

Diffraction Constellations: A Modular System for Acoustic Violin Programmed in Max/MSP

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Diffraction Constellations is a live performance and research project that combines an acoustic violin with a set of bespoke Eurorack modules programmed in Max/MSP and embedded on the Daisy Seed SOM. By capturing, transforming, and re-sequencing violin gestures, these modules operate as compositional fragments that can be patched together in myriad ways. Each module began as a “composition made parametric,” evolving through hardware constraints to support improvisatory practice. This document details the technical design and performance methodologies of six custom modules—called Arvo, Glacial, Detritus, Volution, Widgets, and Forest—highlighting how each processes violin-derived or other input to create layered, time-stretched, and/or autonomous sonic behaviors. These modules collectively shape a system in which performer and electronics co-create emergent musical structures.

Additional Key Words and Phrases: Modular Synthesis, Violin, Improvisation, Embedded Audio, Max/MSP

1 Program Notes

Diffraction Constellations is an improvisatory performance for acoustic violin and a set of six custom Eurorack modules. The system captures and transforms sound and musical gesture through granular techniques, looping engines, and real-time dynamic sampling and manipulation. The performer’s violin playing triggers and reshapes modular processes while the modules contribute partially autonomous behaviors. Over time, layers of violin fragments accumulate and recirculate, creating a constantly evolving texture.



Fig. 1. Performing with the modular case and acoustic violin.

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2 Project Description

2.1 Conceptual Background

The project originated from the author’s desire to move away from prior laptop-based systems for augmented violin [4] towards a more constellation-based design approach in hardware, where each module acts as a distinct unit of compositional logic. Following Walter Benjamin’s image of ideas as constellations—“ideas are to objects as constellations are to stars” [1]—each module began as a discrete musical “fragment” (e.g., a looping or granular process) that underwent iterative parametric expansion. For further discussion, the reader is referred to two companion papers: one examining the philosophical implications of this approach in the context of sensemaking [3], and another providing more extensive technical detail about the development in Max/MSP [2].

2.2 System Overview

Six bespoke modules—*Arvo*, *Glacial*, *Detritus*, *Volution*, *Widgets*, and *Forest*—run on open-source Daisy-based DSP platforms in the Eurorack format. The system is supplemented with standard utility modules (VCAs, envelope generators, mixers), an open-source control-voltage processing module (“Ornament & Crime”), and the Befaco Instrument Interface. The latter is used to bring the violin signal into the modular environment.

- **Arvo** is a looping engine that captures short violin segments, layering them into polyphonic fugues or homophonic chords.
- **Glacial** captures events triggered by the violin’s amplitude envelope. It compresses or dilates these events via time-stretching granular algorithms.
- **Detritus** passively loops continuous input, allowing unpredictable glitch, filtering, and playback reversal. It acts as an autonomous or “hauntological” layer that can foreground or recede, depending on feedback and cross-patching.
- **Volution** extends granular processing to very long “grains” (up to 30 seconds). This serves as a time-dilating engine, generating slowly evolving textures from the violin input.
- **Widgets** houses a collection of smaller “dynamic sampling” processes that capture short gestures, reorder and/or accelerate them, generating bursts of sonic fragments. It also integrates a real-time pitch-shifter for cello-like doubling of the violin.
- **Forest** plays back curated sample buffers (i.e., pre-recorded audio files concatenated with a Python script and ordered by length), driven by real-time gestures and amplitude envelopes extracted from the violin. Forest creates a sense of machinic intentionality through techniques of coupled or delayed imitation behavior, tracing out the violinist’s gestures like a watermark.

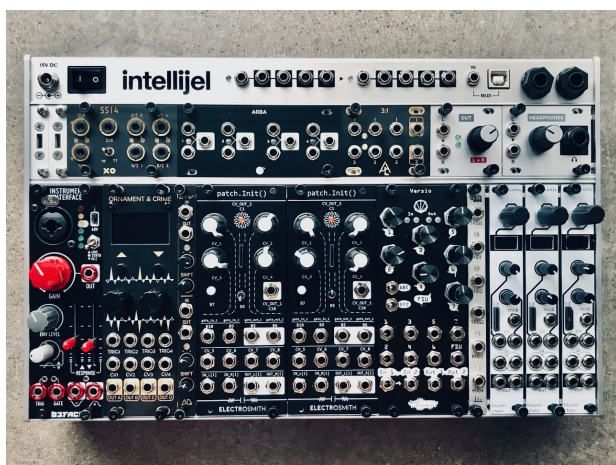


Fig. 2. Unpatched system.

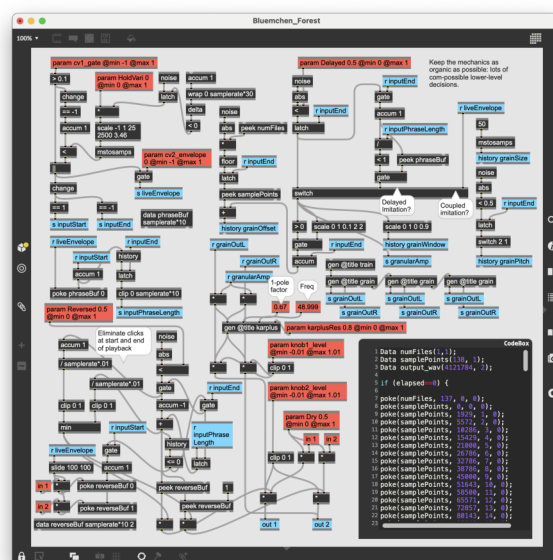


Fig. 3. Screenshot of the “Forest” patch.

2.3 Embedded Development and Constraints

All modules were programmed in Max/Gen and compiled for the Daisy SOM via *Oopsy Daisy* [5, 6]. Hardware constraints (limited knobs, gates, and CV inputs) required each module to be thoughtfully pruned or hybridized parameters. But this constraint-guided process became creatively liberating: focusing on a few key parameters allowed each module to develop a clear sonic identity.

2.4 Performance Methodologies

The system can either be patched such that no manual interaction is required by the violinist to drive the performance forward. On the other hand, treating the modular case like a graphic score is also an exciting and new approach for violinists.

3 Technical Notes

Performance Requirements.

- One acoustic violin and lapel microphone (provided by performer).
- Stereo monitors and TRS cables for the modular outputs.

A full concert setup typically requires a small table for the Eurorack case and two high-quality speakers (or a quad setup if the program supports it). The system can be performed in-person, streamed telematically, or presented as a recorded performance. The author favors a live remote or recorded performance for this iteration.

4 Ethical Considerations

This project makes use of open-source hardware (Daisy platform) and modular synthesis practices, which support reparability and extend hardware lifespan. No human subjects were involved, and no personally identifiable data was collected.

References

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