EDO Artifacts

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1 Program Notes

EDO Artifacts is a live-performance piece for a computer-sequenced modular synthesizer to explore equal division of the octave (EDO) tuning systems. The composition is written prior to performance using the ChucK music programming language. During the performance, a computer running this program interfaces with the modular synthesizer, converting signals from the code into voltage to drive oscillators and amplifiers in the system. The flexibility offered by the programmatic composition supports complex arrangements of phrases, sections, and modulating tuning systems, while the modular synthesizer provides the performer precise control over the sound through real-time manipulation of timbre-shaping parameters. In this way, ChucK acts as the "orchestration" or the "brain", whereas the modular synthesizer is the "instrument" or the "body" of the piece. There are four sections—labeled as fragments—each written using a different EDO tuning: 5EDO, 7EDO, 31EDO, and 15EDO, respectively. Each tuning has been selected to suit the stylistic and textural qualities of its respective fragment, shaping both the compositional approach and the resulting sonic character. The fragments are purposefully brief, serving as previews of the musical potential of each tuning.
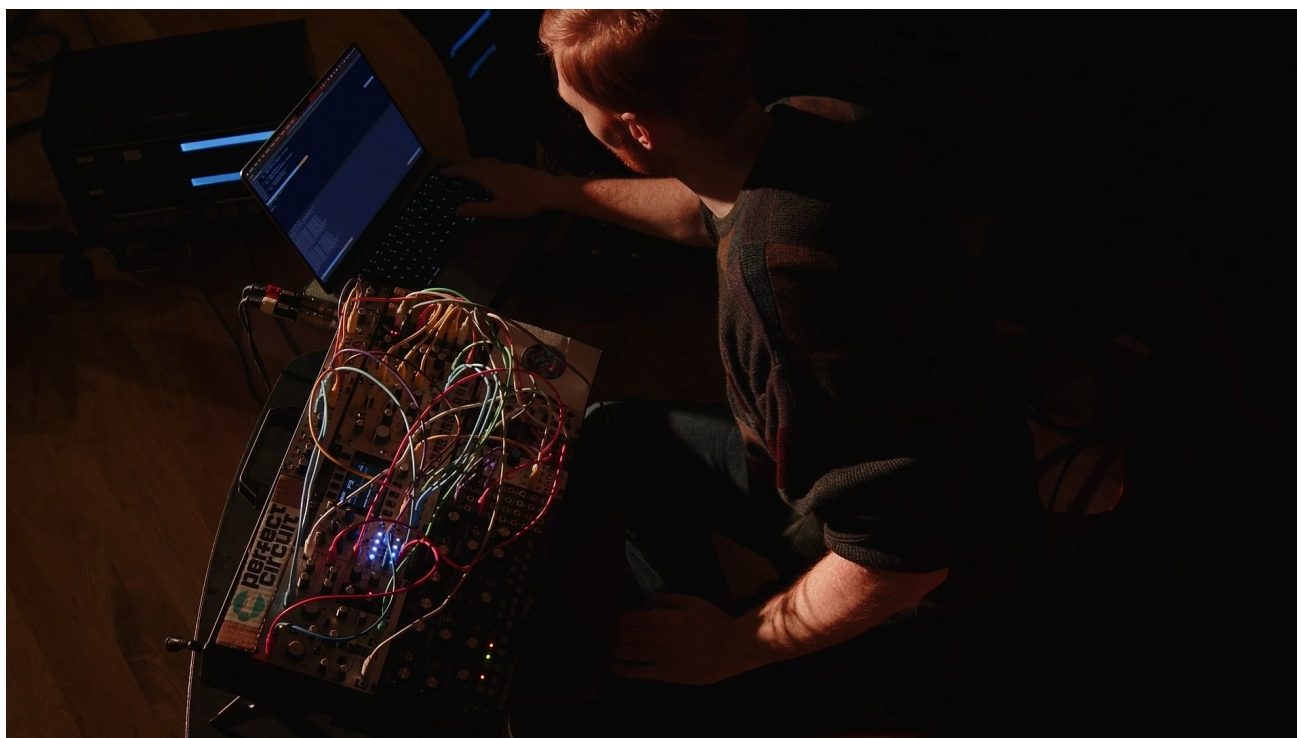

Fig. 1. Overhead view of modular synthesizer and laptop integration, 2024

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2 Project Description

EDO Artifacts is a music performance that explores equal division of the octave (EDO) tunings via a computer-sequenced modular synthesizer. The piece is structured into four distinct sections, each written using a different EDO tuning: 5EDO, 7EDO, 31EDO, and 15EDO, respectively. These tunings were chosen for their distinct characteristics—both in contrast to 12-tone equal temperament and to each other—highlighting their unique compositional possibilities while still maintaining a sense of listenability and consonance. The piece was conceived as a starting point for deeper exploration into the vast world of tuning systems.

Creating complex arrangements of independent voices (i.e. sound sources) in a modular system is notoriously difficult, and may require modules that are large, expensive, and limited in ability [1], which is not practical in a portable setup. For *EDO Artifacts*, granular control over the timing and tuning of each voice was necessary. To achieve this, custom code was written in the ChucK music programming language that enabled precise sequencing, layered voice arrangement, and tuning selection. Two frameworks were developed in ChucK to support these needs: the Tuning framework, which defines arbitrary tunings based on octave divisions or frequency ratios to the fundamental, and the Arrangement framework, which controls the position and timing of notes in a sequence. Sequences can then be ordered, reused flexibly, and assigned to voices. Tunings are also assigned to voices, and the note frequencies in a sequence adapt based on the current tuning. Offloading the sequencing to a programming language enables any tuning system or rhythmic structure without adding to the physical setup. This freedom allows *EDO Artifacts* to sound more traditionally tonal or EDM-adjacent compared to many modular compositions.

Utilizing the frameworks described above, the composition is programmed before a performance. During the performance, a computer running this program translates note sequences for each voice into a stream of numbers representing frequencies and durations. This data is sent via USB to an Expert Sleepers ES-8 module within the synthesizer. Acting as a bridge between the computer and the synthesizer, the ES-8 converts the incoming number stream into voltage—the "language" of modular synthesis. Its outputs are then routed to analog oscillators and amplifiers, which generate the actual sound.

By allowing the computer program to sequence the piece, the performer focuses on sculpting the sound in real time by engaging with the knobs, switches, and buttons of the synthesizer to shape timbral parameters. ChucK acts as the "orchestration" or the "brain" of the piece, the modular synthesizer is the "instrument" or the "body", and the performer is the "energy" or the "spirit" that brings the two together.

Fig. 2. Performance perspective: A live overhead camera feed is projected onto a screen, providing a clear view of the performance, 2024
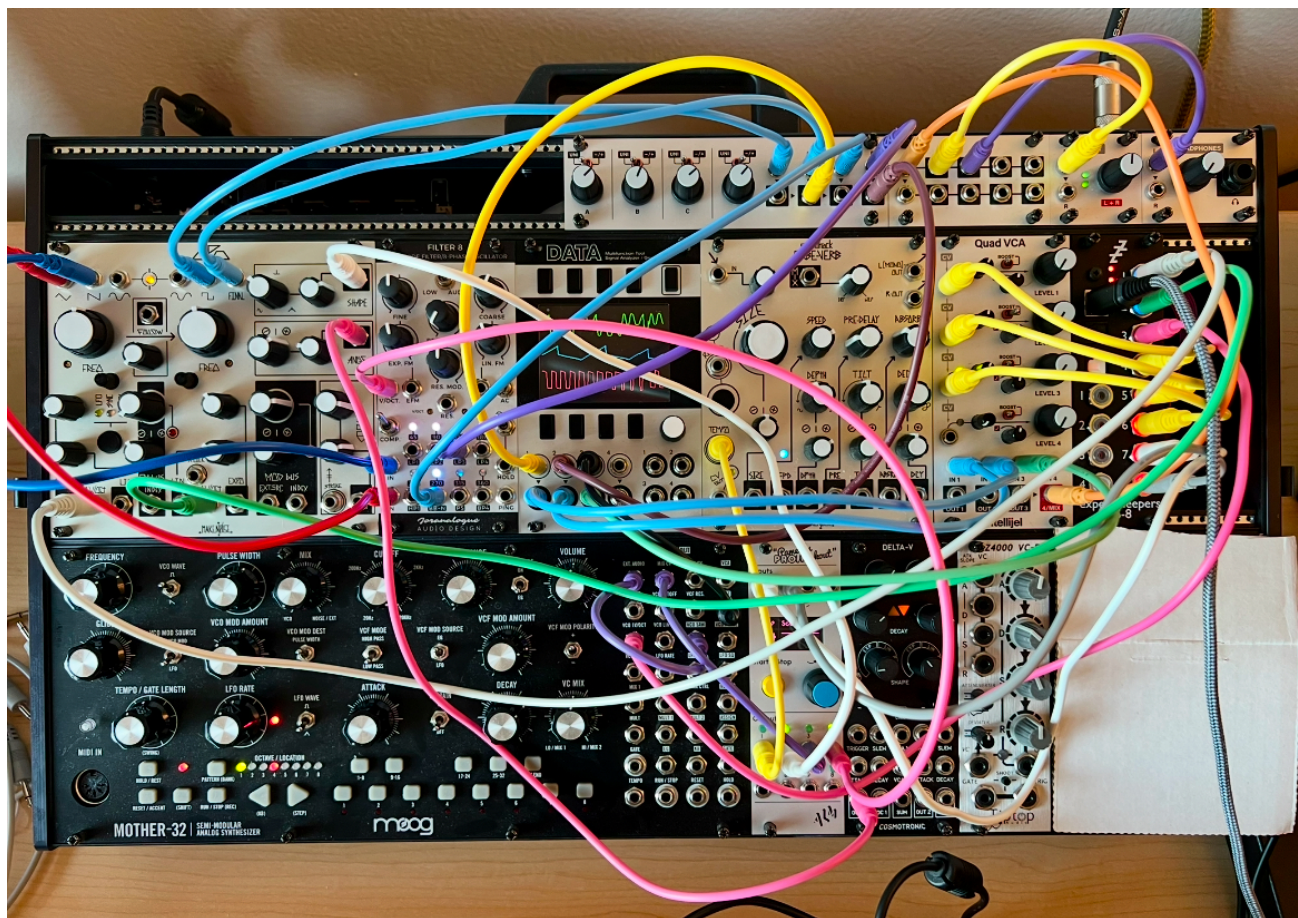
Fig. 3. The Eurorack patch for the performance. The Expert Sleepers ES-8 module (pictured in the middle row, far right) receives pitch, envelope, and clock data from the computer, which sequences the piece, 2024

3 Technical Notes

EDO Artifacts is a live performance and requires stereo output. The performer will be bringing a Eurorack modular synthesizer, a laptop, a 3ft. power cable, multiple USB-C to USB-B cables (only one is needed to connect a laptop to the Eurorack case, the rest are for redundancy), and extra 3.5mm patching cables.

The following equipment is needed:

- Two balanced ¼" cables for the Left and Right output channels of the Eurorack case. These cables should be connected to a stereo speaker system.
- A nearby power outlet or power strip that can support 3 power cables. One power cable is USA Type B and two power cables are USA Type A. The outlet or power strip will need to be reachable by a 3 ft. cable.
- A table (or similar surface) that can fit a 21x12.5 inch (approx. 53x32 cm) Eurorack case and a 12.5x9 inch (approx. 32x23 cm) laptop.

Additionally, if available, an overhead video of the performance should be projected on a screen behind the performer in real-time to show the performer's interaction with knobs, switches, and buttons. To support this, the following equipment is needed:

- A camera that supports live HDMI output.
- A tripod or stand that allows the camera angle to be adjusted downward.
- An HDMI cable connecting the camera to the projector.

The camera can be placed on a tripod next to the performer. The camera will be pointed at the Eurorack and will send live output via an HDMI cable connected to a projector.

The performer will be sitting behind the table to interact with the Eurorack modular synthesizer, so a chair will also be needed.

4   Media

- Video: https://www.youtube.com/watch?v=cg4VUd2ON9E

5   Ethical Standards

The work described does not involve the participation of any human subjects or animals and adheres to the ethical standards set by NIME. The work is self-funded by the author. The author does not have any conflicts of interest to report.

References

[1] Kim Bjørn and Chris Meyer. 2018. *Patch & Tweak: Exploring Modular Synthesis*. Bjooks.