Mycortex: Exploring Non-Human Symbolic Communication through Art and Bioelectric Signals

Zhiqi Wang
Goldsmiths, University of London
London, United Kingdom
zwang035@gold.ac.uk

Patrick Gunawan Hartono
RMIT University
Ho Chi Minh City, Vietnam
patrick.hartono@rmit.edu.vn

Fig. 1. Mycortex installation visual presentation (Photo by author, 2024)

Figure 1b: Mycortex installation sensor processing detail (Photo by author, 2024)

***Abstract*—Mycortex is an interactive art installation that juxtaposes fungal electrical signals with human brainwaves in a dynamic space, transforming them into non-narrative language and symbols. The project perceives language as a dynamic organism, reducing the life phenomena of humans and fungi to electrical signals and converting the waveforms of these signals into non-narrative acoustic language and organic symbol representations. It aims to construct a "third space" for interspecies language translation between humans and non-humans from a non-anthropocentric perspective. Within this confined space, the electrical signals emitted by humans and mushrooms intertwine and influence each other, generating a new dynamic symbolic system. The installation does not claim a literal interspecies dialogue but instead evokes an open, non-anthropocentric field of resonance in which signals, rhythms, and symbols emerge in mutual influence.**

I. Conceptual Framework

Human activity and technological expansion have dissolved the boundary between humans and nature, forming an interdependent ecological whole. Within this, non-human entities possess agency and complex perceptual and symbolic systems [1]. Fungi, for example, create extensive underground mycorrhizal networks that transmit materials and signals between plant roots [2], enabling interspecies communication and contributing to human–nature entanglements [3].

These networks form a complex linguistic system between fungi, ecosystems, and humans — one that exceeds the limits of single-species symbols and resists anthropocentric translation. This raises a central question: How can we build a communicative framework that transcends human - cantered language and acknowledges non-human agency?

Mycortex addresses this question by merging theoretical reflection with installation art. The project constructs a "Third Space" [4], beyond normative logic, where human and fungal signals—brainwaves and bioelectricity, are visualized and signified as abstract, non-narrative symbols. Drawing on posthumanism theory and interactive media, Mycortex seeks to dissolve conventional perceptual boundaries and create a shared symbolic space.

Rather than translating non-human signals into human meaning, the work foregrounds their alterity, using art's speculative potential to bridge perceptual and spiritual gaps. The goal is to generate pre-linguistic, a priori forms of interspecies engagement, enabling humans to encounter fungi through new, non-anthropocentric dimensions.

A. Beyond Human Semiotics: Cross-Species Symbolic Systems

To understand how the signals between humans and fungi might constitute a form of "language," we must return to a more fundamental question: What is a symbol, and who is entitled to use it? Eduardo Kohn, drawing on posthumanism and semiotics, proposed the idea of "anthropology beyond" [1], extending Peirce's semiotic theory to non-human life form. He challenges anthropocentrism by arguing that all living beings—not just humans—use symbols to engage with their environments. This symbolic exchange is essential for species' survival and evolution, offering a broader, non-human view of meaning and language.

Kohn's cross-species semiotics primarily focuses on the symbolic interactions between animals and humans, while overlooking the perceptual capabilities and symbol generation of plants [1]. However, plants can also respond to external stimuli through electrical signals. For instance, research shows that when plant leaves are damaged, they quickly transmit electrical signals, triggering defense mechanisms [7]. Different stimuli generate distinct signals, such as how the Venus flytrap uses action potentials to determine when to close its trap [8].

Communication between plants occurs through underground mycorrhizal networks, which transmit complex information and affect the growth and defense mechanisms of surrounding plants. Studies have found that voltage fluctuations within mycelial networks regulate plant behavior, and around 90% of terrestrial plants rely on mycorrhizal systems for interspecies communication [8][10].

B. Symbolic and Linguistic Systems

From an evolutionary perspective, the linguistic systems of mycorrhizae and humans share key parallels, both relying on environmental perception to transmit signals that aid species survival [6]. Whether through plant networks or human neural systems, biological behaviors are shaped by signals and symbols as adaptive responses to external conditions.

Linguistic signals influence cognition and behavior through dynamic interactions across cultural, biological, and cognitive systems [6]. Their meanings are context-dependent, emerging through sender–receiver relationships [11]. Thus, language and signals form dynamic ecological linkages between humans and fungi. However, fundamental perceptual and symbolic differences prevent direct translation, creating an abstract gap where meanings remain elusive [12].

Art, as a spiritual and symbolic medium, can help bridge this gap. Drawing on Homi K. Bhabha's concept of the Third Space [4], this project constructs an interstitial field where human and fungal symbolic systems converge. *Mycortex* translates bio-signals into real-time audiovisual symbols, forming a nonlinear system that transcends rational and linguistic constraints to explore new perceptual dimensions.

The project extends symbolic representation beyond human–animal models [1], incorporating plants—often overlooked, into this communicative framework. Despite differing impacts on the environment, plants and humans share fundamental electrochemical signalling mechanisms. Through mycorrhizal networks, plants reshape not only ecosystems but human perception of them.

Since true interspecies communication cannot fully escape symbolic boundaries [6], *Mycortex* uses the *Third Space* to propose a unified symbolic system. Through the abstract language of art, it facilitates a form of meaning translation between human and fungal life, offering new insights into artistic practice and interspecies relations.

II. System Design and Technical Implementation

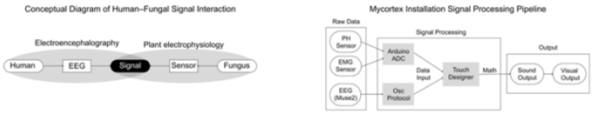

Fig. 2. Conceptual and System Architecture of Interspecies Signal Translation in Mycortex

To implement the system, physiological and electrophysiological data were simultaneously acquired from human and fungal sources using a multi-sensor configuration. EEG signals were non-invasively recorded using Muse 2 headsets, offering high temporal resolution and streamed via OSC to TouchDesigner for real-time processing [15][16]. Participants wore the device in natural environments.

Simultaneously, portable EMG patches were attached to mushroom surfaces to capture fungal electrophysiological activity with minimal interference. These signals were pre-processed for clarity [15]. A pH sensor was also integrated to detect subtle chemical variations in the fungal microenvironment, reflecting metabolic and communicative dynamics [16]. pH data were sampled using Arduino ADC and transmitted to TouchDesigner.

The combined EEG, EMG, and pH signals were processed in a real-time pipeline. EEG frequency bands, fungal EMG oscillations, and pH fluctuations were mapped to sound synthesis and symbolic visual generation. These multimodal biosignals were projected as evolving acoustic textures and non-narrative visual symbols onto a sheer curtain, creating an immersive space of shared perception between humans and fungi.

EEG signals were captured via Mind Monitor and streamed through OSC at 256 Hz. Key frequency bands (Alpha, Beta, Theta, Delta) were extracted and mapped to audio pitch and symbol frequency. Fungal EMG and pH signals were sampled at ~60 Hz using Arduino. During ~5-minute sessions, all biosignals were normalized and fed into a real-time audiovisual system in TouchDesigner, enabling a generative feedback loop between human brain activity and fungal metabolism.

Participants interacted via gentle touch or presence, influencing signal flow and dynamically shaping a shared symbolic environment.

III. Documentation

Visual documentation of the installation is available at [VIMEO LINK.]

IV. Responsible Innovation

Mycortex is designed with careful attention to ethical and environmental considerations. The project uses living organisms (fungi) as artistic and scientific collaborators, raising questions about the responsibilities we hold toward non-human life. The installation avoids any harm to the mushrooms: EMG sensors are attached non-invasively and all sessions are time-limited to minimize biological stress.

The work also contributes to broader ecological literacy by foregrounding the communicative complexity of fungi and plant networks. Rather than exploiting non-human organisms for spectacle, Mycortex positions them as co-authors of a shared symbolic system, fostering interspecies ethics and a critical posthumanist perspective in audiences.

In terms of environmental sustainability, the installation uses low-power Arduino microcontrollers and Muse 2 headsets (rechargeable, portable), and does not require significant energy infrastructure. The use of a sheer curtain as the projection surface reduces material consumption compared to traditional screens. We aim to reuse and recycle all electronic components after the exhibition.

V. Author Bio

Zhiqi Wang is a final-year BSc Digital Arts Computing student at Goldsmiths, University of London, and an incoming MPhil candidate in Digital Humanities at the University of Cambridge (2026–27).

Her art practice centres on bioart installation, interspecies signal systems, and the critical entanglement of living organisms with computational media. Past works include EEG-based interspecies communication installations and a genomic language model bioart piece that routes live plant electrophysiology through a fine-tuned DNA language model. She has also worked as a curator, with experience at Fosun Art Center and the Future Vision Spaces Lab at SUSTech, and recently led a student degree show exploring concealed digital infrastructure as curatorial concept. Her technical toolkit — TouchDesigner, Arduino, Python, HuggingFace, and GLSL — serves the work rather than defines it. She is co-author of the Mycortex paper presented at ARTECH 2025.

Patrick Gunawan Hartono is a researcher and educator at RMIT University, Ho Chi Minh City. His work spans interactive media, bioart, and cross-disciplinary creative practice. He provided supervision and guidance throughout the development of the Mycortex project.

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