
Felicity
Wilcox
THREADING
THE LIGHT

Threading the Light refers to the universal phenomenon of ritual; a constant in human culture designed to transcend worldly concerns. The titles of its four movements - Light, Water, Blood and Fire - refer to elements commonly associated with ritual practices. Inspired during a three-month residency in Andalusia, the work is embued with the passion and spirituality so alive in the rich culture there. You will hear text sourced from saeta, the ancient tradition of a cappella singing heard in Seville during *Semana Santa,* and echoes of flamenco in the music. Other texts were sourced from prayers and contemplative writings across a broad range of faiths. It is dedicated to my brother, the Reverend Dr Gavin Wilcox, who at 46, tragically passed away while I was composing it. Through its music and themes, I can trace the influence of his spirit, strength, and grace as he faced his early death. I am indebted to his wife Wendy for sharing two of his prayers with me, which I have set to music.

A feature of this work is its electronic instrument, which I made to create a shimmering sound world intended to evoke the idea of light. Made up of tones I sourced from singling bowls and then processed, it is tuned in Just Intonation to contrast with the equal temperament of the ensemble. In each progressive movement the pitch material becomes more complex; the two tuning systems increasingly set against each other to introduce dissonance, beating tones and microtonal clusters that build tension as the work reaches its dramatic climax.

Threading the Light was composed between 2008 and 2012, as the cornerstone work of my PhD in composition. I have waited 10 years for its release, which was finally motivated by its world premiere by the Cooperative in 2022.

FELICITY WILCOX – **felicitywilcox.com**

1 I. Light 14'39
2 II. Water 15'46
3 III. Blood 6'28
4 IV. Fire 11'22

Soprano: Alison Morgan
Contralto: Jenny Duck-Chong
Baritone: Mark Donnelly
Violin: Anna McMichael
Viola: Luke Spicer
Cello: Anthea Cottee
Percussion: Alison Pratt
Ensemble: Ben Adler, Victor Wu (violins); Tara Hashambhoy (viola); Anthony Albrecht (cello); Muhamed Mehmedbasic (bass)
Ben Burton (electronic instrument)
Conductor: Sada Muramatsu
Samples recorded at Newington College from the singing bowl collection of Micheal Askill
Recording: Robert Scott at Studios 301
Mixing and mastering:
Daniel Brown at Trackdown
Recorded in March 2012
Cover illustration: Lucy Scott
Released by Move Records, 2022

move.com.au

Felicity Wilcox
Threading the Light

Texts

Text for the work has been sourced from prayers and contemplative writings across a broad range of faiths. To place this is context, Threading the Light refers to the universal phenomenon of ritual, a constant in human culture that is designed to transcend worldly concerns through accessing spiritual support. The titles of the four movements refer to elements commonly associated with ritual practices. Texts have been allocated to each movement depending on their associations with these elements. The texts are set in both the original language of worship as well as in English.

I. Light

Gayatri mantra

Transliteration in Vedic Sanskrit:

aum bhuurbhuvaha swahaha
tatsaviturvarenyam
bhargo devasya dhiimahi
dhiyo yo naha prachodayaat

Vedic, anon.

Translation:

We meditate on the glory of sacred light,
Illuminating the three worlds.
May that divine light inspire our thoughts.

Al-Nour (The Light)

Transliteration in Arabic:

Allahu nooru alssamawati waalardi…
Noorun Allah nooru

Islamic, Qur'an Sura 24-Ayat 35

Translation:

Allah is the light of the heavens and earth

Light upon light.

Thanksgiving Prayer

May the lamp of love
Which eternally burns above
Light divine fire in our hearts.

Buddhist, Lama Surya Das

II. Water

Psalm 23

Transliteration in Hebrew:

Yehova roi loeksar
binot deshe yarbitseni almei menukhot yenahaleni
nafshiyeshovev yankheni venageleitsedek lemaan shemo

Jewish and Christian, Psalms, 23:1-3

Translation:

The Lord is my shepherd: I shall not want
He maketh me to lie down in green pastures:
He leadeth me beside the still waters.
He restoreth my soul:
He guideth me in straight paths for his name's sake.

Blessing and Healing Chant

Just as the soft rains fill the streams,
Pour into the rivers and join together in the oceans,
So may the power of every moment of your goodness
Flow forth to awaken and heal all beings.

Buddhist, anon

Walk in His Ways

I love the Lord for his goodness to me…
He has poured out abundant blessings,
Blessings on me.

Christian, Rev. Dr Gavin Wilcox

III. Blood

Twa Meva Mantra

Transliteration in Vedic Sanskrit:

Twa meva mata cha pita twa meva
Twa meva bandush chasaka twa meva
Twa meva vidya dravinam twa meva
Twa meva sarvam mam deva deva.

Vedic, anon.

Translation:

Thou art my mother and my father thou art
Thou art my family and my friend thou art
Thou art my knowledge and my wealth thou art
Thou art my everything Light of all lights.

Latin sanguis cruor
(blood, blood).

IV. Fire

Prayer

Thank you Lord for your kindness to me.
Thank you Lord.
I am very weak, fragile and flawed,
I am but a breath of wind that soon will pass.

Christian, Rev. Dr Gavin Wilcox.

Psalm 23

Transliteration in Hebrew:

Gam kielekh begei tsalmavet loira ra kiata imadi
Shivtekha umishantekha hema yenakhamuni.

Jewish and Christian, Psalms, 23:4

Translation:

Yea, though I walk through the valley of the shadow of death,
I will fear no evil, for Thou art with me;
Thy rod and Thy staff, they comfort me.

Saeta A Nuestra Sra De Los Dolores

Spanish:

Ya viene la Dolorosa
Con el corazon partido
De ver a su hijo amado
En el sepulcro metido.

Christian, anon.

Translation:

Here comes the Lady of Sorrows
With her heart broken
To see her beloved son
Placed in the tomb

Evening Prayer

O God!
I go to sleep, awaken, live and die by You
And to You is the final gathering.
Amen

Islamic, Prophet Muhammad

This work is dedicated to my brother, the Reverend Dr Gavin Wilcox (1962-2008), whose strong faith and beautiful spirit shone through to the end.

The Electronic Instrument in Threading the Light

Dr Felicity Wilcox

Sound source

The instrument made for Threading the Light consists of tones sourced from Himalayan singing bowls of various pitches. I had initially thought to sample strings or wine glass tones, or to create a purely synthetic sound using sine tones. The timbre required had to be opalescent to reflect the work's title and have a sustaining quality that would evolve over a long period of time in a single event so as to avoid digitally looping the sample.

They are classified as a 'standing bell', which means they sit with the bottom surface resting, rather than hanging inverted or attached to a handle. They are commonly made from an alloy of copper and tin similar to 'bell metal bronze', the alloy from which many gongs, bells and cymbals are also made. As 'multiphonic' instruments, they are designed to produce multiple upper partials at the same time as the fundamental tone. These audible overtones are inherent in the timbre of singing bowls and contribute to the shimmering and transcendent tone they produce. So, whilst in terms of timbre, they were exactly what was required for this work, they presented a unique set of challenges in terms of the organisation of intonation.

Michael Askill (pictured) has collected Himalayan singing bowls over a number of years. I was able to commission him to perform these instruments at a recording session we conducted at Newington College, Stanmore in October 2008. Sound engineer Bob Scott recorded some thirty bowls from his collection for sampling.

Fig. 1: Michael Askill playing a singing bowl during recording.

Rubbing the outside of the bowl with a beater creates the 'singing' tone through generating vibrations that produce the sound. Each bowl was sampled 'singing' for a duration of roughly two minutes and also struck using hard and soft beaters. The sampled set ranged in pitch from A2 to A#5.

Having spent five hours listening to them unamplified during the recording session, I am struck by their power and beauty when they are played loudly. The magnified tone allows one to hear the nuances in every detail. As the electronic score is diffused in surround, this is certainly a better way to hear the bowls than if they were being played acoustically on stage, even if the tuning aspect were not considered. This is not to detract from their natural acoustic quality, rather a reflection that they are not instruments designed for public performance but for intimate functions in quiet spaces. For me, this affirms my decision to sample them and use them as the source tones for my electronic 'just' instrument within a concert work.

Analysis and Treatment of Samples

The cent is a logarithmic unit used for musical intervals where one semitone in equal temperament is comprised of one hundred cents. Of course, it varies between individuals, but it generally any adjustment of above 5 cents is considered to be an audible difference. The basis of the Just tuning system is the harmonic series. To achieve accurate Just Intonation from twelve-tone temperament, small microtonal adjustments are made in increments of 'cents'.

In order to create an instrument with accurate tuning according to the harmonic series, the first step was to analyse the pitch of each sample I was using. I chose to do this by using the Spectrum Analyser in the application Amadeus Pro (HairerSoft). I set this function to analyse the average frequency of the sound file across the entire waveform. The results gave me a graph of peak frequencies, which represented the bowl's fundamental pitch and its most prominent overtones. Perhaps not surprisingly, the overtone content varied greatly depending upon how the bowl was played. Those samples where the hard beater had been used to strike the bowl had the greatest overtone presence, with more and louder overtones. Those where the soft beater had been used had fewer and quieter overtones. The sustained, or singing tones created by rubbing the beater around the bowl had even fewer audible overtones than either of the struck tones and most truly sounded the fundamental pitch. The envelope of these upper partials evolved through the course of the sample's duration and often as the tone sustained, the upper partials took precedence over the pitch of the fundamental. Note the considerable 'noise' in the very low frequencies. This was due to the acoustic of the hall and external rumble from the street. I eliminated this low frequency content in the EQ process that took place after these initial analyses.

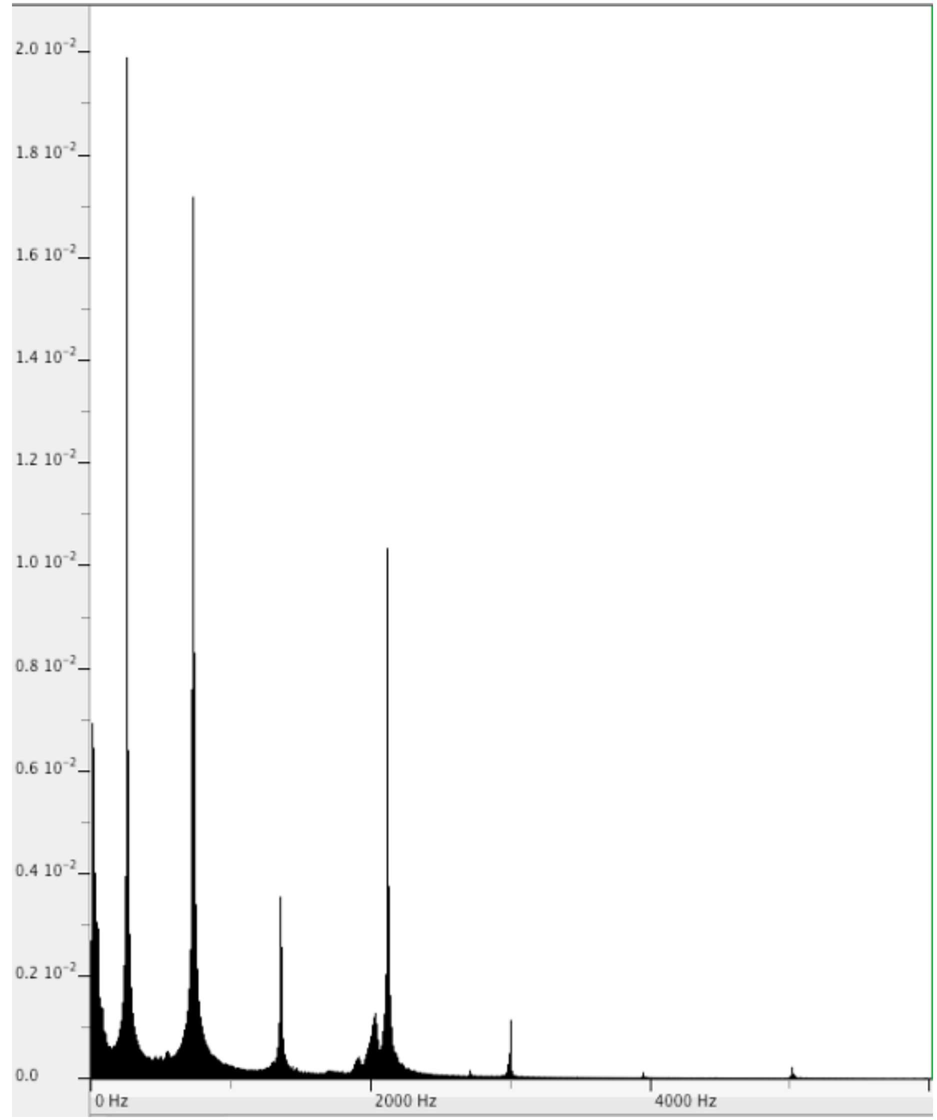

Fig. 2a): Spectrum analysis for sample 'bowl C4 hard'

Gain	frequency	nearest pitch
-34 dB	258.3 Hz	C4 (261.6 Hz)
-35.3 dB	732 Hz	F#5 (740 Hz)
-51.8 dB	1367 Hz	F6 (1396.9 Hz)
-39.7 dB	2120.5 Hz	C7 (2093 Hz)
-58.7 dB	3003.1 Hz	F#7 (2960 Hz)

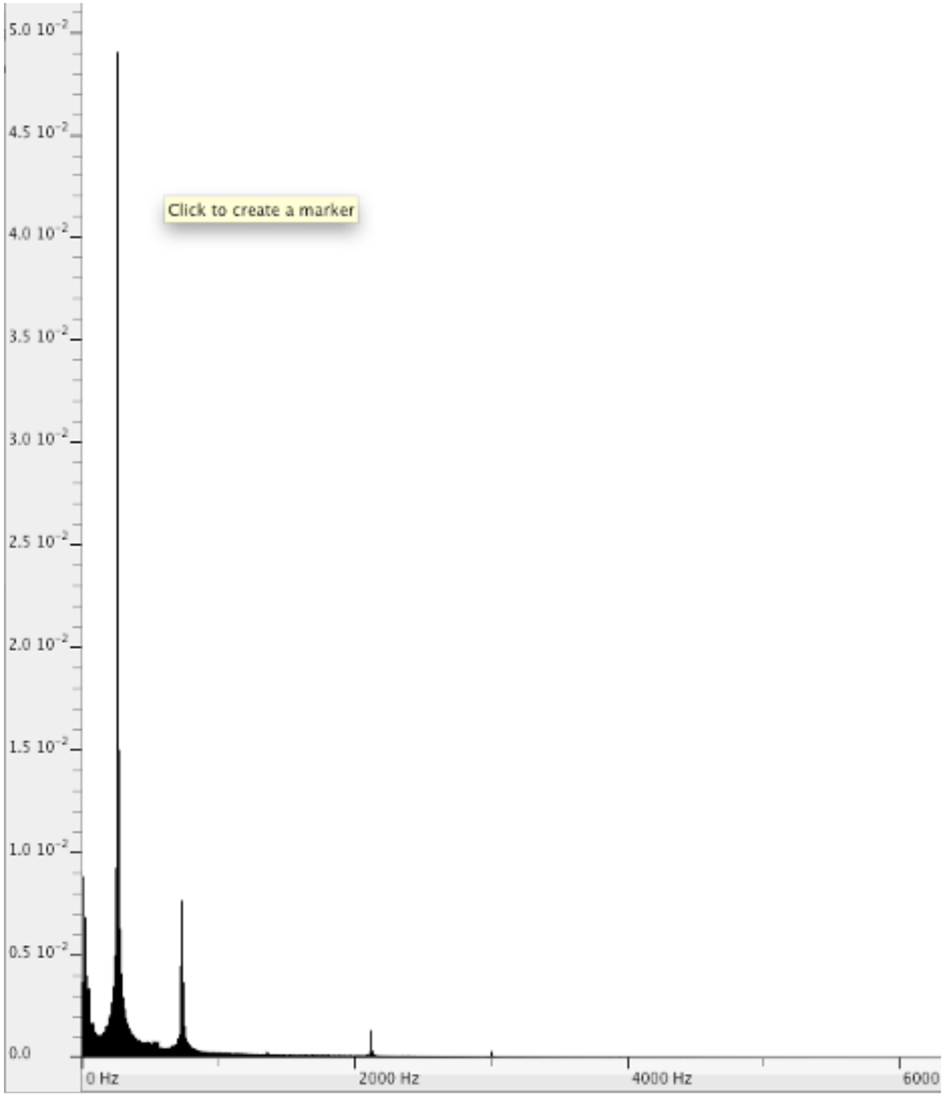

Fig. 2b): Spectrum analysis for sample 'bowl C4 soft'

Gain	frequency	nearest pitch
-26.2 dB	258.3 Hz	C4 (261.6 Hz)
-42.3 dB	732 Hz	F#5 (740 Hz)
-57.6 dB	2120.5 Hz	C7 (2093 Hz)

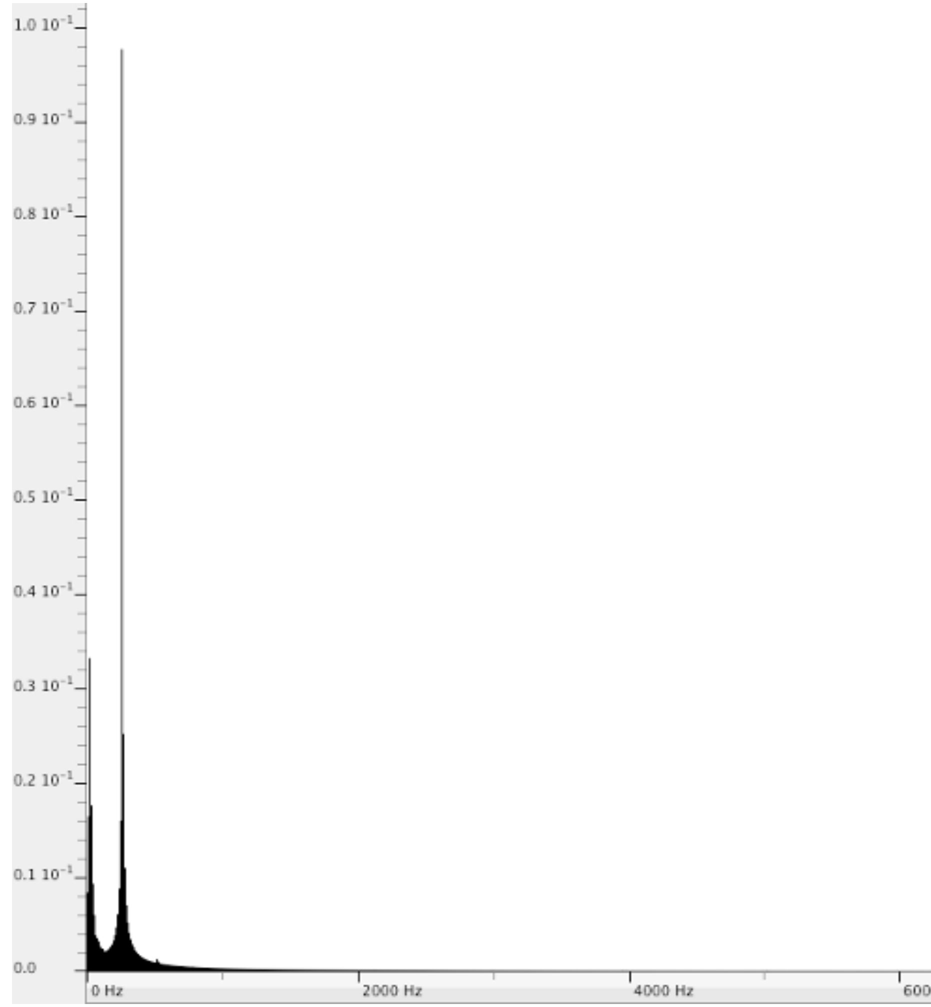

Fig. 2c): Spectrum analysis for sample 'bowl C4 singing'

Gain	frequency	nearest pitch
-20.2 dB	258.3 Hz	C4 (261.6 Hz)

Figure 1a) represents the frequency spectrum average over the course of the sample where the bowl of roughly concert pitch C4 was struck with a hard beater. Figure 1b) shows the frequency average for the same bowl when struck with the soft beater and 1c) shows the same bowl's frequency average when rubbed with the beater. It is clear from these graphs and the audio examples how overtone content shapes the timbre of the bowl depending on the articulation of the performance.

In the above analyses it can be determined that the peak frequency occurs at 258.3 Hz. The nearest note in concert pitch to this is C4, which has a frequency of 261.6 Hz.

For the instrument in Just Intonation, it was important to emphasise the fundamental pitch in each sample. Using a graphic equaliser I isolated the frequencies of the partials and reduced their gain enough to allow the fundamental frequency to dominate but not so much so that the timbre of the bowl was overly compromised. The following graphs represent the same bowl samples after EQ was applied.

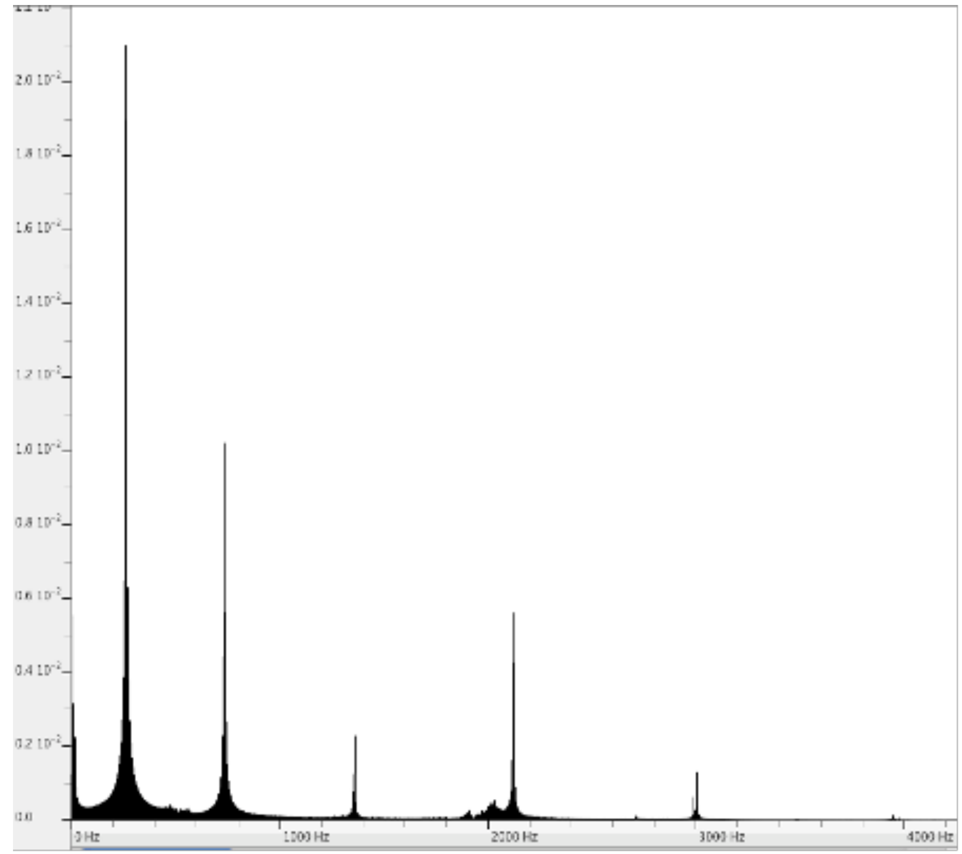

Fig. 3a): Spectrum analysis for sample 'C4 hard+EQ'

Gain	frequency	nearest pitch
-33.5 dB	258.3 Hz	C4 (261.6 Hz)
-39.8	737.3 Hz	F#5 (740Hz)
-52.8	1361 Hz	F6 (1396.9Hz)
-45 dB	2120.5 Hz	C7 (2093 Hz)
-57.7 dB	3003.1 Hz	F#7 (2960 Hz)

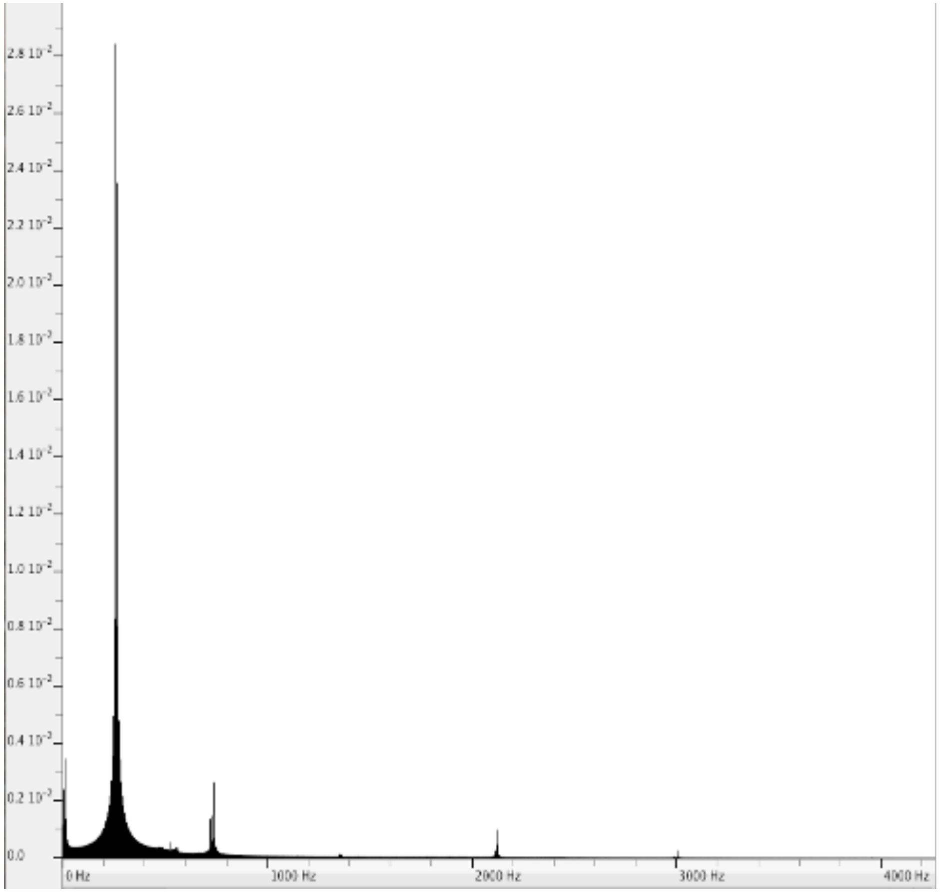

Fig. 3b): Spectrum analysis for sample 'C4 soft + EQ'

Gain	frequency	nearest pitch
-30.9 dB	258.3 Hz	C4 (261.6 Hz)
-51.5 dB	737.3 Hz	F#5 (740 Hz)
-59.9 dB	2120.5 Hz	C7 (2093 Hz)

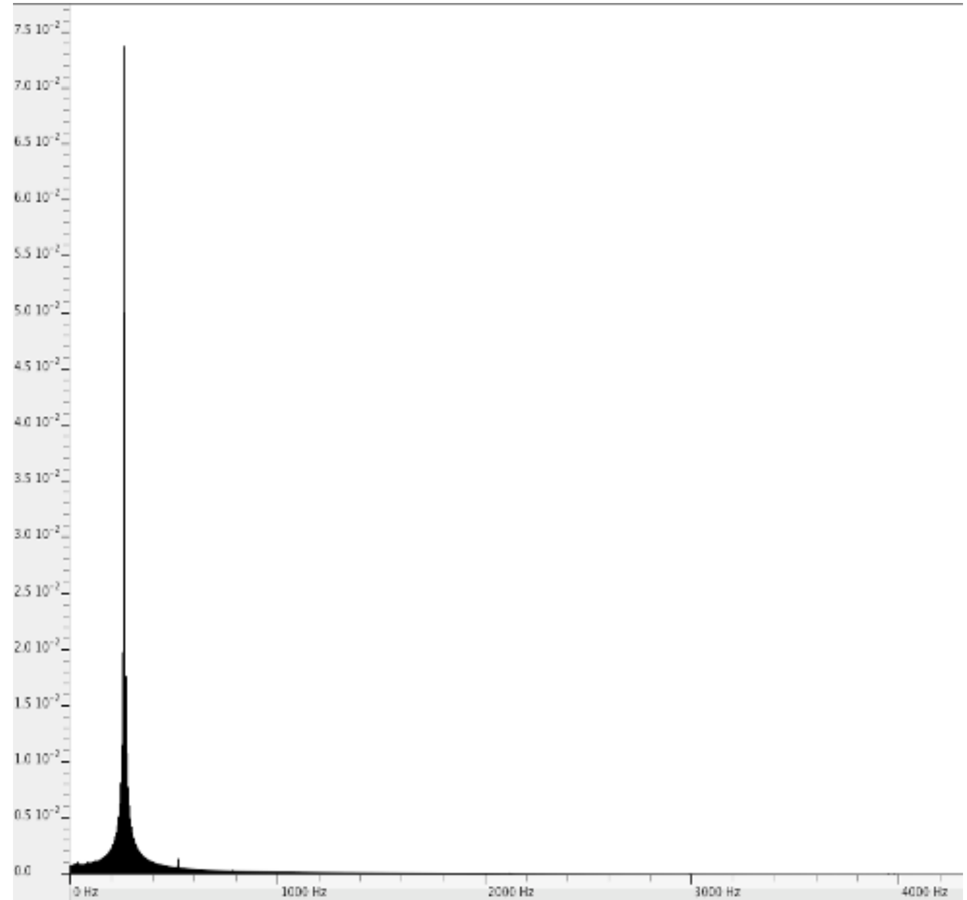

Fig. 3c): Spectrum analysis for sample 'C4 singing+EQ'

Gain	frequency	nearest pitch
-22.6 dB	258.3 Hz	C4 (261.6 Hz)

It is clear from these graphs that while the gain of the fundamental pitch was not always greater than before EQ had been applied, the gain of each partial's frequency was slightly reduced, thus decreasing the presence of overtone content in the sample overall and bringing the frequency of the fundamental to the foreground.

My next challenge was to translate the frequencies for each bowl into concert pitch. Gene Gill, a musician, learning web programming as part of his engineering degree, came up with a simple web program that allows the user to convert frequencies into cents.

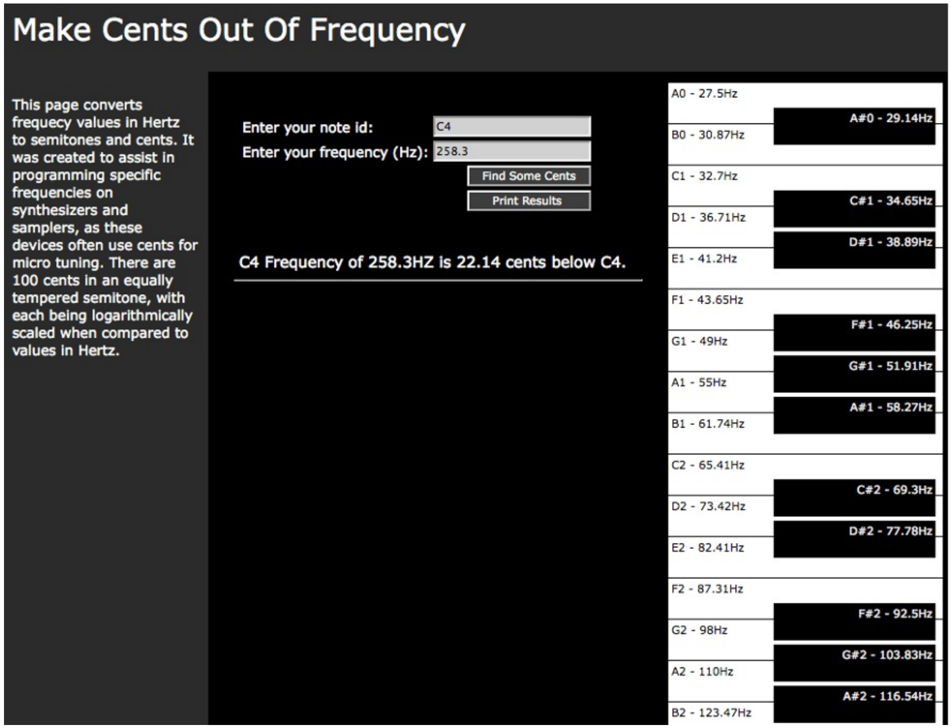

Fig. 4: Html program Make cents out of frequency created by Gene Gill, 2009.

Here, the fundamental frequency value of the C4 bowl was entered and then the "Find Some Cents" button clicked. The result is the difference between the sample's pitch and the pitch of concert C4: in this case 22.14 cents. Using this application, I was able to work out the difference between the pitch of all the bowls I had edited and the nearest pitch in twelve-tone equal temperament or concert pitch. From there it was a matter of tuning them to Just Intonation according to the cents values shown in table 1.

Building the Virtual Instrument

Below is the interface for the NN-XT virtual sampler in the application Reason (Propellerhead) You can load in any sound file you like with the 'load sample' button. You can then set the range for playback of that sample with the 'low key' and 'high key' dials. The original pitch of the sample is entered with the 'root key' dial and is necessary to obtain the correct overall tuning. You can then adjust the tuning using increments of cents with the 'fine' dial in the pitch section of the panel. I made these adjustments according to the data I had obtained with Gill's web page. For example, in the case of C4, it was necessary to tune the sample exactly to C4 in order to fit my Just tuning system with a C fundamental. Once I had set the 'root key' to C4, I then had to adjust the fine tuning dial to +22 cents for this sample. By a slow process, each bowl sample was adjusted to concert pitch and then re-tuned precisely to Just Intonation, according to the cent value adjustments in table 1.

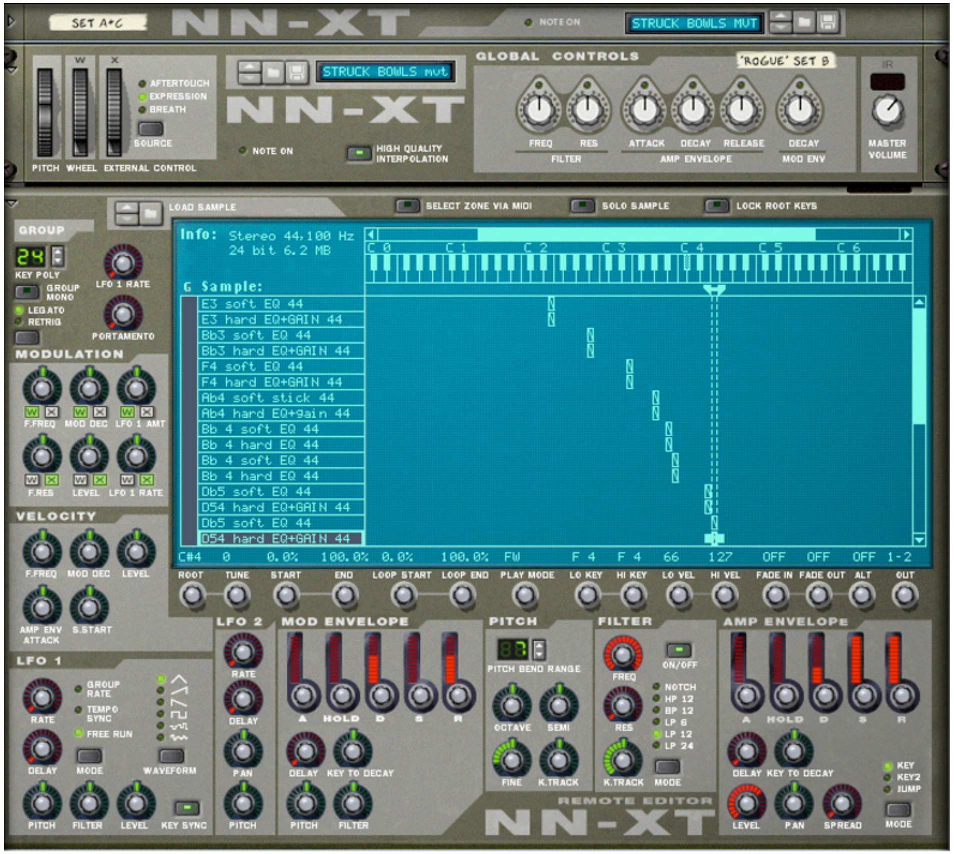

Fig. 5: Interface for NN-XT virtual sampler in Reason.

The organisation of the instrument involves six different NN-XT samplers, grouped into two 'Combinators'. These allow virtual devices in Reason to be combined and controlled together from one MIDI channel. The first 'Combi' contains all of the 'singing' or sustained tones. I have organised each NN-XT to play a different pitch set. These three pitch sets are grouped according to the pitch organisation of the movements in Threading the Light. It simplified my programming to separate the pitch sets in this way; however, in effect they are all played simultaneously when grouped together under the umbrella of the 'Combi'. So 'Combi 1' plays all 32 singing tone samples.

Fig. 6: 'Combinator' 1 containing three NN-XTs each with a different set of singing tones.

'Combi 2' contains another three NN-XT samplers each with its own pitch set corresponding to the pitch organisation in the work. Here I have layered the two different types of struck tones sampled. Additionally, I set up velocity ranges for each sample, so that different key pressure to the controller device triggers a different articulation of the same bowl. Either the sample originally played with the soft beater or the sample played with the hard beater is triggered, depending on the velocity of the strike on the controlling device. Velocity sensitivity is built into all MIDI controllers and the range of sensitivity is factored as numbers ranging from 0-127. When a pressure of 1-65 is applied, the soft beater hits are triggered and a when a pressure of 66-127 is applied, the hard beater hits are played. Again, all three pitch sets can be accessed simultaneously when grouped together in the same 'Combi' but only either soft or hard hits can be played on the same pitch at any one time.

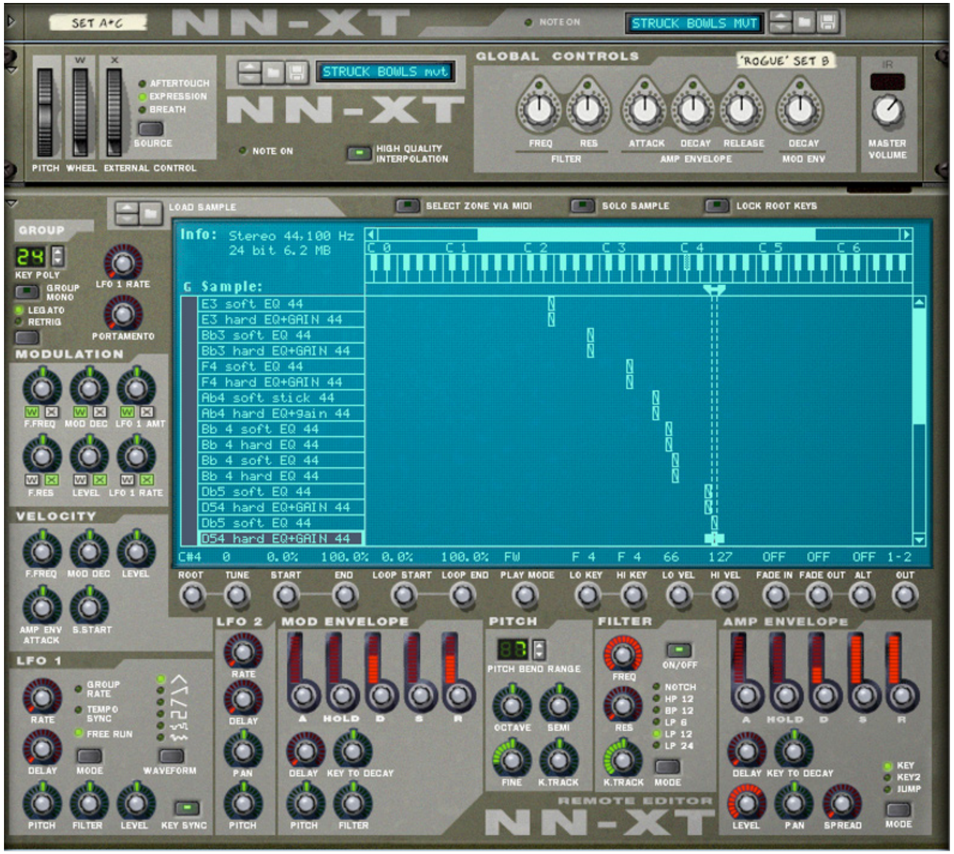

Fig. 7: Layering of hard and soft beater bowl samples in NN-XT with velocity programming.

The Interface

The exact particulars of the interface are still being worked out as I write. As there are thirty-two pitches in the harmonic series I have used, the instrument interface will consist of thirty two trigger pads each assigned to a different pitch of the series and capable of triggering three samples; hard beater, soft beater and sustained tones. A foot controller will determine which MIDI channel is active and thereby select the appropriate 'Combi' for sustained or struck tones. If struck tones are selected, then pressure of the mallet on the pad will determine whether a hard beater strike or a soft beater strike is triggered.

I hope to work in collaboration with a sculptor to create a structure on which to mount the percussion triggers. Our intention is to create something that is visually iconic and ties into the overarching theme of ritual. The sculpture may integrate piezo (Eowave) sensors that will send MIDI data to the virtual sampler in the computer.

Fig. 8: Piezo 'Shock' sensor

The instrument created for Threading the Light will be the culmination of a lengthy process evolving in several stages over many months and involving several collaborators. It draws the listener into a compelling sound world sourced from an ancient acoustic instrument and organised according to an ancient tuning system yet re-imagined through 21st century technology into an immersive, larger-than-life electronic music component in this piece.

Extract taken from PhD thesis: Wilcox, F. 2013. Vertical Montage: Concert Music for Mixed Media (Sydney Conservatorium Library).