SOIL CHOIR v.1.3 – soil moisture sonification installation

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ABSTRACT

The artistic sonification offers a creative method for putting direct semantic layers to the abstract sounds. This paper is dedicated to the sound installation *"Soil choir v.1.3"* that use sonifies soil moisture in different depths and transforms this non-musical phenomenon into organized sound structures. The sonification of natural soil moisture processes tests the limits of our attention, patience and willingness to still perceive ultra-slow reactions and examines the mechanisms of our sense adaptation. Although the musical time of the installation is set to almost non-human – environmental time scale (changes happen within hours, days, weeks or even months…) this system can be explored and even played also as an instrument by putting sensors to different soil areas or pouring liquid into the soil and waiting for changes...

The crucial aspect of the work was to design the sonification architecture that deals with extreme slow changes of input data – measured values from moisture sensors. The result is the sound installation consisting of three objects – each with different types of soil. Every object is compact, independent unit consisting of three low-cost capacitive soil moisture sensors, 1m long perspex tube filled with soil, full range loudspeaker and Bela platform with custom Supercollider code. I developed this installation during the year 2019 and this paper will give insight into the aspects and issues connected with creating this installation.

Author Keywords

Sound installation, sonification, soil moisture, Supercollider, Bela platform, polytemporal

1. INTRODUCTION

The ability of abstract sound to convey information [1] is widely explored by the sonification community for scientific, navigational or artistic purposes. In sound art or contemporary music scene the sonification is used as an alternative compositional technique or an artistic gesture that assigns significant meanings to sounds or an art piece in general. This approach is in very contrast to Pierre Schaeffer semantic reductionism and especially to his second acousmatic reduction *"...the listener does not only needs to separate visual and audio cues, but also to disconnect the sound from any physical, cultural and psychological references and indexes."* [2]. The sonification used in music thus brings semantic flip – from purely aesthetic perceiving of abstract sounds promoted by founders of musique concrète and acousmatic music to something that could be called data rich, informative listening experience.

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In the installation *Soil choir*[1] there are used real-time measurements from the soil moisture sensors as a reference to actual drought period caused by globally discussed climate change. The aim of the work was to give a voice to normally silent processes that are happening in large scale time-space formats. The contrast between expected human musical time scale and the extremely slow environmental processes was the initial definition of the installation.

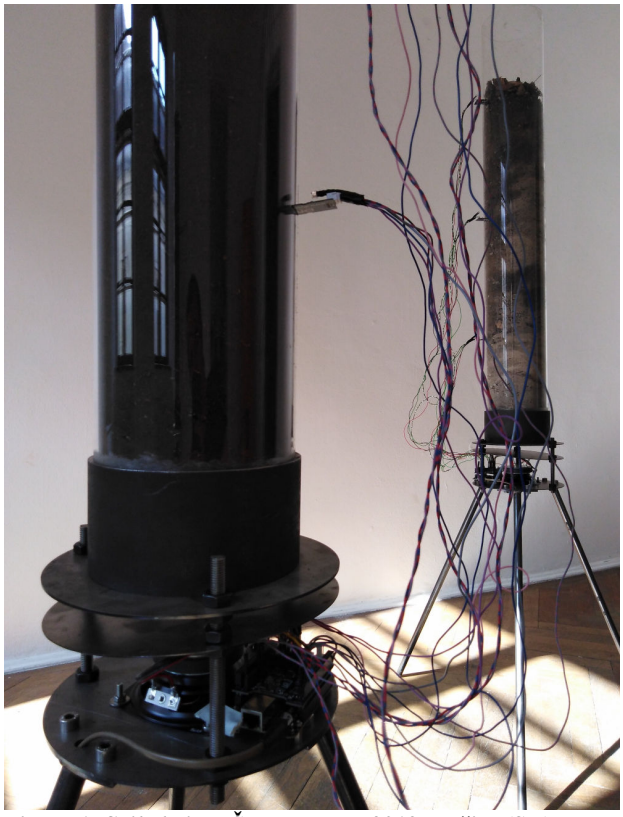

Figure 1. *Soil choir* at Šopa gallery, 2019, Košice (SK)

2. INSTALLATION

2.1 Hardware body

The aim was to create three independent units that handle whole sensor processing, sound synthesis and reproduction in compact hardware bodies. The system of the installation is based on the Bela[2] platform. Electronics is semi-hidden below the Perspex transparent

[1] https://www.jiri-suchanek.net/en/project/soil-choir/

[2] www.bela.io

tube filled with soil. Each unit contains different type of soil (peat, mixed forest, clay with stones) and uses three capacitive moisture sensors placed in 5 cm, 50 cm, 80 cm depths to measure its moisture. Scientifically accurate moisture measurements [3] are relatively difficult to achieve with low-cost sensors. The aim was to minimize the measurement errors by calibration procedure and reducing the air gaps between soil and capacitive sensors that cause errors. Also one red LED light is connected to each sensor and reflects the measured values. Steel stand holds also the speaker that is aimed to the ground and the sound is projected to the ground and reflected back up to listeners.

Figure 2. Detail of the dry garden soil

2.2 Parameter mapping sonification design

Supercollider code was written for the sonifying measured data. Three versions were developed and presented. The third code version will be briefly described below. Because the data inputs are extremely slowly evolving the aesthetic consideration [4] how to achieve suitable listening, the experience was taken to place. The parameter mapping architecture was composed in "one to many" approach – one data input to many parameters. The most significant mapping was dedicated to rhythm – pulsations control rather than pitch and timbre control. The initial idea was to create sort of Geiger counter sonic behavior. The main structural architecture setup is constituted in manner that each sensor controls amplitude modulation of one "parent" tonal oscillator with specified pitch (and controllable timbre) and one noise generator. The data from sensor controls the speed rate of the trigger signal that triggers the amplitude envelope for the tonal oscillator and red LED light. Envelope times of attack and decay are also proportionally adjusted by the trigger's speed rate. Another parameter destination is LFO speed controlling amplitude modulation of noise generator. Then also crossing connection is done between sensor input and another two "non-parent" oscillators / noise generators. These crossing connections are controlling mainly the timbre of oscillators and noise generators. The result is poly-temporal [5] rhythm structure that slowly evolves and creates pulses offsets during the longer listening period. Its behavior refers to minimalist composers like Steve Reich (*Pendulum, Come out, It's Gonna Rain*), Terry Riley (*In C*) but also to Iannis Xenakis polytemporal techniques used in *Pithoprakta*.

3. CONCLUSION AND FUTURE IMPROVEMENTS

This paper gives basic overview of the sound installation Soil choir. The installation is suitable for a permanent setup where listeners could explore the sounds and their changes during the whole year. The installation could communicate an actual environmental topic in a quite unexpected way and creates hopefully functional intersection between art and science. Suitable location for the permanent installation will be searched. For this occasion also several improvements will have to be done – specifically precise placement of sensors and IP65 protection for electronics that could survive public installation. New sonification sound design could also consider tonal changes (not just timbre and rhythm). The plan for the future version(s) is also to include sensitive contact piezo microphones or geophones placed directly in the soil that will add also the acoustic sound layer of hidden soil (micro) sounds.

4. ACKNOWLEDGMENTS

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