

Modes of Sophtar Improvisation

FEDERICO VISI, GEMM))) Gesture Embodiment and Machines in Music - School of Music in Piteå
Luleå University of Technology, Sweden.
mail@federicovisi.com

Additional Key Words and Phrases: Feedback, Improvisation, Solenoids, Embedded Instrument, Embedded Machine Learning

1 Program Notes

The Sophtar is a tabletop string instrument with an embedded system for digital signal processing, networking, and machine learning. It features an array of actuators that can be activated algorithmically by the models running on the embedded computer, a pressure-sensitive fretted neck, two sound boxes, and controlled electroacoustic feedback capabilities by means of bespoke interface elements. This improvisation explores different modes of interaction between electromagnetic actuators, harmonic feedback, embedded symbolic machine learning models, and neural audio synthesis.



Fig. 1. The Sophtar's controls and actuators (left); the author playing the Sophtar (right).

2 Project Description

The Sophtar [7] is an instrument I developed to address my need of consolidating several electroacoustic, signal processing, and machine learning techniques that have been part of my practice for years. Recent developments include a set of solenoids mounted over the strings next to the bridge and a signal processing method to feedback specific harmonics for each string.

The solenoids can be controlled by a custom arpeggiator, and by algorithms such as Notochord—a symbolic model trained on MIDI data that listens to the notes played by the strings [5], and Somax2—a multiagent system for human-machine co-improvisation [1]. Both run on the Sophtar's embedded computer. A Notochord model trained on txalaparta performances [3] receives the note onsets from two strings via MIDI. Its output activates two solenoids placed on two other strings. The rhythmic patterns resulting from the interplay between the human player and the Notochord model evolve dynamically and echo those typical of txalaparta performance.

2.1 Digital processing of electroacoustic feedback

The transducer housed in the head sound box allows to generate electroacoustic feedback that sustains the vibration of the strings. The signal of each string is processed individually with filters tuned to the string's harmonics, allowing specific partials to ring. Harmonics can be selected manually through the touch strip along the neck; or algorithmically.

Author's Contact Information: Federico Visi, GEMM))) Gesture Embodiment and Machines in Music - School of Music in Piteå
Luleå University of Technology, Piteå, Sweden.
mail@federicovisi.com.



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An instance of Somax2 is used to tune the bandpass filters in the electroacoustic feedback loop in response to how the strings are played. The model receives pitches and onsets of selected strings via MIDI and responds with pitches and onsets following a local stylistic knowledge space, or *corpus* [1]. These output pitches are mapped to 12 harmonics and onsets are used to activate the solenoid of selected strings.

This way, the Sophtar can be played by embedded models. This algorithmic play occurs through the physical excitation of the strings, so it is entangled with how the player is touching, fretting, or plucking them. The strings effectively become a place of contact between human and machine players performing simultaneously on the instrument.

2.2 Timbral exploration through the pressure-sensitive neck

The pressure sensitive neck is used to interact with per-string waveshaping distortion and neural audio synthesis. Each string has an individual pressure sensor underneath its own segment of the fretboard. Exerting pressure on a string adds bias to one of the latent dimensions of a RAVE [2] model that is receiving the audio signals of the strings as input, effectively altering the sound generated by the model. In concrete terms, this means that the neural synthesis model can be activated by the sound of the strings and its sound continuously altered through tactile pressure.

2.3 Community: Feedback Musicianship

In response to NIME 2026 theme “Communities” I would like to acknowledge how the community of feedback musicians has inspired the design of the Sophtar. I am particularly grateful for the conversations had with Adam Pultz Melbye, the originator of the FAAB (feedback-actuated augmented bass) [4]; and the exchanges with Halldór Úlfarsson, designer of the halldorophone [6].

3 Technical Notes

3.1 Duration

Approximately 13 minutes.

3.2 Stage Requirements

- A table at least 160 cm wide and 60 cm deep.
- 6x power outlets (220V, Euro).
- A chair or piano bench.

3.3 Audio Requirements

I usually do my own stereo or multichannel mix and send it to the venue’s mixing board or speakers. My outs are all balanced TRS jacks.

The Sophtar is a multichannel instrument, I usually adapt the audio output to the venue. If a quad or 8-speaker setup with subwoofer are available I would set it up for multichannel out, otherwise I am also fine with mixing everything down to stereo if preferable.

3.4 Setup Time

20-30 minutes.

4 Media Links

Video [8]: <https://doi.org/10.5281/zenodo.19919387>

5 Ethical Standards

The Sophtar was built using FSC 100% certified wood. FSC 100% wood comes from responsibly managed forests certified by the Forest Stewardship Council (FSC)¹.

Acknowledgments

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¹<https://fsc.org/en/label>



Fig. 2. The author playing the Sophtar at IRCAM's Studio 6, Paris, April 2026.

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