Useless Box: A Sonic Automaton Integrating Robotics, Sound Art, and Performance

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Abstract. Useless Box *is a transdisciplinary performance work at the intersection of robotics, sound art, and interactive composition. Inspired by the myth of Pandora's Box and Schrödinger's cat, this piece utilizes an autonomous wooden box equipped with physical computing, sensors, and actuators, all controlled by a MaxMSP-based system with machine listening and AI capabilities. Through the integration of sound design, theatricality, and algorithmic processes,* Useless Box *explores questions of agency, unpredictability, and performativity. The box, which initially appears empty and inert, unfolds into an unpredictable sonic and kinetic world—oscillating between reality and fantasy, mechanical and organic, the playful and the ominous. The work challenges conventional notions of instrumentality, composition, and performer/audience relationships by blurring the boundaries between object and subject, chaos and order, and the real and the imagined.*

Keywords: physical computing, sound art, robotics, MaxMSP, interactive composition, machine listening, performance, transdisciplinary.

1. Introduction

The *Useless Box* is a performative installation that merges sound-based composition, robotics, and human interaction. Drawing upon both ancient myth (Pandora's Box) and modern physics (Schrödinger's cat), the work questions the boundaries of meaning, agency, and unpredictability in sonic art. Rather than acting as a traditional instrument, the box itself becomes the protagonist—a semi-autonomous agent capable of sensing, thinking, and acting.

2. Conceptual Framework

The conceptual design of *Useless Box* is built upon three foundational stages: Sense, Think, and Act.

- **Sense:** The box is equipped with an array of sensors—infrared, gyroscopes, piezo elements, and switches—that capture data from both internal states and performer interaction.
- **Think:** Sensor data is transmitted to a MaxMSP environment programmed with machine listening and AI routines, which process information, analyze gesture, and generate responsive strategies in real time.
- **Act:** The box responds using a network of actuators: motors, lights, fan, pump, and a vape pen, which together create a kinetic and sonic performance.

Figure 1: The Sense–Think–Act interaction model.

The interaction model draws upon the parable of Pandora's Box (hidden chaos) and Schrödinger's cat (ontological ambiguity), positioning the box as both object and subject, machine and performer.

3. Methods and Technical Implementation

The creation of *Useless Box* required interdisciplinary integration across physical computing, sound design, algorithmic composition, and performance practice.

3.1. Hardware and Fabrication

- Custom-designed wooden box, CNC machined and hand-finished
- Embedded hardware: Arduino microcontrollers, IR sensors, piezo sensors, MEMS gyroscope, relays
- Output actuators: stepper motors, LEDs, fan, liquid pump, high-voltage relay for vape
- All electronics powered and managed by modular custom PCBs

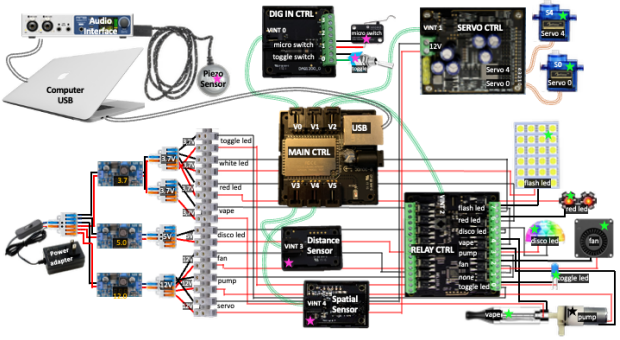

Figure 2: Hardware and control schematic for the box's sensors and actuators.

3.2. Software Environment

- MaxMSP is the central environment for data acquisition, signal processing, and actuator control
- Custom machine listening algorithms extract features such as gesture, rhythm, and impact
- Real-time analysis triggers adaptive responses and algorithmic routines
- Signal path designed for rapid, low-latency feedback and flexible scenario mapping

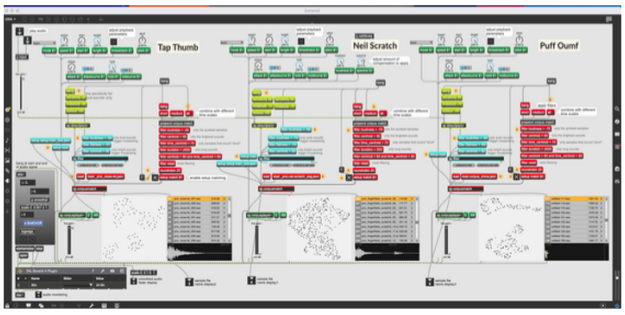

Figure 3: MaxMSP interface used for data analysis and response mapping.

For the machine listening part of Useless Box I used Fluid Corpus Manipulation Toolkit (FluCoMa) and SP-Tools. The Fluid Corpus Manipulation project (FluCoMa) instigates new musical ways of exploiting ever-growing banks of sound and gestures within the digital composition process, by bringing breakthroughs of signal decomposition DSP and machine learning to the toolset of techno-fluent computer composers, creative coders, and digital artists.

SP-Tools are a set of machine learning tools that are optimized for low latency and real-time performance. The tools can be used with Sensory Percussion sensors, ordinary drum triggers, or any audio input.

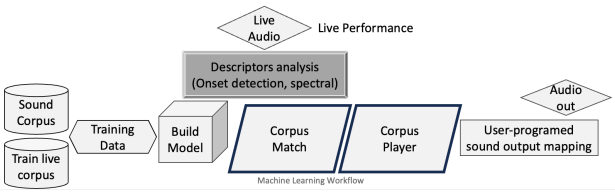

Figure 4: Supervised machine-listening workflow.

Supervised Machine Listening process:

- Training data sets (corpus of sounds)
- Train live corpus setup to improve corpus matching
- Load corpus and live train analysis files
- Feed live audio for RT descriptor analysis
- Realtime corpus-based sample playback

3.3. Performance Interface

- The box responds not only to direct operator input but also to environmental cues and random variables
- Machine listening routines enable the box to "learn" and "improvise" responses, creating the illusion of autonomous behavior
- The sound design is realized through both acousmatic diffusion and physical resonances from the box itself

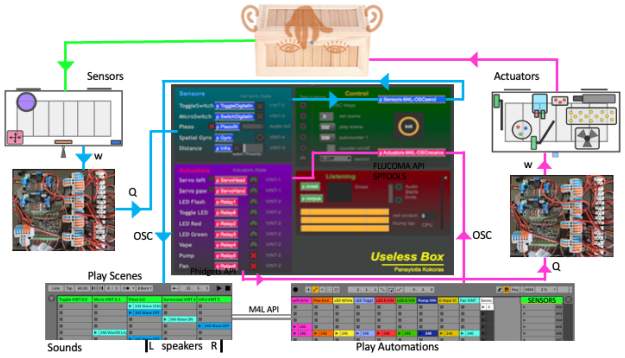

Figure 5: Performance interface and communication paths among sensors, software, scenes, sounds, and actuators.

4. Artistic and Theoretical Context

Useless Box is informed by traditions of kinetic art, musique concrète instrumentale, and interactive installation, but subverts expectations by embedding both spectacle and uncertainty within a mundane object.

The title alludes not only to the popular "useless box" toy but also to the idea of creative resistance to utilitarian thinking.

- The work is structured around spectromorphological manipulations and transcontextual associations.
- The opening and closing motif quotes Julius Fučík's "Entry of the Gladiators," a familiar circus tune associated with spectacle and irony, setting a tone of theatrical deception and transformation.
- The piece interrogates the line between chaos and order, performance and autonomy, inviting the audience to question the boundaries of agency, intention, and chance.

4.1. Section and Form

1. **Pandora's Box.** The god Prometheus stole fire from heaven to give to the human race, which originally consisted only of men. To punish humanity, the other gods created the first woman, the beautiful Pandora. As a gift, Zeus gave her a box, which she was told never to open. However, as soon as he was out of sight she took off the lid, and out swarmed all the troubles of the world, never to be recaptured. Only Hope was left in the box, stuck under the lid. Anything that looks ordinary but may produce unpredictable harmful results can thus be called a Pandora's box.
2. **Entry of the Gladiators.** "Entry of the Gladiators" is a military march composed in 1897 by the Czech composer Julius Fučík. It is often associated with circus performances and fairground organs. Hockey Arena Organ: O'Malley Steps. Citation—Artist: Nancy Bea, Album: *Take Me Out to the Ballgame*, Released: 2003.
3. **Paw Automata.**
4. **Robot Choreography.**
5. **Active Accelerationism.** Accelerationism is a range of revolutionary and reactionary ideas in left- and right-wing ideology that call for the drastic intensification of capitalist growth, technological change, infrastructure sabotage, and other processes of social change to destabilize existing systems and create radical social transformations, otherwise referred to as "acceleration."
6. **Hand pinched Cherries.**
7. **Schrödinger's cat.** A cat, a flask of poison, and a radioactive source are placed in a sealed box. If an internal monitor (e.g., Geiger counter) detects radioactivity (i.e., a single atom decaying), the flask is shattered, releasing the poison, which kills the cat. The Copenhagen interpretation of quantum mechanics implies that after a while, the cat is simultaneously alive and dead. Yet, when one looks in the box, one sees the cat either alive or dead, not both alive and dead. This poses the question of when exactly quantum superposition ends and reality collapses into one possibility or the other.
8. **Potion of Illusions.**
9. **Rock N Roll Vape.**
10. **Treasure Box Sparrow.**
11. **Karate Ninja Swashbuckler.**
12. **Rocket Magic.**
13. **Circus Butterfly Effect.**
14. **Radio shack.**

5. Documentation and Reception

Useless Box has been performed and presented internationally, receiving the Best Short Film Award at URTIcanti (Italy, 2024), the Métamorphoses Public Prize at the 13th Métamorphoses International Acousmatic Competition (Belgium, 2024), Honorable Mention at the 15th Destellos Competition (Argentina, 2024), and was shortlisted for Prix Russolo (France, 2024).

Video documentation, technical schematics, MaxMSP patch files, and performance notes are available upon request or from the author's website.

6. Conclusion

Useless Box embodies a transdisciplinary approach to composition and sonic art, creating an unpredictable, interactive, and thought-provoking performance space. By integrating robotics, machine listening, and physical computing, the work challenges conventional boundaries between performer and instrument, sound and object, chaos and control.

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