'Microtonal Tunings in Electronic Dance Music: A Survey of Precedent and Potential', *Contemporary Music Review*, Vol. 35, No. 2, Taylor & Francis, pg. 242-262

¹⁵ Ibid.

Such endeavours into electronic music production standards, software, and microtonal EDM composers led me to using the Reaper DAW, with an open-source VST plugin synthesiser, Vital, which could handle microtonal frequency inputs using .tun files to calibrate its tuning configuration. Sevish, one of the forefront composers of microtonal EDM today, has created a software programme¹⁶ to construct tuning systems and export them as .tun files. This outlines the fundamental processes of my compositional methodology for *The Poles of Jupiter*, but more specific mathematical work was required in order to construct and graphically demonstrate my custom temperament - this called for an external, interdisciplinary collaboration. I approached Tilde Resare, a physics student at the University of Nottingham with specialisation in mathematics and computer programming, to help me to conceptualise and construct a tuning system which contained all the octave divisions given by 14-EDO, 31-EDO, and 39-EDO. First of all, we had to ascertain the lowest integer that was a common multiple of 14, 31, and 39. This turned out to be 16,926. Now, it would not be incorrect per se to just describe *The Poles of Jupiter* as being written with an equal temperament of 16,926 notes per octave - but this was very impractical considering the 127-note limit for MIDI synthesisers and sequencers; with the Vital synthesiser, one could retune those 127 notes to any frequencies with exact precision, but plugging a .tun file of 16926-EDO in would yield an extremely limited set of notes available to use, only ~0.75% of an octave or ~9 cents - bearing in mind the average frequency difference that humans are able to distinguish is ~5-6 cents.¹⁷ Since the vast majority of notes in this hypothetical 16926-EDO temperament do not appear in 14-EDO, 31-EDO, or indeed 39-EDO - swathing deductions can be made. It would be a monumentally time-consuming effort to check all of the intervals in this temperament, manually remove the ones that do not appear in any of the original temperaments, and then plug the results back into Vital - so Tilde decided to automate the process by writing some code out with Python. The resultant data was then graphed, simplified, and then converted into a .tun file through Sevish's Scale Workshop (user interface shown in Figure 4), which Vital could read and produce the corresponding tones. This temperament is heard most prominently in the celeste-type patch heard at the end of *Tempest* from the 08:35 mark, and in the opening two minutes of *Jovius*. See the upcoming figures for a visual representation of the 81-note unequally-tempered tuning system.

¹⁶ <https://sevish.com/scaleworkshop/>. Accessed 07/2022

¹⁷ Loeffler, Dominik B. (2006) - 'Instrument Timbres and Pitch Estimation in Polyphonic Music', Department of Electrical and Computer Engineering, Georgia Institute of Technology, pg. 6

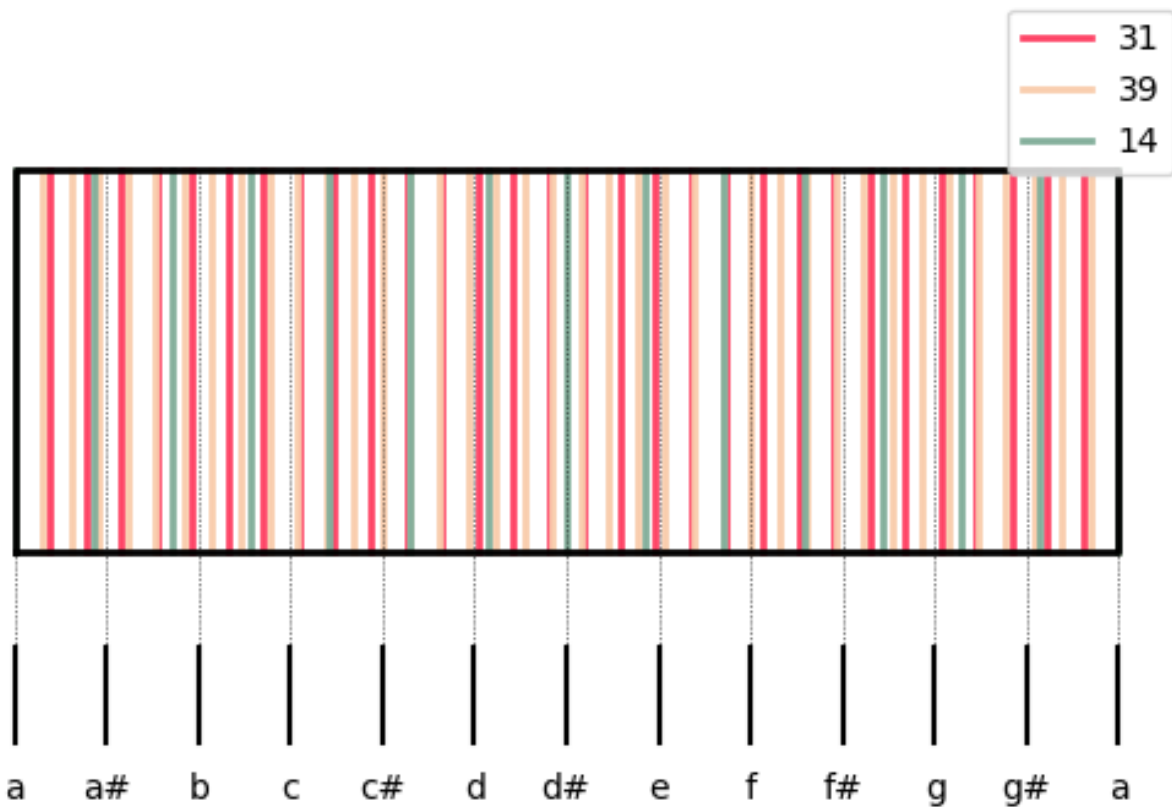


Figure 1 - a simplified graphic representation (Resare, Tilde, 2022) of the custom temperament used in *The Poles of Jupiter*

Figure 1 depicts an octave (1200 cents) divided into 82 parts (yielding 81 notes) through the programmed selection of specific nodes from the 16,926 equal-divisions (of 1200 cents) temperament that appear in the 31 equal-divisions (of 1200 cents, shown in red) temperament, the 39 equal-divisions (of 1200 cents, shown in yellow) temperament, and the 14 equal-divisions (of 1200 cents, shown in green) temperament. For reference, the standard divisions of 12-EDO (starting at the note A) are shown underneath. For a more detailed, numerical depiction of the temperament, a second graph was programmed - aptly-cropped sections of this graph are shown in the following figure.

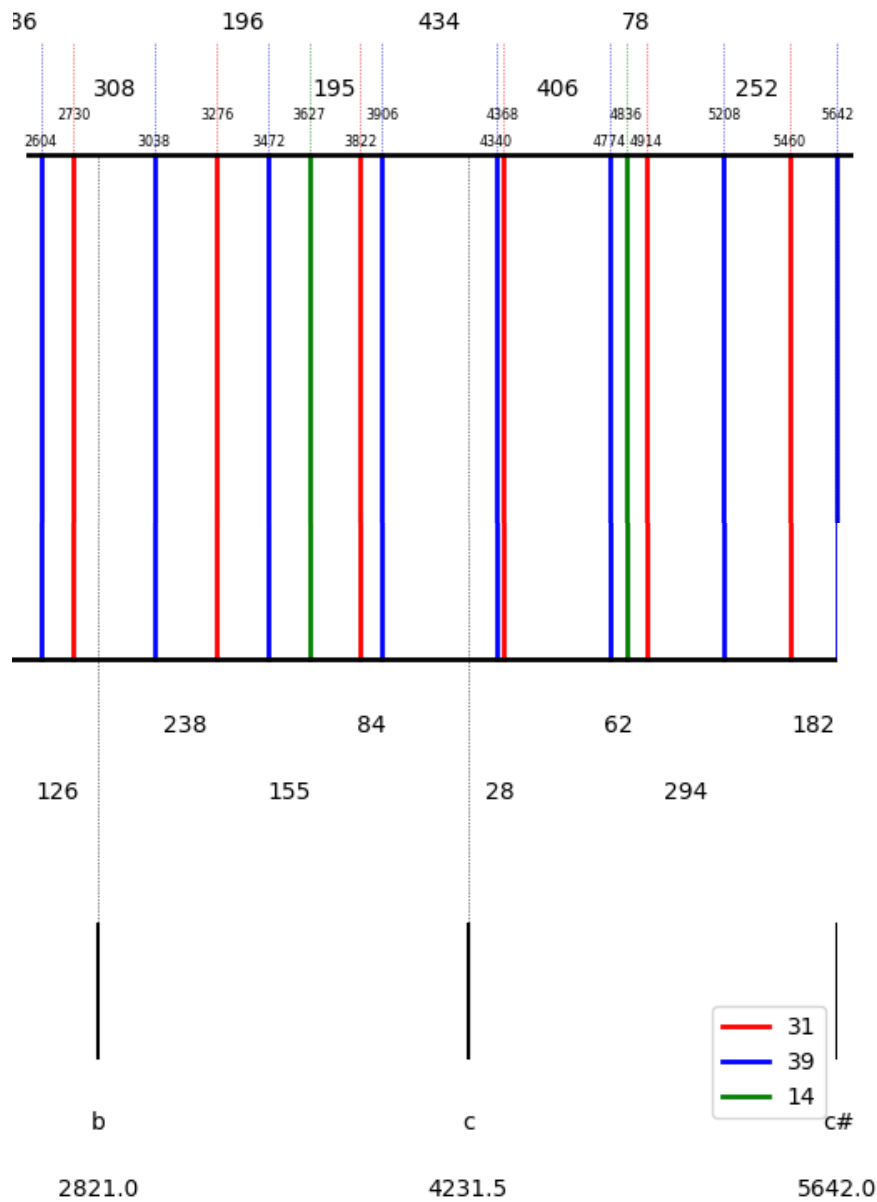


Figure 2 - a cropped and magnified segment of an unsimplified graphic representation (Resare, Tilde, 2022) of the custom temperament used in *The Poles of Jupiter*

Figure 2 depicts a small segment of the same octave divided in the same manner as in Figure 1, encompassing the aforementioned 12-EDO notes of B (200 cents, where A is 0 cents, and A one octave higher is 1200 cents), C (300 cents), and C sharp (400 cents). The numerations of these nodes correspond to their position in relation to the initial 16,926 note temperament this is derived from - where one unit is equal to one division. This is the case for all the numerics in the figure (apart from the legend denoting which of the three component temperaments each node is taken from), where the smaller numerics at the top denote the overall position of each of the nodes within the octave, and the larger numerics denote the size of the intervals between each node.

The level of frequential precision afforded by this 81-note temperament yields a seamless, wavering, uncannily haunting sonic quality which is exacerbated by the purity and sine-wave sonority of the otherwise unassuming tone of the celeste Vital patch which adjoins *Tempest* and *Jovius*. Commenting on the other aspects of the Vital synthesiser that formulate all of the tones and sounds heard in the final pieces provides a segue into my penultimate research question.

Synthetic Timbres

Vital is an extremely powerful but simple VST synthesiser, which can be utilised to produce an extensive range of timbres and patches including pads, leads, plucks, basses, arpeggiators, sound effects, and myriad more. Its uniquely accessible user interface gave me ready opportunities to create my own patches through sound design and additive synthesis.



Figure 3 - a screenshot of the user interface view of Vital VST synthesiser, running the 'Synthetic Quartet' patch heard in *Tempest* from 08:35-08:54

As mentioned previously, the Vital synthesiser can very easily be completely retuned to any set of frequency values inputted into the 'Load Tuning File' menu in the form of a .tun file. Sevish's Scale Workshop houses a multitude of presets for commonly-used temperaments

and tuning systems, but also the option to input your own frequency values; once again, I used the programme that Tilde wrote to input the set frequency values for the custom 81-note temperament we devised, and then plugged the resultant .tun file into Vital for the celeste patch bridging the two movements. The user interface of Sevish's Scale Workshop is shown below.

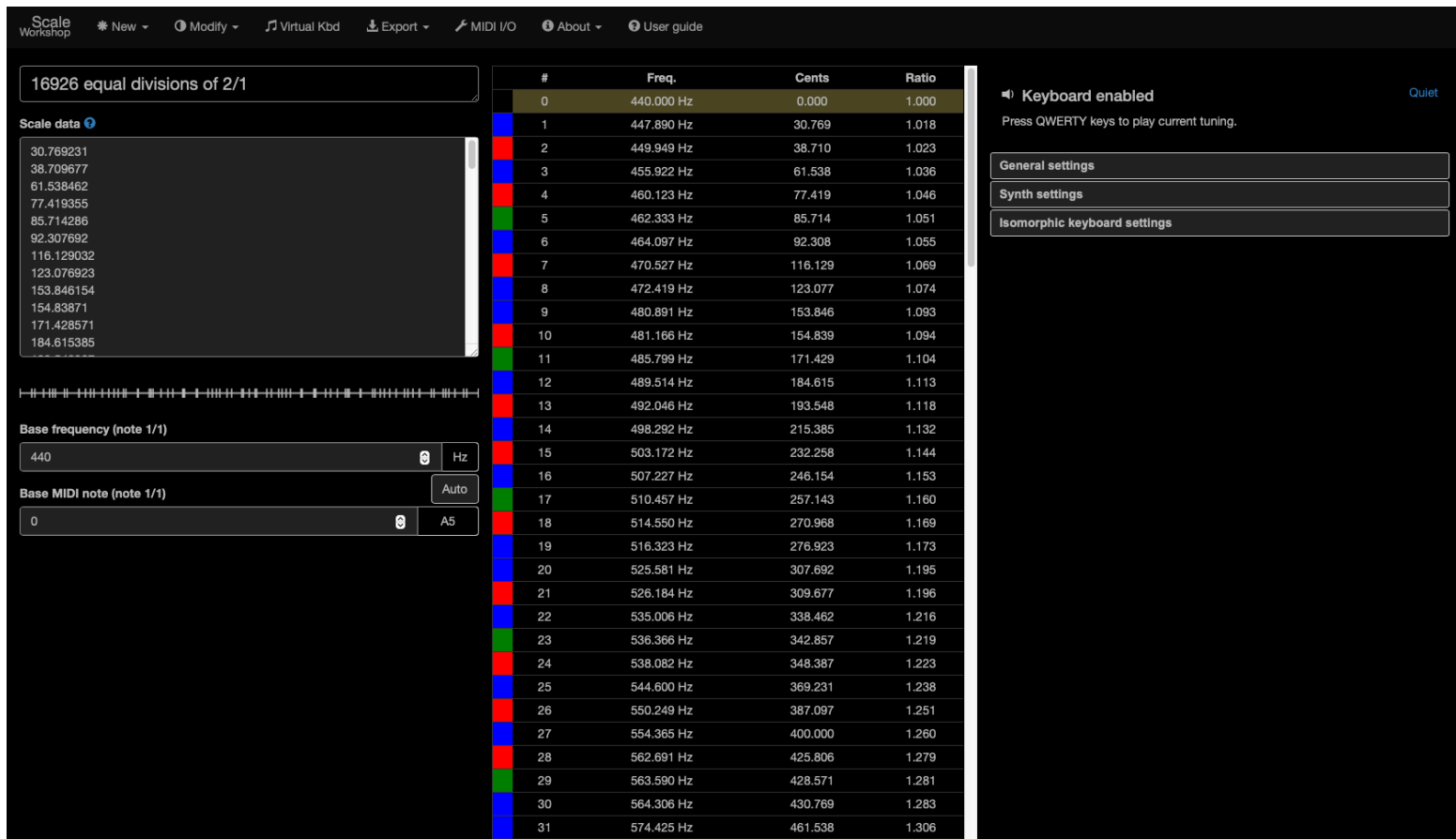


Figure 4 - a screenshot of the user interface of Sevish's Scale Workshop, currently displaying some of the various frequency values of the custom 81-note temperament used in *The Poles of Jupiter*

Regarding the fourth research question, the expansive versatility of Vital (and indeed the ready implementability of the Reaper DAW) and all the different timbres it is able to produce matches the range of harmonic and tonal qualities working with microtones affords in spades. Automating the levels of reverb, the dynamic gradients, the polyphony of the synth patches, delay timings and iterations, equaliser settings, filters, envelopes, and a plethora of effects allows for both the accentuation of the tuning discrepancies for moments of tension - as well as the blending and fading of the sounds to create the superlunary, celestial quality that contributes to an evocation of the Jovian atmosphere. Historically, this level of control

over every aspect of the dimensional parameters of music (timbre, structure, space, frequency, time et al.) has been held in a similarly celestial, almost spiritual regard. 'Electronic music [allows] the composer to reflect the order of the universe, controlling frequency spectra, pitch and duration to a level of detail not available with traditional musical instruments, reflecting the divine more accurately',¹⁸ and affording an infinitely larger scope with regards to timbre.

There are two specific sections of *The Poles of Jupiter* which should be mentioned with pertinence in order to demonstrate the extent of timbral control available through electronic means - that I believe are symbiotically resonant with the tuning idiosyncrasies throughout. There is a segment during the cadenza-esque celeste section, beginning at 11:15 in *Tempest*, where the array of 81 notes per octave is utilised to approximate the partials of the harmonic series derived from a line of fundamentals with more accuracy than is possible in standard tuning. This evokes a lot of spectralist conventions and practices of the 20th and 21st centuries, wherein the timbral quality of the instrument is dictated in an entirely controlled manner by the arrangement of the harmony; 'there is no distinction between harmony and timbre [...] harmony can be subsumed into timbre. Intervallicism can come in and out of spectralism, and it is in the ambiguity that much of the richness lies.'¹⁹ Towards the end of *Jovius*, from 12:50 to 15:17, timbre is once again at the forefront of the music; where I sequenced 18 separate synthesisers, all dispersed equally across the spatial spectrum with a range of contrasting timbres, to play in unison (weaving in and out of antiphony over the duration). By sequentially automating the volume on each of these tracks, I was able to create a klangfarbenmelodie effect - which during the dizzying climax of the piece (an evocative point of intense squall and atmospheric pressure) lends to the intended disorientating quality. The power of this segment is also bolstered by the spatialisation of the music, which is an aspect I have paid great attention to for the duration of the entire piece.

¹⁸ Till, Rupert (2017) - 'Ambient Music', *The Bloomsbury Handbook of Religion and Popular Music*, Bloomsbury Publishing, pg. 327-337

¹⁹ Harvey, Jonathan (2001) - 'Spectralism', *Contemporary Music Review*, Vol. 19, No. 3, Taylor & Francis, pg. 11-14

Spatialisation

The final research question I devised centres around the intended performance medium of *The Poles of Jupiter*. This piece is intended for an acousmatic realisation - that is, through a deliberately spatialised array of speakers in a performance venue. In surety, the manipulation of how all of the sounds and patches are spread amidst a tangible space provides another controllable parameter of evocation and expression - but with specific regards to this piece, considering its tuning configurations, there is indeed another, more functionally necessary reason to take consider spatialisation. In many instances, the sheer density of the texture of the music, particularly during the more climactic parts, benefits massively from a carefully considered dissemination of instruments across the space; this is especially apparent when the tonic and harmonic dissonances are many, and also temporally dense. It is paramount to give these foreign temperaments the breathing space they need, so to speak, for the benefit of an audience - Blackwood's mission statement of democratising and universalising microtonal music rings strikingly true here.

Reflections

The process of composing *The Poles of Jupiter* - the conceptualisation, the research and practice, the collaboration, the technical realisation, the mixing and mastering, and indeed the analytical essaying - have been undoubtedly invaluable. In this nascent stage of my compositional career, and at the end of my musical studies at the University of Nottingham, composing with alternative tuning systems for a year has had a profound effect on the way I conceptualise music altogether. I have, through interdisciplinary collaboration, started a number of contemporary and professional relationships which I believe have (and will continue to) inspire and influence me substantially. I am particularly satisfied with the technical compositional process - which has taken around a year to refine and overhaul to an efficient, effective, and stimulating state. Beyond my studies, I intend to compose further with alternative tuning methodologies and practices, and shall definitely research further into the canon of microtonal composition. Perhaps, given more time, I would have lent more effort to the narrative and emotive elements of the music I have produced; whilst the thematic melodic and textural content of *The Poles of Jupiter* is explored in several manners, I would like to have spent more time fleshing out a more concretely Jovian narrative, which

would have perhaps a more obvious justification of the microtonal pursuit, from a conceptual point of view. Nevertheless, what I have produced I personally believe to be my finest work to date, and I have never felt more motivated to compose.

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