

The Possibility of Infrasonic Music

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Abstract

Low frequency sound on the cusp of the audible offers the possibility to redefine the way we think about listening to music. The extension of music into sound art means that more plastic art forms, such as installation, may involve music and allow vibration to manifest in objects other than musical instruments. As the perception of tonality is lost in very low frequency sound emissions, an opportunity arises for a different kind of music, and a different way of listening. This paper explores the possibilities for what may be called an 'infrasonic music'.

1. Sound and the musical arts

Investigation of new ideas and materials for art practitioners has only recently been recognised as a legitimate research stream alongside more traditional quantitative research methodologies within academic frameworks¹. In addition, congruence between art and science has developed in recent times, and music has been no exception to this. There are now many opportunities for artists to use scientific data and technological developments to enhance or indeed build their practice on, and work collaboratively with scientists in the creation of artworks.

¹ In Australia, this development is largely attributed to a document known as the Strand Report (Strand, 1998), developed as a result of lobbying from music and visual arts bodies, and later supported by theatre and dance practitioners. It has influenced the structure of research funding and support within university schools to include recognition of creative practice as a bone fide research outcome.

One scientist who took a great interest in informing music practice with scientific concepts was Hermann Helmholtz, who proposed the delineation of noise and music through investigations into acoustic science and its deployment in music. Helmholtz attempted to unite two sciences that he believed had been always considered separate: music and its related aesthetics with the physical and physiological sciences (Helmholtz, 1885, p.24). Helmholtz's ideal has been largely reinforced within the development of art forms such as sound art and installation, where music, visual, acoustic and architectural factors are blended. Sound art and installation are more strongly defined by their occupation of physical and/or acoustic space than a relationship to time, creating a different way of experiencing music. According to Licht (2007);

Sound art, then, rejects music's potential to compete with other time based and narrative driven art forms and addresses a basic craving for sound. (p.16)

But when does sound become music? Around 1940 maverick composer Edgar Varése coined the term 'organized sound' to describe the possibilities for the future of music (Varése, 1936 p. 207). Yet since Helmholtz, the incorporation of so-called 'non musical sounds' into music has been a slow, and as yet unfinished, journey. It began with the Italian futurists ideas about the inclusion of all sounds into a contemporary musical language that would accurately reflect industrialised society. This was most clearly articulated in Luigi Russolo's 'Art of Noises' manifesto in 1913, where he states: "This limited circle of pure sounds must be broken, and the infinite variety of 'noise-sound' conquered" (Cox, 2004 p.11). This was an invitation for new instruments (of which Russolo himself invented many) as well as an opening up of music to a wider variety of possibilities, realised to a greater extent in the work and writing of John Cage, who declared in 1937;

I believe that the use of noise to make music will continue and increase until we reach a music produced through the aid of electrical instruments which will make available for musical purposes any and all sounds that can be heard. (Kostelanetz, 1974, p. 54)

2. Hearing and listening to music.

It is crucial to discuss what being 'heard' means exactly. Whilst it has been said that "we can allow that

sound is a minimal condition of the music fact” (Nattiez, 1997, p. 43), we need to ask what constitutes a sound – the vibrations that create it, or our ability to hear it? Vibration obviously occurs in many areas outside of music, but to consider such vibrations as art or music, this material would need to be organised, contemplated, created and/or controlled to some extent.

Is it possible to hear and thus listen to music in more ways than with the ear? Hearing can take many forms – we hear mostly with our ears, but we may also sense sounds in other ways – though anticipation as well as other physical responses, such as feeling the movement of air (like standing in front of a loud sub woofer speaker at a rock concert, for example). This is not unlike the coalescing of senses that takes place when audience enjoy works that involve sound, performance, visual stimuli and even interactivity together. In fact, there are many inaudible low sounds that make part of the harmonics required to hear specific notes and chords on many instruments, as in those of the string family and the lower ranges of bass wind instruments (Helmholtz, 1885, p.152). But for hearing to be processed by the brain into a more refined sensibility, we must consider when hearing becomes listening. When do sounds demand to be listened to, rather than just heard? The study of semiotics has some useful ideas here. French post-modern theorist Roland Barthes, for example, suggested that hearing is a physiological condition, whereas listening is actually a psychological act (Barthes, 1984, p. 245). That is, listening requires a certain type of engagement from the brain that hearing does not. Music requires listening to be understood or appreciated, and of course hearing to facilitate this psychological state. If listening is what differentiates music from other sounds, and the body provides a way to hear, listening can involve the presence or absence of audible sound.

When the very low frequency range becomes inaudible to the human ear (and the threshold depends on a variety of factors such as age, etc) we may call it infrasound. This is where the ear loses its ability to define pitch. It is at this point, where sound moves in and out of this range of hearing, that infrasonic music can sit, enabling different listening experiences defined by a listener’s physical experience of the work.

Once low frequency sound moves below a certain measurement, it passes a point in aural perception when the brain becomes increasingly sensitive to messages about sound from organs other than the ear, such as skin, through The Merkel Cell, Meissners corpuscles and

Pancinian corpiscles (Leventhall, 2003, p. 22). Low frequencies (usually referred to as *bass* in music) may also be perceived inside resonating cavities of the body, such as the ribcage or the inside of the head (Takahashi and Maeda, 2002, p.141). This offers a possibility to create a music where the entire body, rather than any particular organ, is active in the listening experience. The body becomes a kind of “vessel for the instantiation of musical works” (Brown, 2006, p. 39). The absorption of patterns and formations in certain music compositions in a bodily way is a realisation that the medium of sound is in fact a very visceral, physical phenomenon.

3. Sound and the imagination

Sound employed in creative contexts can take on many forms – as playback, input, artefact, an interactive signal or even as a three dimensional aspect. It can be employed as a conceptual framework, as was preferred by Fluxus artists such as Yoko Ono and Dick Higgins among others². This often meant that the audience is left to ‘imagine’ a sound or be challenged about the very idea of sound and its creation. This kind of conceptual music offers a useful analogy for the experience of sounds that you can’t hear in any traditional sense.

Douglas Kahn discusses the idea of an ‘impossible inaudible’ in music and claims; “there is no doubt that silence exists. On the contrary, there is an acknowledgement of a multitude of silences” (Kahn, 2001 p. 240). Here Kahn references the way concepts of silence has been investigated in musical works, using the particular example of La Monte Young’s *Composition 1960 #5* (Kahn 2001 p.237) centres on a butterfly - whilst the wings of a butterfly do produce a sound, it is almost impossible to hear it – but that does not deny the existence of that sound. Here, the idea of a sound replaces its actual creation or possibility of hearing that sound. Works of this nature tend to be closer to an idea of visual art – in fact sound art theorists such as Brandon LaBelle argue for the inclusion of artists such as Young in the canon of conceptual art as well as the canon of music (LaBelle, 2006, p.153). Just as imagery can allude to a sound, sound can work in conjunction with, or even control imagery: such as occurs in cinema or radio art. Silence, then, it not really possible in

² Fluxus was an art movement most active in the middle of the Twentieth Century that explored art that combined different disciplines.

music, if we include the very thought of a musical work to be a kind of music in itself.

John Cage is a name often associated with ideas about silence and music. His influential work *4'33"* (1953) features three movements of 'silence'. Cage himself has never clearly articulated whether this piece was about an absence of sound or the deliberate inclusion of all environmental sounds into the realm of music. The latter concept was largely confirmed with the French *musique concrète* movement of the 1950s who made the most of new recording technologies to record 'found' sounds – such as trains and other environmental sounds, manipulating and reproducing them as music. This shaped new phenomenological ideas about music, articulated in the work of acoustician Pierre Schaeffer, who developed a new concept for music through a study of acousmatics. His idea was to allow sound itself to have its own existence and identity distinct from its source, an idea that has been widely accepted in today's electronic music practice and approaches to music theory.

The proposition of an infrasonic music then pushes the dimensions of silence, acousmatics, and sound art even further, by offering a music that combines new ideas of listening with physiological limitations of the listeners themselves. Silence is reincorporated and reinterpreted in a music composition where sounds may be measured according to their relationship to human hearing, and this relationship be manipulated and developed into artworks.

4. Art that investigates listening with the body

A number of artists have investigated alternatives to the ear for the experience of listening that have helped form a path to a kind of infrasonic music within performance, installation and recording. Anderson's *Handphone Table* (1978) is a work where Anderson claims that the cranial cavities of the participant become a 'speaker' for her compositions (Fig. 1). A source of low tones is sent to powerful amplifiers embedded in the table. The listener can only hear the sound source by placing elbow in the marked depressions of the table's surface and covering the ears. Sound is conducted from the recording through driver, table, and elbow and on to the skull, creating a work that explores an alternative to the ear for listening.

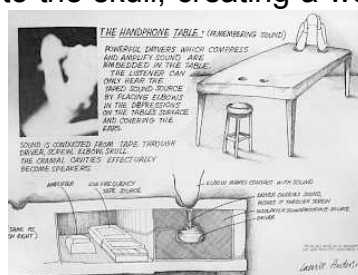


Figure 1: Laurie Anderson, the score to HANDPHONE TABLE.

Maryanne Amacher attempts to make the listeners body create its own sounds as part of the listening experience in the compact disc *Sound Characters (Making of the Third Ear)* (1998). This release features tracks that are engineered to vibrate, and thus ‘activate’ the inner ear with the music on the CD recording when it is played at high volume. This allows our ears to “act as instruments and emit sounds as well as receive them”, an effect known as otoacoustic emissions (Amacher, 1998, CD sleeve note). The sound is created inside the ear as it resonates with certain frequencies, triggering additional sounds heard only inside the head, exploring a new way for the body to be engaged in the listening process.

Echoing the conceptual sound ideas of Kahn and LaBelle, sound can be used to create visual or sculptural works. Carsten Nicolai’s *Milch* (2000) used a range of frequencies from ten to 150 Hz to create patterns in milk. This work mirrors Ernst Chladni’s experiments that used pure sine tones to vibrate granular matter into a range of shapes that shift with the changing frequency (Helmholtz, 1885, p.71). In *Milch*, the low frequency tones used were almost inaudible, and the sound was ‘visualised’ in the pools of milk as they form three-dimensional patterns in their containers (Fig 2).

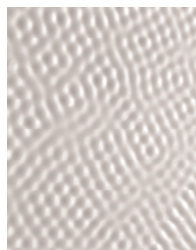


Figure 2: Carsten Nicolai, still image from *Milch*

San Franciscan sound artists Scott Arford and Randy Yau investigate the way low frequency sound and the body interact in a series of live performances entitled *Infrasound* (2001-present). The artists take physical measurements of the performance space, and then create music that interacts with the calculated resonant frequency of that space by creating sympathetic vibrations. They encourage a listening with the body where the music is very much in the space, rather than from any audio speakers. They seek

a type of psycho–physiological effect on the audience using high volumes and vibration to activate both the architecture and the listeners inside it (Arford and Yau, 2001).

Activation of the architecture by sound effectively makes musical instruments out of objects and buildings. Mark Bain's *Live Room* (1998) installation attaches out of phase vibrating oscillators to the internal pillars of multi-story buildings so as to make them perform. The music is emitted from rooms several floors above the point of placement of the oscillator on a pillar. Bain also created a seventy-four minute work entitled *StartEndTime* (2004) using seismographic data collected during the 9/11 incidents in New York in 2002, exploring the 'conceptual music' idea using low frequency data. This is an ambient work where different levels of slow moving sound produce mixture of frequency ranges that are quite distinct and electronic.

English acoustic engineer and composer Sarah Angliss performed a series of experiments at the Purcell Room in London in 2002 in collaboration with other acousticians and artists. Her composition *Some Go Back Underwater* (2001) for electronics was performed with a lacing of infrasound added to the work. A sound cannon, a device designed to create very low frequency sound at high amplitude, was placed at the back of the room and switched on during the piece. The audience were surveyed on the different responses experienced, to discover if indeed there was any difference between works with and without the sound cannon activated. The published results claim that the pieces laced with infrasound created 'strange' responses in over twenty two percent of the audience, which included descriptions such as a "sense of coldness, anxiety and shivers down the spine" (Angliss, 2003 p. 164). The artistic or musical effect of this 'strangeness' however, was not tested.

5. Methodologies for composing infrasonic music

The movement between tonality (audibility with the ear) and sensation (audibility with other body parts) is the area much infrasonic music investigates. Immersive and ephemeral performance or listening experiences are enhanced by the opportunities offered when working with low frequency sound – creating a music that moves between innovative and traditional ways of listening. This can be realised in three general approaches; composing and performing music that comes in and out of tonal

audibility or pitch recognition, increasing the listening spectra to include other physiological experiences, and using low frequency tones to activate other objects to turn them into performing instruments or translators of the sonic data into other physical dimensions. A fourth approach is the lacing of music with infrasonic tones. However, this in itself is less of a compositional approach in that the actual music itself is not created with low tones.

In my installation *The Low Groom* (2006), a low frequency tone is emitted from a bass amplifier into a small room, where one person may enter at a time. The person listens to a low, slow sultry voice on closed headphones which instructs them to manipulate a piece of fresh offal in a bowl before them (the offal is filmed live and projected onto the naked back of a live performer in the space, which gives an effect of 'manipulated' internal organs). Here the intention of the low tone is not to offer the audience something to listen to or focus on in a conventional sense, but to offer an effect that will alter the way the listener experiences the voice in the headphones; a resonance within the body, when the ears are closed off and they eyes focused elsewhere (Fig 3). The tone intends to create a 'feeling' or 'atmosphere' in the room that the visitor is unlikely to even notice sonically. It is used and devised in a similar way to Muzak – to control the way people experience a space. Muzak claims to 'affect those who hear it but does not require a conscious listening effort' and uses psychology to understand the best types of music for certain situations.³ *The Low Groom* uses low frequency sound not as music (it is after all a rather tedious ongoing tone) but as part of a larger, spatial concept of composition. The headphones are very personal, both in their use and the style of voice played through them. But so is the low tone, it feels very close even through the source is not close to the listener or even visible. Low frequency sound is omnidirectional and as such 'fills' a space.

³ Muzak is scientifically engineered sound - functional music rather than entertainment. The Muzak Corporation, when it was first founded, had psychologists and musical experts on their staff to tailor music to certain requirements. This quote is taken from a Muzak Corporation brochure.

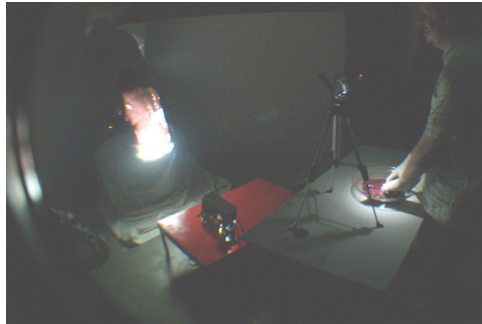


Figure 3: Cat Hope, *The Low Groom*. Audience member and performer.

This is a different effect to works created by my *Abe Sada* project (2006-). *Abe Sada* is a project for any number of bass guitars. They create loud, rumbling soundscapes that are constructed almost exclusively of tones below fifty Hertz, often mixed with bass feedback. *Abe Sada* directs these sounds at various sites in a performance – onto bodies of the audience, transferred into the architecture of the performance venue or by vibrating objects in the room. These effects are not meticulously controlled, rather they ebb and flow with the input of the various performers featured in each *Abe Sada* performance. Each *Abe Sada* performance has a score, sometimes graphic, other times more propository, such as in Figure 4 below. This enables performers freedom to improvise and allow sounds to interact by accident, but within the restrictions stated in the score;

AbeSada
Liquid Architecture_2007_
RMIT carpark

Play as slowly and loudly as possible. Do not play any note above the highest string (G). Use only 15" speakers (at least 2) and at least 500W of tube amp. Performers should spread out in the space, and not use anything resembling a stage. All amps facing into the middle, against the walls for maximum volume. Feedback is encouraged. No melody or riffs. Detune when possible. Try to make your pants flutter in the breeze of your amp. Play for twenty minutes. Remove the lead from your amp to signal the end.

Figure 4: Score for *Abe Sada* performance at Liquid Architecture Festival of Sound Arts, July 2007.

The use of guitars creates a strong image in performance that is linked to conventions of rock posturing rather than art installation or classical music ensembles.

However, conventions of rock music are challenged, as pointed out in the following review;

Slow, subtle and introspective, this is darkly beautiful music that partly builds on the aesthetic that emerged in the Hendrix era of the electric guitar, but which draws more on the ethos of sound art to establish a unique and compelling oeuvre (Reid p45).

The group usually performs around a venue rather than on a stage, out of the spotlight and into the audience's space, uses its bass amps and no other speakers to ensure a consistency in the level of bass sound in the mix. As in *The Low Groom*, venues are preferably small and claustrophobic, enabling the speakers to be much closer to the audience, intensifying the listening and performative experience. The music moves between different levels of frequency and volume, climatic and meandering, to create a live music experience that involves different types of listening perception. Audience members describe physical experiences such as teeth chattering, pressure in the chest, chills and note objects vibrating in the room.

In *Sada Abe 1936* (2006), the group performed under raked seating in a performance venue, turned the amplifiers on their backs and in contact with the seating support structure, allowing their music to vibrate the audience through the very structure they were seated upon (Fig. 4). The audience watched a screen that showed very abstract live footage of the group performing under the stage, but the focus was very much on the physicality of the sound for the audience.



Figure 5: Abe Sada, a member under the stage in *Sada Abe 1936*

A more studied approach to low frequency tonality takes place in recordings, where a range of compositions are treated in more controlled ways. My album *Fetish* (2002) is a recorded collection of short bass guitar solos that explore the movement in and out of pitch recognition in

low frequency ranges. Pitches move below the range of the bass guitar using unique tunings, octave displacement, post production tuning and loop manipulation. Distortion is used to blur the sound and create diverse textures where a wide range of pitches coexist. Likewise, *Hertz Circus* (2001) composed by Lux Mammoth (a collaboration between myself and artist Dr Alien Smith), explores bass effects for two bass guitars and tone generators through the compact disc mastering process, whereby the manipulation the final mix uses a variety of low frequency management and outboard effects.

Lux Mammoth also investigated the potential of low tones produced by power tools in a musical context in the *Tools* (2000) series of performances using film to reinforce links between visibility and audibility. In this series of concerts the motors of power tools were amplified through bass amplifiers and sub woofers. Contact microphones and piezo pickups were used to amplify a more intense vibration source that was then looped and effected by the performers. The power tool as musical instrument has remained constant in many of my projects since then, for example the first Abe Sada recording, *Subzilla* (2007) featured chainsaw solos on two of the tracks. This is largely because the low tones emitted by such tools sit well in the timbre of the bass guitars (in a live setting in particular), and acknowledge the influence of the early ideas of 'noise machines' by the Italian futurist on such music as Abe Sada's.

Projects such as Lux Mammoth, Abe Sada and Fetish investigate a use of bass not common in music. Bass is traditionally used as a reinforcement or colour, and in rock music generally reinforces a beat or underpins chordal structures, often linked with percussion. These projects however use bass in all components of each composition – texturally as well as harmonically - even melodically at times.

Whilst the study into the effect of low frequencies in music is not as extensive as the range of studies in a noise abatement context, many anecdotal comments made after my concerts have proved useful in shaping the aims of this music. A common description is that the music creates a 'sensual' and 'warm' experience in the body. This is in marked contrast to the 'annoyance' or 'pressured' feelings reported by people exposed to environmental, unfocused, ongoing infrasound (Broner, 1978, p. 483), showing more in common with the responses of patients exposed to low frequency vibration in treatments such as Vibroacoustics,

where low frequency sinusoidal pressure waves are blended with music for therapeutic use (Boyd-Brewer, 2003, p.24).

The idea of infrasonic music, therefore, is to create a listening that goes beyond definitions of 'silence' and 'sound', but includes 'sensation' as another dimension to listening.

7. Conclusion

John Cage believed that '*the principal of form will be our only constant connection with the past*' (Kostalnetz, 1974, p.56). Infrasonic music offers a new approach to form, not only of music composition, but also of reception. It is with these ideas in mind that composers such as myself are able to stake a claim to music and share these experiences with a range of adventurous participants. Whilst the idea of a music that is 'silent' has been investigated thoroughly through conceptual approaches to music composition, infrasonic music offers a more physical, tangible approach to the possibilities between silence and music.

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