Electromagnetic Field as Medium to Listen to the Texture of the World

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ABSTRACT: Reflecting on how listening to the electromagnetic field could reveal the energetic fabric of our world – and therefore influence our environmental relationship to it –, the paper presents the approach and results of the "Electromagnetic Field / Acoustics Explorations" workshop presented during the conference "Invisible Places" on sound urbanism and sense of place.

KEYWORDS: electromagnetic field, sound in space, sonification, invisible activity, textural presence, noise, information, environmental awareness, listening as social design.

1. Introduction

As a sound artist, I consider that my primary job is to bring awareness to the ubiquitous presence of sound, and the role that it plays in connecting us to the environment. Approaching listening as a medium, but also, as a social design practice, part of my work consists of leading soundwalks in urban environments to creatively engage the local communities with their living surroundings.

By bringing attention to the presence and behaviour of the electromagnetic radiations, the workshop aims to explore how listening to the invisible noise of our urban environment can inform our understanding of it.

2. Report

2.1. Mechanical versus Magnetic Waves

As electromagnetic waves are not mechanical vibrations but electromagnetic radiations, they cannot be directly perceived by the human ears. To be heard, electromagnetic radiations must be converted to pressure waves in order to convey 'readable' information to our ears.

Because sound is a mechanical energy, it uses matter (like air, water or plasma) to transfer information to us. It is mechanical vibrations that our hearing system interprets as significant audio signals. In other words, it is only raw data of vibrations that our ears turn into meaningful symbols of linguistic signs and musical structures. And so, it is the transformation of vibrations into sound that helps us understand the world around us. Based on this method, the process of sonification[1] is used by scientists, researchers and artists, to understand phenomena that exist beyond the scope of our physical senses. With sonification, complex data can be revealed, interpreted and analysed.

2.2. Listening to the invisible

In the attempt to make the listeners aware of the flow of information that sparks and disseminates within the urban environment of the city of Ponta Delgada, the participants were equipped with a professional high frequency analyser and a hand-made amplifier circuit. With these devices, the electromagnetic field is rendered audible, and thus observable in terms of frequency, sonic texture, grain, loudness, volatility, variability and density.

Built for the detection of electric smog in areas of building biology, the professional device (the HF35C Analyser) uses a transducer to transform the electromagnetic fields into acoustics waves and signals, which are detected by an omnidirectional antenna. Designed for the identification of radio waves ranging from 800Mhz to 2.5 GHz, the analyser is particularly

1. Sonification is the use of non-speech audio to convey information or perceptualize data.

relevant to detect cellular phones, cordless phones, microwaves, as well as technologies such as WLAN, WIFI, 3G or Bluetooth. Mainly translated into a vocabulary of audio signal pulsations and granular noise textures, the electromagnetic radiations appear to be quite constant in their aspects and constitutions. The Bluetooth signals, for example, render the high steady pitch that we all know very well by now. These signals, when reaching a maximum speed and/or interfering with other signals, start to create – from a textural point of view – interesting granular material: a mix of medium to fine grain particles intertwine in the foreground, while a more fat and gross granular texture lies in the background. Other propagations like the DECT[2] (cordless telephones) generally delivers a repetitive thick 'beep. beep – beep / beep.beep – beep' signal that overlaps a more detached 'tak.tak / tak.tak' sound, recalling some kind of hypnotic techno beat from the 90's, twisted with the minimal rawness of the electromagnetic field's idiosyncratic style. Quite sensitive to other signals, the DECT radiations are volatile and can accumulate pollution from other near signals, adding significant power to their original output. The DECT radiations are the most prominent in Ponta Delgada. Their pollution is very present and can be very intense; especially nearby hotels, banks, institutional buildings, and sometimes churches. The reason for that are the security systems. Used by public buildings, but also by private consumers, those security systems are the number one source of electromagnetic smog in the small city of Ponta Delgada. Spreading within a radius of 4 to 5 meters from their sources, the DETC radiations can easily investigate the whole streets. For example, the street 'Beco Jardim Antonio Borges' with its fifty rooms hotel, and parking, located nearby a bank and the post office, renders an impressive amount of DECT radiations. Some measurements have shown quite dramatic results, even at more than 5 meters from the hotel and parking spaces. Strong DECT radiations are also present in dilapidated walls and other run-down structures. The frequency radiations seem to agglomerate in cracks, crevices and clefts like insects and moulds.

Another repetitive, and volatile pulse-pattern, is the one of the GSM signals from mobile phones. Allocated between 900 MHz to 1800MHz, the cellular audio signals render a consistent 'morse code' that displays a quite aggressive character. The oppressive effect is mainly due to the general loudness of the signals. Also, the 'ta.-ta.-ta.-ta.-ta.-ta.-ta.-ta.-ta.-ta.-ta.-' characteristic of these audio signals, as it rarely evolves into other rhythms, makes it very difficult to listen more than a few minutes. These two features (loudness and fast repetition) make the GSM signals one of the most repulsive to my ears. Only when the signals get coupled with other close radiations, can some variations then happen, offering some relief from their frontal repetitive pattern.

The WLAN also features a repetitive pattern that displays a sequence of 'pa.pa.pa.pa.pa. pa.pa.pa.pa.pa'; but on the contrary to the other ones, this one has almost no granularity.

2. Digital Enhanced Cordless Telecommunications (usually known by the acronym DECT), is a standard primarily used for creating cordless telephone systems.

Each ‘pa’ signal is clear, compact and dry. Their loudness rarely evolves into a too high volume, and their impulses are quite soft. There is something almost mechanical about the WLAN signal that takes away the general aesthetic of electromagnetic radiations. There is not much to expect from those signals, as their patterns, tones and behaviors are very constant and demonstrate no particular creative impulse. WLAN appears therefore as pretty flat and redundant. It only gets interesting when it mixes with other signals, for it accumulates more texture, density or richness in the background, contrasting even more with its mechanical materiality.

Another electromagnetic signal that I am particularly a fan of, is the one from some radars. Evolving in the higher frequencies, they demonstrate an elegancy close to ‘micro-sound’[3] and other compositional works from Alva Noto and Ryoji Ikeda. Fine, discrete and fragile, these particles of radiations are the delicacy of the electromagnetic field. Their graceful presences demonstrate a politeness toward the listener. To the contrary of the aggressive GSM, the radars radiations are exquisite to my ears. Unfortunately, I could not find many of these delicate tonalities and sparkling particles in Ponta Delgada’s city center. It is by the harbour that most of the radar waves could be heard; but even so, not many of those microtonal radiations were to be found there.

To get to hear the refined world of electromagnetic micro-particles, the participants then needed to use the other device: the hand-made one. Specially build for the soundwalk, the device uses a capsule microphone amplified by the LM386 chip, with an additional gain. Amplifying the electric currents and their electromagnetic radiations, the device allows the participants to listen to the micro sparks of electric and electromagnetic waves. With this device, the capsule microphone acts as the antenna to capture the electric radiations. And so, it is by scanning screens of mobile phones, computers and other public machines (like parking meters) with the capsule microphone that the device reveals the flares, radiating dots and scintillations of the electromagnetic field.

2.3. Implications in listening

The two devices and their respective sonification of the electromagnetic field involve different attitudes in listening. The professional HF35C Analyser allows for a larger reading of space than the hand-made amplifying device. With the HF35C Analyser, the body’s gestures can scan buildings, streets and the environment in an intuitive and almost playful way; thus, enabling a more global mapping of the various electromagnetic waves in the different urban zones of Ponta Delgada city.

The hand-made amplifier device, on the other hand, brings a more gentle and focused attention in listening. Implying the use of headphones to enter the world of subtle micro

3. Microsound are all the sounds that are below the time scale of musical notes. They usually last less than one-tenth of a second.

particles, the device immediately generates a more intimate type of listening. Changing the posture of the body from extravert to an almost introvert position, the hand-made amplifier suggests a more private listening, which makes it possible to observe the tiny sounds that evaporate and mutate like dust in the air.

3. Conclusion

Listening to the sonification of the electromagnetic radiations – and their propagation in space-, allows us to become aware of the invisible and textural electromagnetic energy that cohabits within our urban environment and lives. Superimposing their granular existence, and microtonal language over the streets and buildings, and through all of our communication tools and toys, the electromagnetic radiations navigate the vacuum of the world by using their own routes, waves, lines, and gathering rules. They do not relate to matter as we do. Therefore, they pass – and trespass – our concrete walls, as they do with our fleshy body and structural bones.

Becoming aware of their presence, it's opening our selves to the realms of energy that exist beyond the frontiers of our eyes. It participates in "reimagining form so that it resists the conventional objectification of the material world" (Anunas and Ingold, 2013). As Sufi master Pir Vilayat Inayat Khan expresses it, "to step beyond the physical plane, one has to learn to remark the form beyond the substance; and enter a whole world of forms beyond the world of substance". Listening to the world around us, contributes to connecting us

to the vibratory energy of sound, and thus partakes in reshaping our understanding of it. Tuning our ears to the invisible radiations that animate the background of our world, is to consciously observe the texture that interconnects each of us, and our implication in it.

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