BRAIN.WAV: EEG BIOFEEDBACK IN PERFORMANCE AND IMPROVISATION

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ABSTRACT

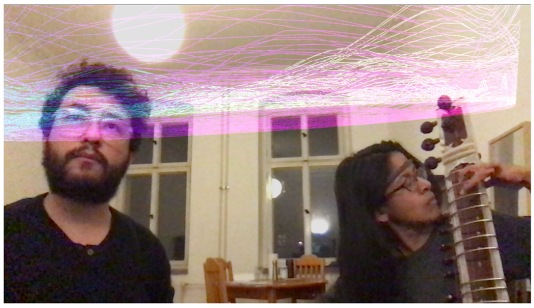
Brain.wav brings their unique process iBoS (Input Brain Output Sound, patent pending) improvising with both brain and acoustic waves, creating biosonic loops. Shama and Nico will present and exclusive teaser, tailormade to the virtual world, merging analog and digital. Through digital signal processes Nico captures and sonifies Shamas brainwaves into electronica sounds, while Shama incorporates the sonified brainwaves into her improvisation, generating a recursive loop and of course, listening to her own brainwaves changes her own brainwaves, so its a tightrope act. Nico and Shama unique process disrupts the market of contemporary improvisatory music and creates orthogonal, value for their stockholders (aka the audience.) We invite you to take part in this world premier teaser and become a member of the BrainClub, directly from the streets of Berlin into your living rooms.

1. INTRODUCTION

During the last decade or so, we have been a surge in consumer-level devices that are capable of measuring brainwave activity in one way or another. They range from basic tasks such as meditation relaxation and sleep aid, to experimentation and educational proposes through the programming of microcontrollers. One of the main appeals of devices is that they can stream and present data in real time, making them attractive for consumer. Real time application is a great vehicle for the sonification of data, as it is immediately available and direct interaction with the device can elicit a recognizable sonic response.

One of the most logical applications for this device is their use as Brain-Computer Musical Interfaces. A thorough review on the ideas of BCMI can be found in [1]. According to them, the idea of BCMI is to create a device that controls musical parameters. Just are regular BCI are used to control other computational devices (see, locked-in syndrome.) As a form of control, mapping is the main tool to develop significant changes over sound signals and musical events. As the capacity of computers and devices to process information grows, the number of parameters and indicators that can be mapped to music are greater and therefore more flexible.

2. IBOS



iBoS Streaming set up

We created an authonomous project of musical improvisation that merges synthetized sounds controlled by brainwaves with traditional acoustic instruments such as the Sitar. Through digital signal processes we capture and sonify brainwaves into electronic sounds, incorporating them into the acoustic improvisation, generating a bio-feedback loop. The auditive cues presented through sound spatialization and sonic immersion function as the medium to explore the nuances of our emotional perception. This generative production of space is dictated by AI algorithms that react to signals captured in the room i.e. the improvisations created by the performers and their soundwaves.

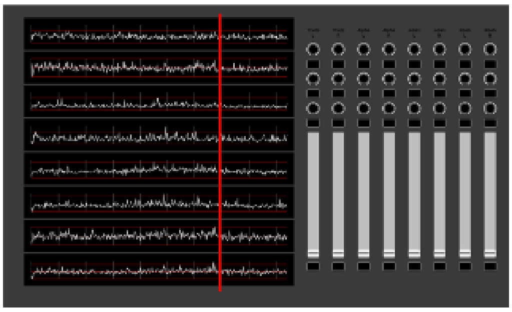
Brain.wav is the first creative output of the iBoS project. It is an improvisation between sonified brainwaves and acoustic instruments. The set up consist of a Muse2 headband connected to a smartphone using the MindMonitor application. It is a commercial app developed by James Clutterbuck and is designed to be used in conjunction to the Muse device. The application serves mainly as a bridge between the Muse2 and the main MaxMsp patch running on a computer. The data is then transmitted as OSC messages via WiFi connection. MindMonitor allows the streaming of different data including the raw data from the four main electrodes, as well as the FFT analysis of each electrode, resulting in power band frequencies of Delta, Theta, Alpha, Beta and Gamma. It also recognizes blinks, jaw clenches, and transmits gyroscope and accelerometer data.

Once the OSC data is incoming, we tried different approaches. Some of the most common mappings were tested, including the audification of the different frequency parameters (mapping frequency band to audible frequency bands in an specific range) creating a sort of pre-established harmonic floor; mapping to filter frequencies, resembling voice formants; mapping raw signals to the amplitude of the channels, and so on.

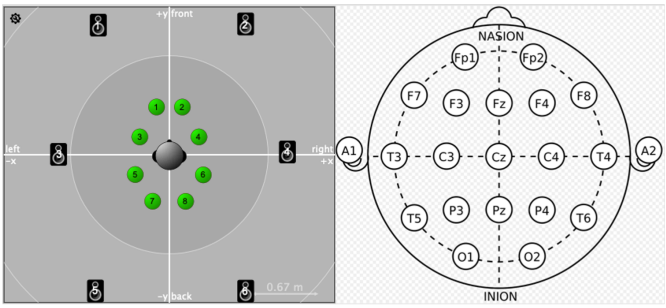
3. PERFORMANCE PERSPECTIVES

Initially, the goal was to produce an event that will showcase the results in the form of a multichannel audio concert or sound installation, but all the prospects have been postponed due to Covid-19. Six speakers distributed in an architectural space, representing each of the brain areas, reproduce sound translated from the data of different EGG measurements. This will allow to not only hear, but properly embody the reading of the brain activity . The multichannel mapping would reflect the position of brainwave activity in different areas of the brain. The first iteration of iBoS / Brain.wav was presented at the Polymath festival in a Virtual format in February 2021. Therefore, the piece and the process is already available to perform in a virtual space.

4. FIGURES



Brainwave Sonic Instrument prototype



Binaural Set Up

5. MEDIA LINKS

- `https://www.youtube.com/watch?v=T3_-IKE4jtw`
- `https://soundcloud.com/nicodaleman/brainwav`

6. REFERENCES

[1] J. Eaton and E. R. Miranda, "On mapping eeg information into musi," in *Guide to Brain-Computer Music Interfacing*, E. R. Miranda and J. Castet, Eds. London: Springer-Verlag, 2014, pp. 221–254.