

DIY BIONOISE

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1. PROJECT DESCRIPTION

DIY Bionoise (2018) is an instrument in which the performer can generate sound and noise, deriving from their own body. It contains a circuit that can measure the bioelectricity from living beings to control the instrument by tactile sense. This instrument has two functions – a modular synthesizer with an eight-step sequencer and a bionoise control mode.

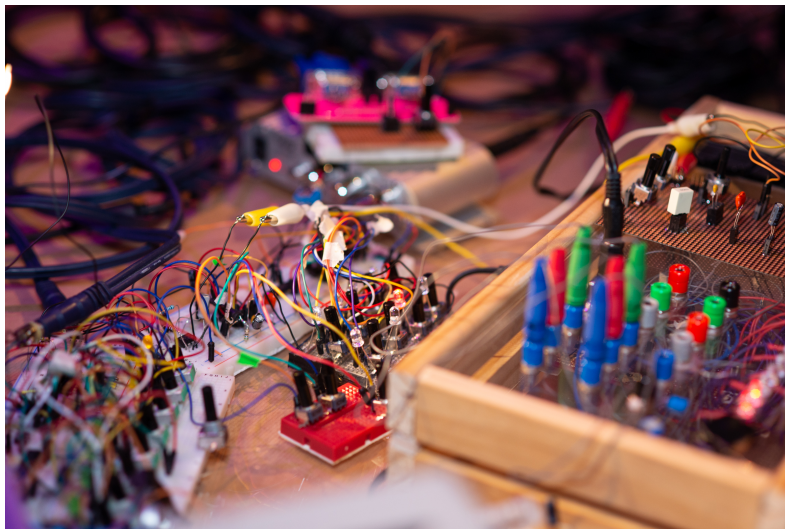


Fig. 1. DIY Bionoise Instrument

DIY Bionoise is developed from my previous work *Sonomatter* [1] which explored the transformation of bioelectrical energy from soil bacteria to sound. In my previous work *Sonomatter*, I used microbe's bioelectrical energy as Control Voltage (CV) to operate custom designed *Bioelectricity-Controlled-Oscillator (BCO)* module, and it translates electrical signals into sound of oscillator, therefore the amount of voltage, measured from soil bacteria, influences on the duration of the sound.

Bioelectricity can be produced by any kinds of living organisms. It is an evidence of life activity especially in the microscopic world. Biosignals have been implemented not only for medical devices such as Electroencephalogram (EEG), Electromyography (EMG) and Electrooculography (EOG), but also it have been used in artistic works. For instance, Alvin Lucier used certain brain signal to control percussion instruments in his performance *Music for Solo Performance (1965)*. Like he explained that it is about energy control rather than making sound, he picked up alpha wave from his brain through meditational status [2].

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In recent years, many artists have created artworks related to biological materials and technological experiments. Furthermore, advanced biotechnologies have inspired artists and researchers, and enable them to create unique artworks. For example, artist Guy Ben-Ary used his own stem cell to make an autonomous synthesizer, controlled by electrical signals from neural network [3].

DIY Bionoise also used biosignals as a musical expression. *BCO* module has been modified to create noise from performer's tactile senses. The instrument interface design adopts electronic music devices such as modular synthesizers and step sequencers as well as devices emerging from the DIY culture. This instrument can easily be customised by changing different values of electronic parts such as capacitors and sensors. It creates systems to a musical instrument that can interact with bioelectrical energy from the human body.

2. TECHNICAL NOTES

The technical implementation of *DIY Bionoise* is developed from a customized circuit called *Bioelectricity-Controlled-Oscillator (BCO)* module, which use bioelectricity as CV (Control Voltage) to operate an oscillator. BCO has an instrumentation amplifier chip (AD620) for amplifying bioelectricity, and Hex Schmitt oscillator chip (CD 40106) to make sound.

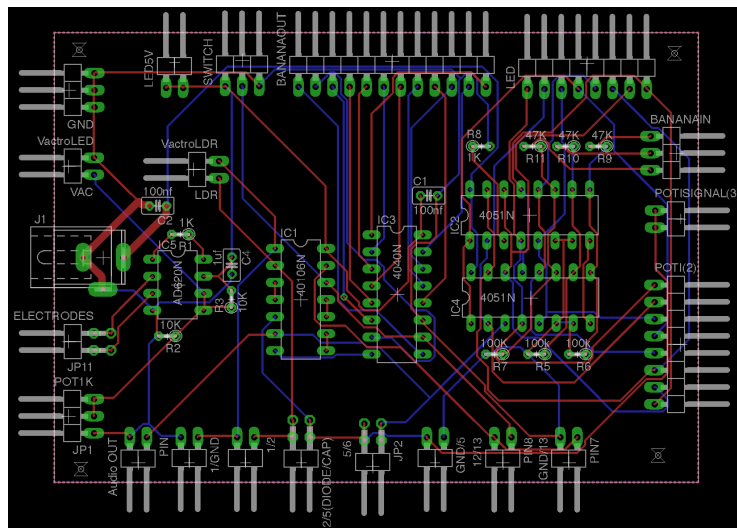


Fig. 1. PCB design

In this work, I have reformulated this BCO module to be used with bioelectricity from human tactile sense, and to mingle with DIY fun. With this instrument, performer can choose between modular synthesizer mode and bionoise mode.

In the noise mode, when the performer touches the touch pad, performer's bioelectricity is feeding to the circuit therefore the performer can control sound of their own bionoise. Technically, a performer's electrical energy is interrupting the sound of oscillator.

For the synthesizer mode, I added an 8 step sequencer, made of a CD 4040 (14 stage binary counter) and a CD 4051 (8 channel multiflexer). The bioelectrical signal from a performer is amplified by an instrumentation amplifier and routed to an oscillator. The oscillator is connected to a counter and a multiflexer, so that the sound of pitch and duration can be controlled by customisable knobs. The parameters of Low Frequency Oscillation (LFO) and pitch are controlled with 100K potentiometers, and performer can choose among various sensors such as Light Dependent Register (LDR). As a result, *DIY Bionoise* has a mono output, bionoise control pad, 12 different time divide mode with banana connectors and an eight-step sequencer with pitch and LFO control.

The touch pad is installed as electrodes similar to BCO module in *Sonomatter*, however, its function is more focused on touching the surface as tactile interface rather than the measuring certain amount of electrical energy.

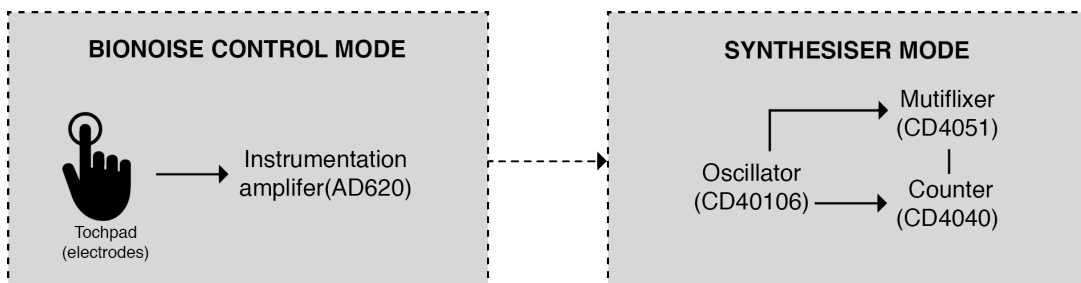


Fig. 1. Two modes of DIY Bionoise: Bio-control mode and Synthesiser mode.

3. PROGRAM NOTES

My works are related to finding multi-layered relationships between human and non-human living beings by translating imperceptible data in natural elements into different perceptual experiences. Biological materials often used, combined or connected to machines, and transformed. I have used bioluminescent algae, soil bacteria, my breathing data, and bioelectricity as well as technology including computational and analog methods. For this project, I wanted to use bioelectrical energy as joyful musical expression that can be performed by human beings.

This project design is inspired by DIY cultures such as hardware hacking, custom designed modular synthesisers and circuit bending experiments from Nicolas Collins [4] and many other DIYers communities. Those hands-on techniques are revived recently with the Post digital media concept, brought us a new creation of physical interfaces, modular systems [5] and combination of different mediums [6]. *DIY Bionoise* is a musical interface built based on the post-digital media philosophy that is connecting electrical energy of living beings to a circuit board. Also, this instrument focuses on enjoying making music out of performer's own body energy with a customisable interface.

For the live performance, I add a visual element by connecting a custom designed video synthesiser from a workshop by Wolfgang Spahn [7], so the audio signal is visualized, and the audience can watch how the performer can customise the instrument in real-time.

Media Link(s)

- Video: <https://sabinaahn.com/bionoise/>
- Audio: <https://soundcloud.com/sabinaahn/diy-bionoise-ulsan-new-music-live>

ACKNOWLEDGMENTS

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REFERENCES

- [1] S.H Ahn, *Sonic Transformation with Living Matter*. ISEA Proceedings, 2019. <https://www.sabinaahn.com/sonomatter>
- [2] D. Kahn, *Earth sound Earth Signal*. Berkeley, USA: University fo California Press, 2013.
- [3] G.Ben-Ary, and et al. CellF: a neuron-driven music synthesiser for realtime performace. *International Journal of Performance Arts and Digital*, 2016.
- [4] N.Collins, *Handmade Electronic Music: The Art of Hardware Hacking*. New York, USA: Routledge, 2009.
- [5] T. Magnusson, *Sonic Writing: Technologies of Material, Symbolic, and Signal Inscriptions*. London, UK: Bloomsbury Academic, 2019.
- [6] P. Weibel, *The Post-Media Condition*. <http://www.metamute.org/editorial/lab/post-media-condition>
- [7] W. Spahn, http://paperpcb.dernulleffekt.de/doku.php?id=vga_synthesizer:vga_main