Silence As Stillness? Sonic Experiences in Art using Infrasonics

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Abstract
Is silence the ultimate depiction of stillness in a sonic environment? Not all music is audible, if it is created using a frequency range high or low enough. Developments in sound reproduction, measurement and creation technologies have allowed us to control the frequency and volume of sound more fully, challenging our idea of what silence is. There are certain ranges within the low frequency sound spectrum that teeter on the cusp of audibility, but are never silent. Rather, they involve entire structures or bodies in the 'listening' experience through vibration, ultimately allowing listeners an individualised role in their own experience of a work. This paper discussed some artists approaches to low frequency sound production in composition, installation, and performance.

A sound is all the possible ways there are to hear it. (Fontana, 1981)
Inaudible low frequency sounds, often called infrasound, offer a radical new tool in the construction of sound works that wish to involve the listener in new, centralised ways, creating new levels of embodiment in installation, performance and recording. Infrasound can be used to lace audible sound, imply sonic depth or to create controlled vibrations, the latter which can have a range of physical effects on human bodies and objects in general.

The experience of listening is something often aligned with stillness through ideas of contemplation, focus and direction. Silence as the absence of music is no longer possible, since history has redefined what music is. Concepts of timbre have enlarged to include electrical signals and environmental sound as well as acoustical instruments, and musical form engages much more than traditional elements of melody or harmony. John Cage performed a famous experiment with the anechoic chamber in 1951, where he found two sounds - a high frequency signal (his nervous system) and a low frequency hum (his blood) omnipresent in an environment that does not allow external sound, leading him to conclude;

> There is no such thing as empty space or empty time. There is always something to see, something to hear. In fact, try as we may to make silence, we cannot... (Cage, 1961)

We have never lived without music then, as our physical bodies do not allow us to enjoy silence. In the late 1970s, English auditory physicist David Kemp first put a microphone to an ear and discovered the sounds of the cochlea at work, suggesting our very hearing mechanism produces sounds of its own. But there is a point in the human listening experience where our understanding of sound changes from a listening experience (with the ear) to a resonating one (with other parts of the body) - we cease to hear what we have called a sound and start to feel it as the vibrations that make up all sound. According to Hemholtz's theory of sympathetic resonance, every object has a resonant frequency and will vibrate sympathetically in response to it – every tissue in our body has its own unique frequency at which it starts to vibrate sympathetically with an external sound vibration. This theory can be thought of in the example of the opera singers shattering glass – once the singer hits a note with the same resonant frequency of the glass, it will shake itself apart and shatter.

So when does sound cease to be sound, and start to be understood by us as a different sensation to listening? This is a complex question that can be answered more easily in scientific terms than in experiential ones. A healthy young person hears all sound frequencies from approximately 20 to

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20,000 hertz (Hz) [1], so technically, we cannot hear below 20 Hz in most cases, depending on attributing factors such as hearing damage, age, reproduction volume and environment. For example, a sine wave tone at 20 Hz requires from 85 to 90 decibel sound pressure level (DbSPL) to be audible, 1 and 2 Hz needs over 120 dB SPL. Experiencing a loud rock concert or jet engine can give you an indication of the power of volume over frequency. Pyschoacoustic healing is a health treatment that uses the low frequency sound range to resonate different parts of the human body, using different frequency measurements that they claim heal different parts of the body[2]. We would hardly call the signals used for this purpose 'music' or 'art'. So perhaps our understanding of inaudible sounds is about how the sound is delivered – is it intended for listening, or as a sensation, or finally - a more obvious combination of both? French theorist Roland Barthes describes how listening has changed from a fixed deciphering to a more active "signifying" of sounds[3]. If we take the dictionary meaning of listen as "to hear attentively; to pay attention to" and hearing "to perceive (sound, or something that emits or causes sound)" [4] then we can indeed included the effects elicited by inaudible sound, and in the case of this paper, infrasonic sound, as sound for listening.

The way our body perceives sound vibrations offers up interesting avenues for sound in art – what perceptual modes are triggered and how these will exist for a listener. The way we locate and sense sound are important in our understanding of sound art works that focus on the hearing/vibrating experience, and allow audience to contribute to the experience of a work. These are works that will often explore physical resonances of the individual audience members body and/or the presentations site's architecture. They may deal with ways of translating vibration in audible sound. They deal with thresholds, immersion and physiological experiences of acoustic space. There has been much written about the damage to the human body low frequency can create at high volume: including discussions on sonic weaponry such as those by robotics engineer Dr. Vladimir Gavreau, Nicola Tesla and the Nazi's in world war two. Infrasound is shrouded in myth (as many 'invisible' things are, such as ghosts) but it is a sonic phenomena that is subject to the same issues of the other extreme in the hearing range i.e. high frequency: extreme volume can be damaging. The combination of pitch and volume is important, and controllable.

Many composers, sound artists and performers find interesting creative possibilities in the low frequency sound range, and artists have engaged with them in different ways. Investigating the lower edge of most human hearing thresholds, artists approach audibility and sensation in different ways.

The study of low frequency ranges between around 20 Hz and 0.001 Hz is what seismographic machines use for monitoring earthquakes, which provide a useful illustration for this discussion. The 'rumble' heard in an earthquake is the sound of things vibrating, not the vibrations themselves. Japanese sound artist Toshiya Tsunoda translates inaudible vibrating objects into a audible range to facilitate a listening experience discoverable on a purchased recording, resulting in a radical rethinking of the concept of field recording. He creates recordings with a piezo-ceramic sensor that generates pressure with a weak current. This allows the vibration inside a solid object to change into a voltage which can in turn be recorded. He titles his pieces with what they are, and his album *extract from field recording archive #3: Solid Vibration* begins with a track entitled *Metal –plate fence. Tauraminato-cho, Yokosuka city, Kanagawa* which is followed by notes about the behaviours of the vibrations and the methodology of the recording.

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[1] Cutnell, J. D. and Johnson, K.W., 1998, *Physics*. 4th ed. New York: Wiley, p466.
[2] It should also be noted that even through this technique has existed since the 18th century, it has never been recognised by mainstream formal medical practice.
[3] Barthes, R. (Trans. Howard, R). 1984 "*Listening*" in *The Responsibility of Forms: critical essays on music, art and representation.* Oxford: Basil Blackford
[4] Oxford English Dictionary Online, accessed 22/4/07

> In the micro-level, there's a pulse-like random vibration going on during the amplitude comparing to effectors that just draws simple smooth slopes. This is the reflection of the physical shape in space. The level of my CDs are low in general but that's because it includes the frequencies that are usually cut off on normal CDs. maybe it's a bit reckless in terms of audio since I don't use editing softwares etc, and I just use the recording as it is. You can understand the nuance when headphones are used. As an exception, I equalize and cut specific frequencies when i wish to focus more on particular points. (Tsunoda, 2002)

Tsunoda manipulates the media of CD reproduction to his own means, by extending the CD frequency range that is usually limited to 20 – 20 000 Hz, the generally accepted range of healthy human hearing. Tsunoda claims that locating the original source of sounds in an environment is not as exciting or important to as exploring how those sounds interact with each other and the space in which they exist even when that 'space' is a CD recording.[5]

Californian sound artist Randy H. Yau is also interested in translating sound – specifically infrasonic waves into audible fields for installations and live performances. He often uses only a small hand held device to generate the original tones which are then manipulated using frequency modulation on a laptop computer to pitch them down in frequency. Yau has collaborated with Scott Arford, a sound artist with an architectural background who uses low frequency to achieving spatialization of sounds. Together in 2001 these artists formed the *Infrasound* collaborative performance project, where they produced live concert performances that:

> More than just creating and delivering an "infrasonic" effect, everything from composition to presentation originates from the principle mission of activating the body and space through sound. (Arford and Yau, 2004)

Prior to their live performances, which often happen in general spaces rather than concert venues, the artists test the spaces thoroughly to discover the acoustic possibilities and characteristics of each. This group's performances saturate the body and surrounding architecture with subsonic vibrations, inviting the audience to experience their own body through the performance. They also focus on the way low frequency sound reacts and multiplies in a room, activating sympathetic vibrations in bodies as well as architectures. Vibration becomes acoustical effect, making the sound, space and listener inseperable. It becomes difficult to distinguish what is heard and what is felt, what is amplified and what is vibration. Body and ear become one:

> The body is thus displaced in the multiplicity of overheard voices, against the layers of frequency and volume, giving way to psycho-acoustical occurrences, where body and ear short circuit their seeming division. Subjectivity is thus made "radiophonic": cut up, thrown apart, transmitted and received, dispersed and doubled-up, sound agitates the very borders of body and mind, vibrating its limits and introducing a "difference"—that of bodily listening. (La Belle, 2003)[6]

The idea of bodily listening is an integral part of New York artist Maryanne Amacher's site specific installation work. Amacher explores the displacement of a body through frequency and spatiality, and the very loud sounds she uses are structurally borne, not air borne. Speakers are placed against architectural structures or in other rooms to allow sounds to reach the listener via these structural means. Her work aims to activate what the artist calls the 'third ear' – sounds created inside the ear as it resonates with certain frequencies, creating individualised sounds for different people in the

[5] Interview with the artist, http://www.inpartmaint.com/plop/e/feature.html# accessed 22/5/07
[6] LaBelle, B. 2003 *"Sound Art and the space of the museum"* http://www.samtidskunst.dk/3sted/index.php?pid=10&va=&t=t&id=8 accessed 25/4/07

room. Sounds and architecture are intertwined, as they are in Arford and Yau's performances, but architecture bears and presents the sounds, encapsulating and articulating the work.

> The virtual tones are a natural and very real physical aspect of auditory perception, similar to the fusing of two images resulting in a third three dimensional image in binocular perception ... I want to release this music which is produced by the listener ...(Amacher, 1999)

Here the focus of the work is on how we hear, and what that hearing can create. Amarcher claims 'technologies of presence' are making immersive installations easier, though also expresses frustration with the 'mechanical souls' of loudspeakers. Computing has offered an enormous amount of control function and operable interface to sound spatialization, measurement and manipulation, and yet sound reproductive technologies still maintain a very mechanical operational basis, residing in the physical 'air shifting' realm.

A number of experiments have been made lacing music with infrasonic vibrations to establish if low frequency sound can affect mood. These projects use a device known as a 'sound canon' a long tube made to move the large amounts of air required to produce an accurate effect. *Soundless Music* project leader, English composer and engineer Sarah Angliss added the infrasonic 'effect' at 17Hz to musical works as they were played during a concert in the Purcell Room, in 2003. The audience claimed to report a variety of effects from 'coldness' to 'anxiety'.[7] Works such as these attempt to attribute something of an 'emotive' effect to vibration, a concept that has been thought to contribute to the experience of so called paranormal events.

A more interesting outcome of these sorts of experiments is the way that certain inaudible sounds may effect the way we hear audible ones. The structure of harmonics work this way, where a fundamental frequency combined with overtones creates the timbre of an instrument. This is one area of infrasonics that could be investigated further from aesthetic point of view – where the vibrations caused by inaudible sounds create audible ones from other objects.

Through different approaches to stillness – of site, reproduction and the listening experience artists have used inaudible low frequency sounds to enable resonance to sculpt hidden acoustic potentials of all things material, including ourselves. In doing so they manage to embody the audience as part of the work in ways that provide new involvement for audience and creative experience alike.

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Biographical Notes

Cat Hope is an active performer, sound artist, composer and music researcher. She creates pure music, music for film, sound art, singer-songwriter material, noise music, video art, interactive art and has over 10 CD releases. Her music focuses on the low end of the sound spectrum, and she has a particular interest in the relationship between sound and image. She has toured her works in Europe, Japan and the USA. She is a PhD candidate in Sound Art at RMIT University Melbourne, and coordinator of composition and music technology studies at WAAPA, ECU.