Learning to Move, Learning to Play, Learning to Animate

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Abstract

Learning to Move, Learning to Play, Learning to Animate is a cross-disciplinary multimedia performance exploring the entanglement of human, synthetic, and organic intelligences. Through an interplay of human performers, robots crafted from organic materials, real-time AI-generated visuals, and biofeedback-driven soundscapes, the work critiques anthropocentrism and reimagines intelligence as an emergent, interdependent phenomenon. Drawing from David Abram's concept of the "more-than-human world," the performance dissolves traditional boundaries between nature and technology, fostering an interactive environment where embodied intelligence unfolds across physical and virtual dimensions. Shadows, movement, and sonic resonance serve as conduits for co-creation, allowing audiences to experience a world where intelligence is not singular but symbiotic. The work invites reflection on learning, adaptation, and coexistence, embracing a vision of shared creativity beyond human-centered paradigms.

CCS Concepts

• **Applied computing** → **Performing arts**; **Media arts**; • **General and reference** → **Design**; • **Computing methodologies** → **Artificial intelligence**.

Keywords

Interactive Multimedia Performance, Real-time Generative AI Art, More-than-human-world, Found Object Robotics, Bio-feedback Sonification and Visualization

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1 Artwork Description

Learning to Move, Learning to Play, Learning to Animate is a cross-disciplinary multimedia performance that responds to the current crises of environmental degradation and technological overreach, challenging human-centric thinking and offering a reflective lens on how we might rethink our entangled relationships with the world. The piece features two robots constructed from organic materials, human performers, real-time AI-generated visuals, and biofeedback-driven soundscapes. The narrative, through chapters including "Emergence," "Learning to Play," "Integration and Interaction," and "Coexistence," chronicles the journey of embodied synthetic intelligence, symbolized as robots crafted from organic materials, from awakening to harmonious coexistence with human performers, highlighting the evolving relationship between humans, technology, and nature.

The conceptual foundation of this performance draws from David Abram's "more-than-human world" [1], which dissolves the divide between humanity and the natural environment. This perspective reimagines intelligence not as a hierarchy but as an interdependent and interconnected network of human, technological, and ecological systems. Machines, traditionally regarded as mere tools, are reframed as active participants with the ability to create art, write, solve complex problems, and inspire new ways of thinking beyond human comprehension. Their role parallels our dynamic relationship with ecology: just as we draw knowledge and resources from nature while it adapts to our actions, machines learn from us and, in turn, provide insights into forms of intelligence that transcend human perspectives. Our work reflects this shift, exploring coexistence without domination and recognizing the agency of all forms of intelligence. How can we inhabit a world where nature and technology are not opposites but co-creators of shared intelligence?

In reflecting this thinking, the performance seeks to blur the boundaries between human, ecological, and technological entities through physical and digital materials, narrative, interaction, and soundscape design. This multimedia exploration invites audiences to reflect on *learning*, *interaction*, and *perception* within the more-than-human world, bridging the natural and synthetic in search of shared meaning. Video and photographs of the project can be accessed via this link [4].

2 Related Works

Increasingly, artists are challenging human-centric perspectives in response to ecological crises and technological developments that highlight the limitations of viewing humans as separate or superior entities. These projects expand artistic boundaries by investigating meaningful creative collaborations involving non-human entities

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Figure 1: A still from our performance, where the organic and synthetic merge—the performer, plants, and shadow united in movement.

and technologies. Špela Petrič's *PL'AI* (2020) creates interactive play between cucumber plants and an AI-driven robot, prompting viewers to reconsider curiosity and interaction as traits shared across life forms [15]. Scenocosme's *Phytopoiesis* (2023) allows plants, facilitated by AI, to generate visual art through audience interaction, highlighting ecological collaboration and blurring the distinction between artist and subject [9]. *SuperRadiance* (2024) by Memo Akten and Katie Peyton Hofstadter uses generative AI combined with dance performances and poetry to depict Earth as a deeply interconnected organism, emphasizing collective identity and planetary-scale relationships [2].

Our project, *Learning to Move, Learning to Play, Learning to Animate*, uniquely contributes by merging robotic, biological, and human intelligences within a dynamic performance environment. This format facilitates real-time, fluid interactions and narratives, distinctly emphasizing co-creativity and coexistence beyond human-centered perspectives.

3 Narrative

Our narrative explores the evolving relationship between humans, robots, and nature through four scenes: "*Emergence*," depicting the robots' initial awakening with exploratory movements and a mysterious soundscape; "*Learning to Play*," where a dancer introduces playful interactions, interacting with dynamic visuals including real and artificial shadows that respond to the agents in the scene; "*Integration and Interaction*," featuring the dancer joining the robots behind a scrim, blending human and robot shadows with synchronized digital elements and a fusion of orchestral and electronic music; and "*Co-existence*," where color emerges, another performer interacts with the environment, and the two performers ultimately converge, symbolizing a full integration of human, robot, and nature, transforming the stage into a living canvas. The details of stage direction and narrative integration is shown in Figure 3b.

4 System Design: Integrating More-than-Human Intelligence

Our stage design explores interconnectedness and coexistence within the more-than-human world through a synthesis of technical implementations and conceptual frameworks. As illustrated in Figure 2 and 3, the space represents a convergence of shared and synthetic realities, with the central projection screen serving as a fluid boundary between these dual worlds. Shadows play a crucial role in this performance, serving as a medium through which beings transition between realities. As performers move through the space, their shadows on the central screen become representations of their embodied presence, while the robot's shadow conveys its movement, challenging traditional perceptions of physicality and animation across realities. Our narrative (Figure 3b) follows these interactions between embodied beings—performers, robots, and plants—as they navigate and influence this multi-reality space, creating a responsive environment where every entity simultaneously influences and is influenced by others.

The technical implementation features three key elements that embody our concept of more-than-human intelligence.

First, we developed two found-object robots (Figure 4a) constructed from local natural materials—fallen branches and prairie

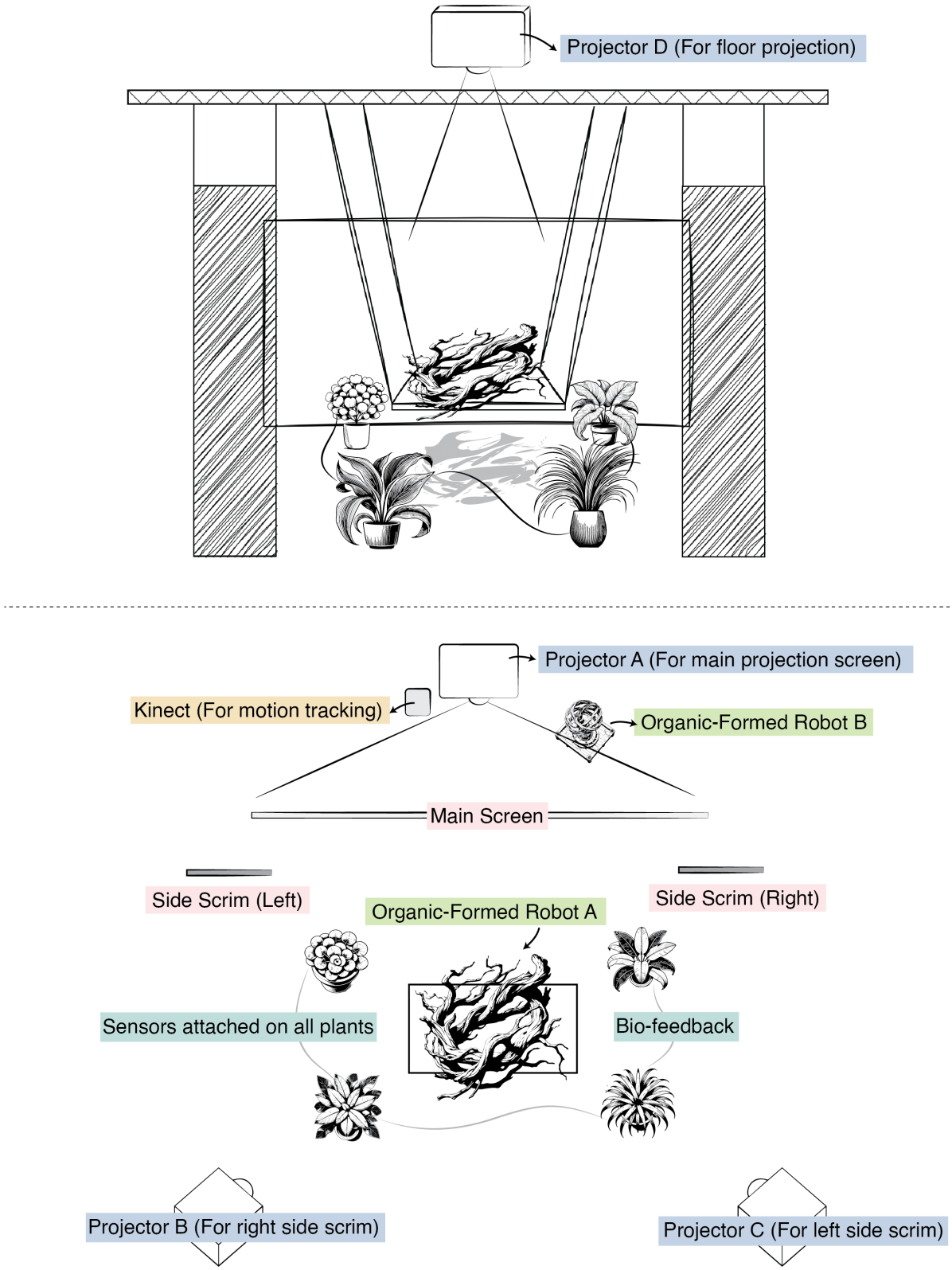
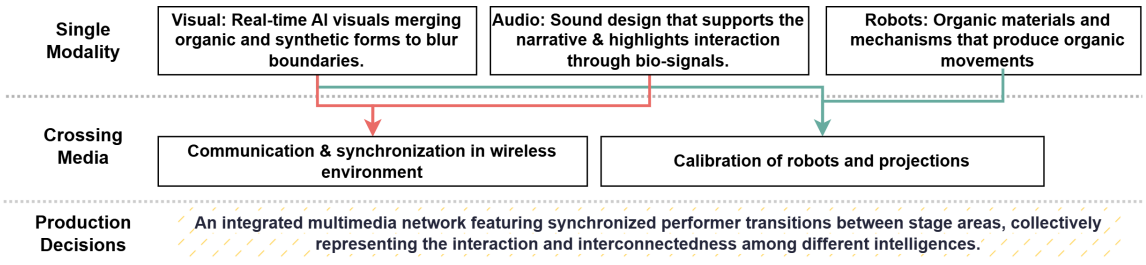
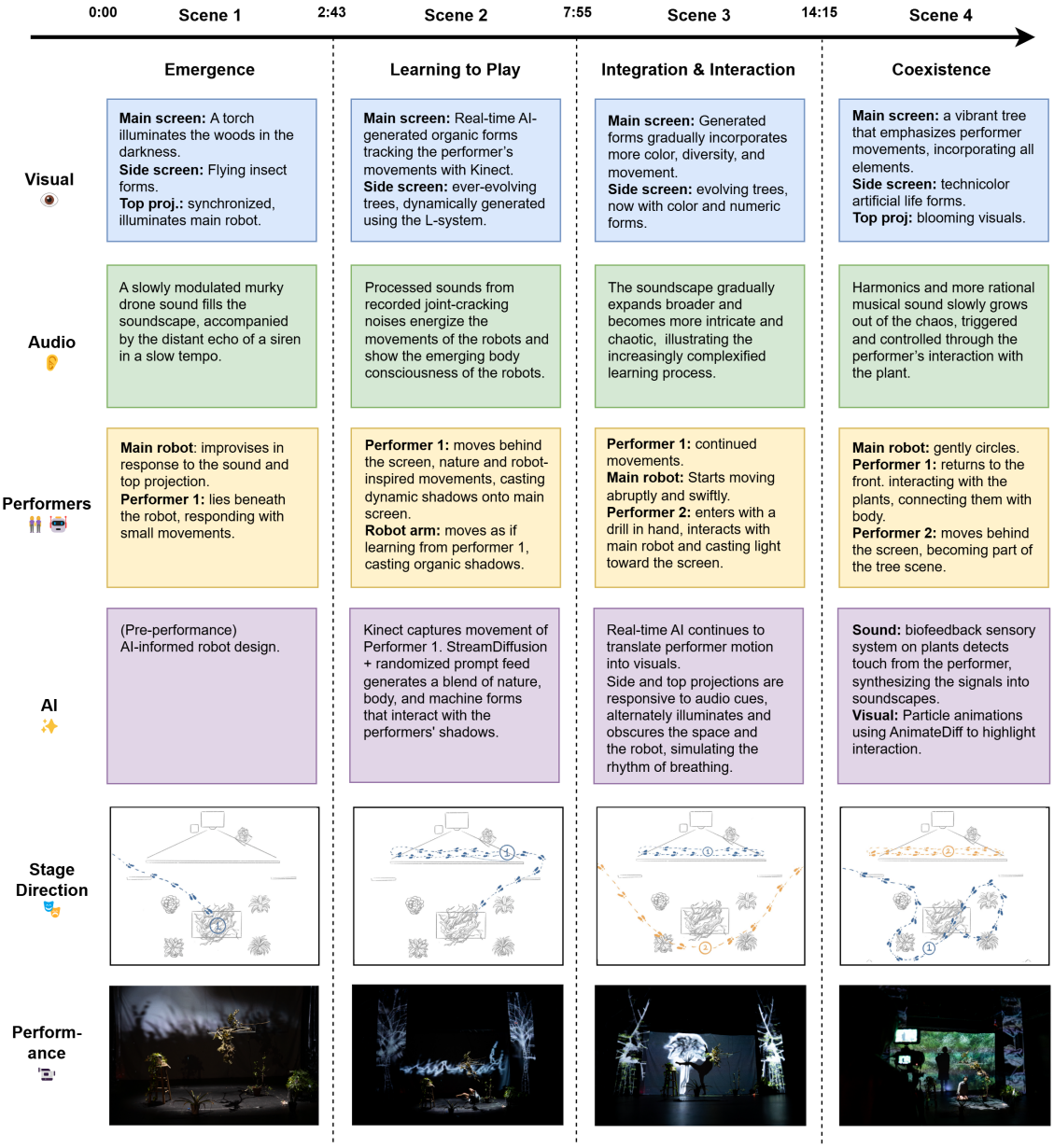


Figure 2: Stage design diagram

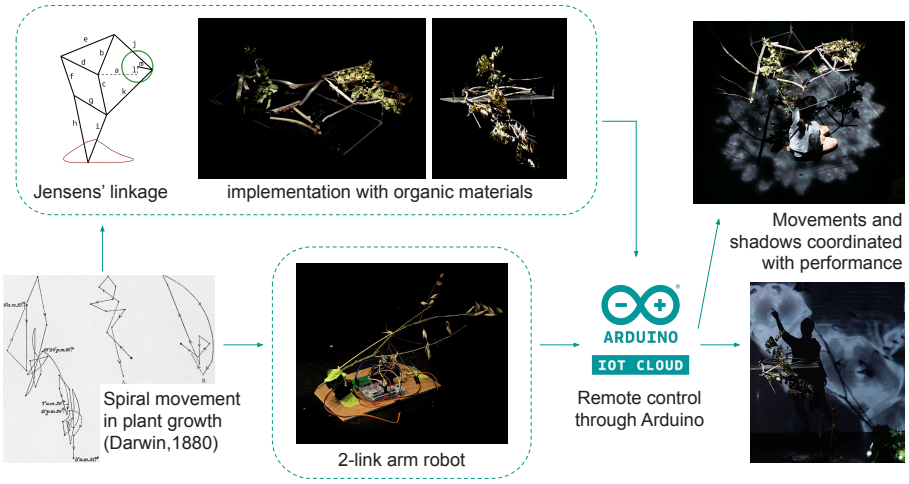


(a) System Design

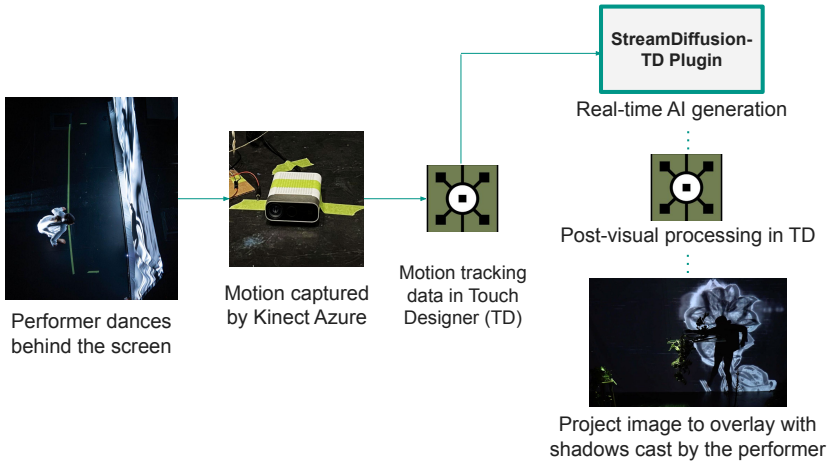


(b) A chronological overview of technical and narrative elements

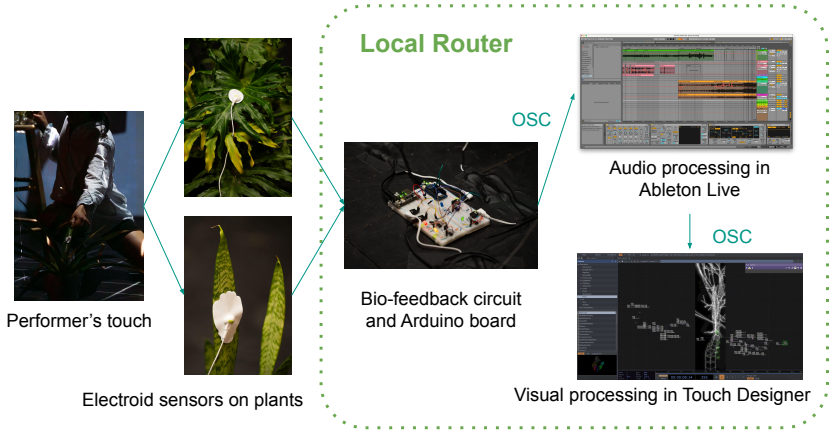
Figure 3: System Design and Narrative Overview for our Performance



(a) Design, implementation, and effects of the found-object robots featured in the performance.



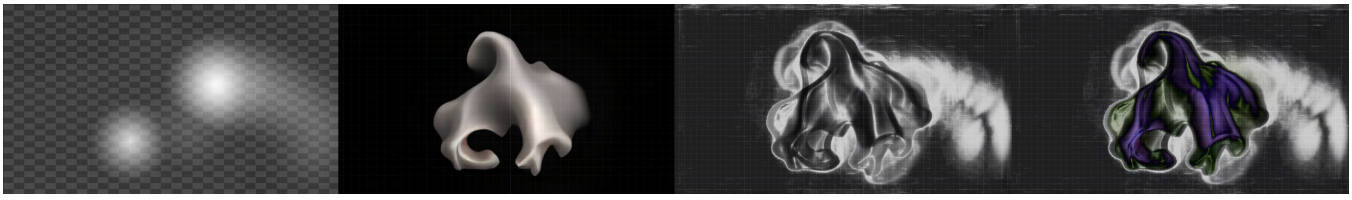
(b) Real-Time AI-Generated Imagery with Motion Tracking: the interplay of real and generated imagery



(c) Bio-feedback: Sonifying and visualizing plant-human interactions in real time.

Figure 4: Diagrams for the technical workflow.

(a) Performance photographs illustrating our exploration of "Synthetic Embodiments" in Visual Design



(b) A demonstration of real-time AI image generation using motion tracking data and Stream Diffusion

Figure 5: Details of visual design

grass—following recent eco-friendly robotics approaches [3, 11, 13]. The centerpiece robot employs the Jansen mechanism [6] to create spiral movements mimicking plant growth, utilizing 11 interconnected branches with one link serving as the rotational input powered by a mounted brushless motor. The shadow robot uses an Arduino-UNO-R4-WiFi-controlled pan-tilt platform to create tilting and swaying motions that echo dancers' movements, allowing for remote artistic control that seamlessly integrates with the performance narrative.

Second, our visual design creates synthetic embodiments through multiple projection systems (Figure 4b), manifesting in three distinct forms. The main screen displays AI-generated "secondhoods" of performers using StreamDiffusion-TD [5, 7], driven by real-time Kinect Azure motion tracking. This creates a radiographic aesthetic [12, 14] that transitions between black-and-white and color, revealing hidden connections between natural and synthetic elements. The side scrim features algorithmic tree-like forms generated through the L-system framework [10], which respond dynamically to audio cues. Additional virtual entities are created using TouchDesigner and AnimateDiff for ComfyUI [8], particularly evident in Scene 4's flourishing tree-like visuals. The interplay between natural and digital shadows creates a compelling hybrid presence, most notably in Scene 3 where performers use handheld lights to cast shadows that interact with and partially dissolve the AI-generated visuals (Figure 5).

Finally, our sound design weaves together embodied field recordings and bio-signal sonification (Figure 4c) to create a rich, multidimensional soundscape. The composition intentionally incorporates real-world sonic elements from our building process, including body joint sounds, footsteps on grass, and construction noises from the robot assembly. These recordings undergo digital processing with cross-layer modulations and are complemented by electronic elements created with the Arp 2600 synthesizer. Drawing from the medical concept of biofeedback [16], which demonstrates biological

entities as learning systems, we integrate EMG sensors to capture electrical activity from plants. These signals are processed through custom circuits [17], transmitted via an Arduino MKR WiFi board using OSC protocol, and transformed into sonic elements. In the performance's final scene, direct physical contact between performers and plants initiates bio-information transmission, triggering real-time processing that transforms a chaotic soundscape into a harmonious texture, symbolically representing the synthesis of natural and technological elements.

This technical implementation creates a unified experience where each element (robotics, visuals, and sound) contributes to our exploration of more than human intelligence while maintaining the conceptual integrity of interconnectedness and coexistence. The result is an immersive performance environment that challenges traditional boundaries between natural and synthetic realities while highlighting their fundamental interdependence.

5 Conclusion

Our work, *Learning to Move, Learning to Play, Learning to Animate*, explores robotics' relationship with the organic world through AI-generated visuals and bio-signal-integrated sound. By combining found natural materials with computational techniques, we challenge traditional boundaries between human and non-human, organic and synthetic. The performance demonstrates technology and nature's potential for harmonious coexistence, encouraging a more inclusive understanding of the more-than-human world.

Future directions include incorporating machine learning to enhance performer-robot interactions and expanding biofeedback mechanisms for richer audio-visual experiences. Through this artistic exploration, we aim to inspire deeper appreciation for the interconnectedness of all entities—living beings, plants, and robotic systems—while promoting sustainable coexistence.

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