JESSE-JAMES REHU PICKERY

Taonga Tū Pūoro

Sound and light both exist and travel as waves. The properties we attribute to these waves differ considerably. Sound waves travel around a million times slower than light waves; we measure both in Hertz (Hz). 20Hz-20,000Hz is generally audible to human ears.[1] They have respective wavelengths between 10 metres and 1 centimetre, and will easily diffract round corners.

Light waves have much smaller wavelengths, 430 trillion hertz, seen as red, to 750 trillion hertz, seen as violet, and only diffract through very small holes. This difference is the reason why you can often hear things that you cannot see.

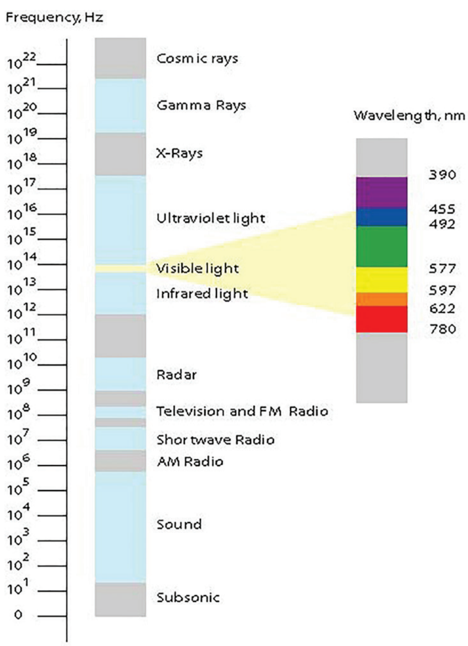

Figure 1. Full Hertz-range of observed frequencies[2]

The visible portion is but a tiny "blip" on the scale of the full range of frequencies we have yet observed, from less than 3 billion hertz, as in radio waves, to greater than 3 billion billion hertz (3 x 10^19), as in gamma rays.[3]

Though sound can be measured using the same "ruler" as light (Hz), sound is classified as a mechanical wave and not as an electromagnetic wave. This is due to sound existing as an organised series of compressions and decompressions of the fluid in which it travels.

For *Taonga Tū Pūoro: Standing Waves in Space*, the frequency to be used in the room was found using a tone generator. To find the optimal wavelength I would listen for a resonance (a fuller sound indicating a phased feedback) in the tone, then explore the space physically to test the quality of the phase-lock. By doing this I found 123Hz to

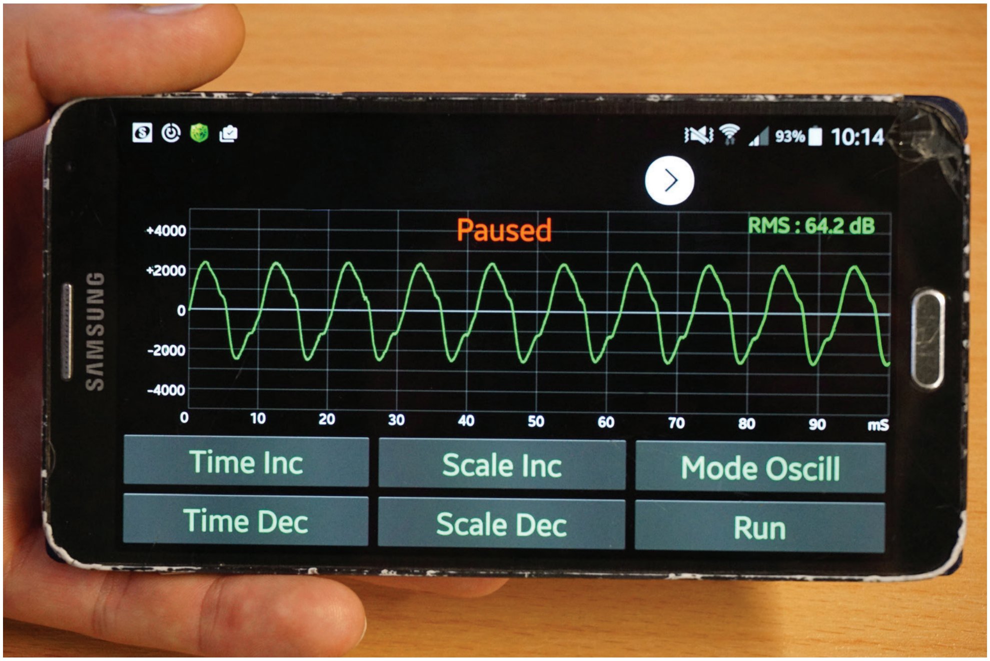

Figure 2. Phone using a 123Hz reading on oscilloscope to visualise the quality of the sine wave.

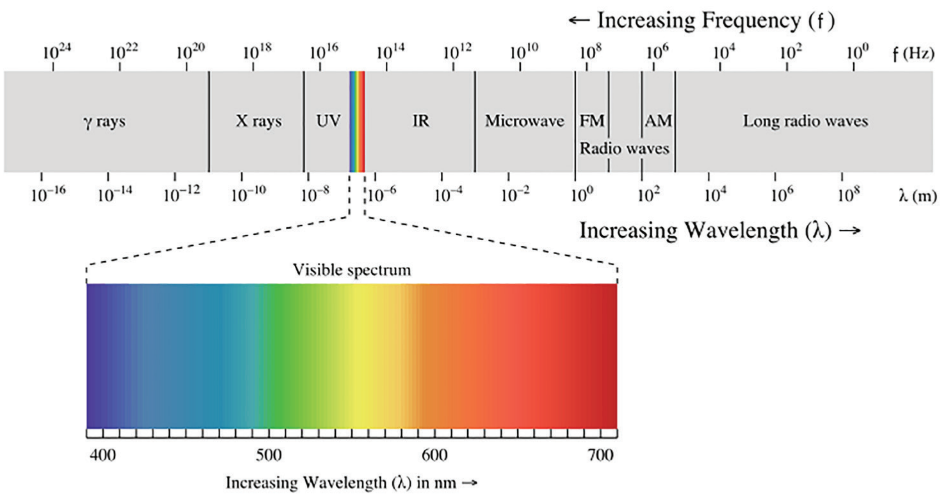

Figure 3. Detail of Electromagnetic Spectrum with Wavelength(λ):Frequency(f)[4]

be the most resonant tone of the HD Skinner Annex. To approach the space allowing for it to define the final tone was paramount to its holistic sound value and the resulting quality of the standing wave.

Using a speaker to generate the sustained 123Hz tone (sine), a standing wave was established with a wavelength (λ) of nearly 2.79 meters. This was both heard and felt by participants exploring the space and experiencing the crests/troughs (anti-nodes) and nodes as fixed and static "bubbles of sound and silence". These bubbles of sound/silence varied in size and strength according to the specific waves in junction and how far in/out of phase they were. Occasionally, an observer would note the discrepancy of sounds being received in each ear.

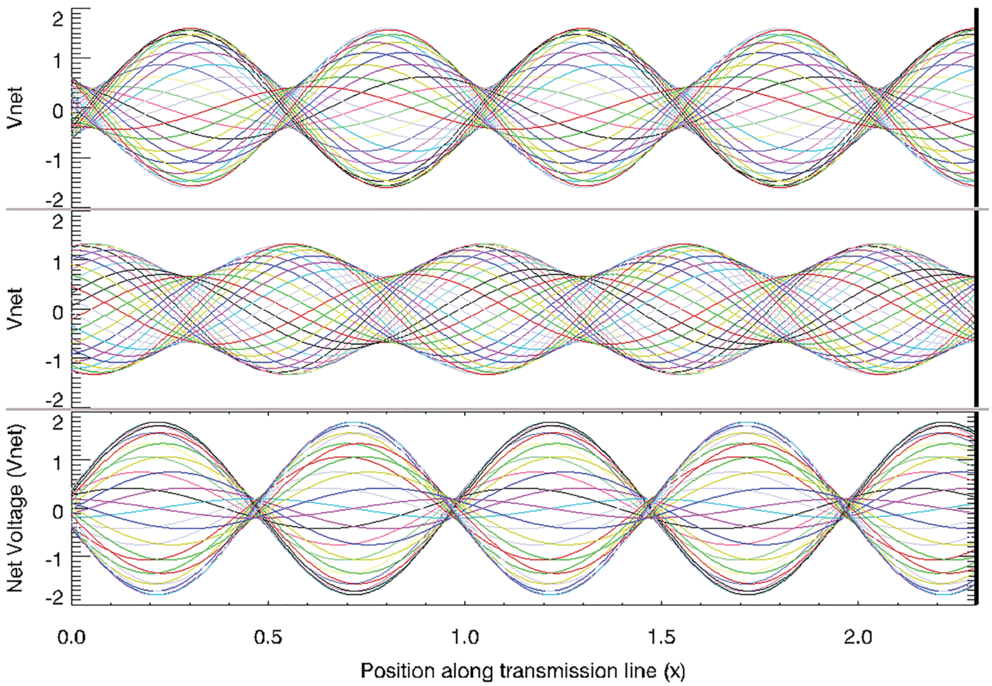

Figure 4. Standing waves on transmission line shown in different colours at 30 points of temporal phase.[5]

The phenomenological experience is counter-intuitive as the received sound does not relate in linear fashion to the source of the sound, as does in natural dispersion. The tone being sustained allows for one to explore the space and "feel out" the sound wave forming a 3-D audio-map of the space.

This illusion of "freezing" sound is a critique of, and response to, methodological reductionism. In this example, I've reduced a dynamic process (sound) to an apparently static entity (phase-locked bubbles of sound) which we can subjectively analyse for the purpose of understanding/defining its attributes.

The intensity and the directional origin of sound varied depending on where one encountered the wave in the physical space. In a locale where both the incident wave and reflected wave were completely in-phase, the amplitude of the perceived sound wave is the summation of the colliding waves (i.e. louder where two peaks or troughs collide, but silent where a trough meets a peak).

Taonga Tū Pūoro was part of an ongoing exploration into sensory ecology; it was also a study of subtle patterns/wave forms at play which define our perceptions of reality and navigation of space.

Jesse-James Rehu Pickery is absorbed by patterns underlying our reality—seeking resonance and frequency in sound, light and earth. He is studying ceramics at the Dunedin School of Art. Jesse worked in discussion with David A.W. Hutchinson of the Dodd-Walls Centre, Department of Physics, Univeristy of Otago, during the Art and Space project.

1. This range can narrow from as early as 18 due to presbycusis, it can also be up to and beyond 5kHz https://www.scientificamerican.com/article/bring-science-home-high-frequency-hearing/, http://www.dspguide.com/ch22/1.htm
2. Diagram of wave frequency and wavelength in which you can see that the "visible light" section of frequency measured in Hz, is but a tiny fraction of the total electromagnetic spectrum at http://www.sengpielaudio.com/calculator-wavelength. htm (accessed 28 November 2016).
3. Ibid.
4. Ibid. See diagram of the visible part of the electromagnetic spectrum as measured for wavelength.
5. Diagram of standing wave ratios at various points of temporal phase at https://commons.wikimedia.org/wiki/File:StandingWaves-3.png