Music for Surrogate Performer

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Alvin Lucier premiered *Music for Solo Performer* on May 5th, 1965, at the Rose Art Museum at Brandeis University in Waltham, Massachusetts. Lucier, who held a position at Brandeis, had invited John Cage to perform a concert there. Cage accepted the offer on one condition; that Lucier also performs one of his works. Lucier replied that he didn't have any pieces ready, however, he told Cage that he was developing a new piece but needed more time to fine-tune the technology and methodology. Cage convinced him to perform it, encouraging him by saying, 'It doesn't matter if it doesn't work'. This performance marked the debut of Lucier's ground-breaking experimental music composition. *Music for Solo Performer* pushed the boundaries of traditional musical practices and introduced innovative concepts, technology and techniques that challenged conventional notions of composition and performance.

Figure 1. Alvin Lucier performing Music for Solo Performer (Lucier, 2021).

In this essay, we argue that *Music for Surrogate Performer,* which will debut as part of the Venice Biennale Music 2023, builds upon the precedent set by *Music for Solo Performer* while speculating on how current bio-technologies extend the discourse to align with the novel concepts of "*In-vitro* Intelligence" and "Surrogate Performer".

Music for Solo Performer explores the relationship between brainwave activity, specifically alpha waves, and sound generation. The piece uses brainwave amplification technology to capture and amplify the alpha waves produced by the performer's brain. Alpha waves are a type of neural oscillation that occurs in the 8 to 12 Hz frequency range. They are associated with relaxed and calm mental states, often observed when an individual is meditative or reflective. In *Music for Solo Performer*, electrodes are placed on the performer's scalp to capture the alpha waves, amplified and fed into a network of resonant percussive instruments. Lucier comments in his book *Reflections* that "after all, alpha's really a rhythm; scientists call it alpha rhythm" (2005, p. 58). The sounds generated by the instruments directly reflect the performer's brainwave activity, creating a unique sonic environment that evolves in real time from the fluctuations of the performer's alpha waves. The composition allows for the emergence of unpredictable and ever-changing soundscapes generated by the inherent variability of the performer's alpha waves.

Music for Solo Performer was a collaboration between Lucier and Edmund M. Dewan, a physicist and associate to Norbert Wiener, one of the founders of cybernetics who, as early as 1957, had linked brain wave analysis to Artificial Intelligence (Barrett, 2023, P. 22). We argue that the theory of cybernetics influenced Lucier, and *Music for Solo Performer* showcases the interconnection between human cognition, technology, feedback loops, and self-regulating systems. Furthermore, it exemplifies how the composition operates as a cybernetic system, highlighting the dynamic relationship between the performer's mind and the resulting music while engaging with the principles of control, adaptation, and interaction within sound and technology.

Drawing from these cybernetic concepts, Lucier challenges the traditional glorification of the performer's physical prowess or technical virtuosity by shifting the focus to cognitive activity or the cognitive labour involved in generating the music. This perspective deconstructs the conventional hierarchy that often places the performer's physical actions as the focal point of the performance. By utilising brainwave amplification technology, Lucier emphasises the cognitive labour of the performer as a central element of the composition. The performer's mental processes, thoughts, and focus become the driving force behind the generation of sound in the composition. The audience becomes witness to the performer's cognitive labour, blurring the boundaries between the performer, technology, and sound. By deconstructing the glorification of physicality, the composition highlights the value of cognitive labour, challenging established hierarchies and broadening our understanding of artistic merit. Thus, *Music for Solo Performer* delves into the connection between consciousness and sound and investigates the relationship between mental states and the resulting sonic experience. The piece raises questions about the nature of perception, the physical manifestations of cognitive processes, and the role of the performer's mind in shaping the musical output.

Music for Surrogate Performer (Commissioned by the Biennale Music, 2023) references, celebrates and extends Lucier's *Music for Solo Performer* by using cutting-edge biotechnologies to incorporate the unique discourse of *In-vitro intelligence* (IVI) and *Surrogate Performer* into a new composition. The performer is non-human, however, its musical components are still driven by cognitive labour – a disembodied or *in-vitro* brain.

This approach emerged with the introduction of the work titled *cellF*, a collaborative project produced in 2015. It brought together artists, musicians, and scientists to create the world's first biological neuron-driven analogue modular synthesiser or a cybernetic Surrogate Performer. *cellF* juxtaposes biological material with electronic circuitry and presents a new direction in sound performance and production. *cellF's* (disembodied) 'brain' was made from living biological neural networks grown in a petri dish that controls an array of analogue modular synthesisers in real-time which were custom-made to work in synergy with the evolving neural network. The biological neural networks grew over an interface to become an '*in-vitro* brain' as these interfaces allowed for feedback into and from the neural network. Human musicians are invited to play with cellF in special one-off shows with the human-made music fed to the neurons as stimulation (feedback), and the neurons responded by controlling the analogue synthesisers. Together they perform live, reflexive and improvised sound pieces that are not entirely human.

This approach represented a provocative move away from Artificial Intelligence (AI) enquiries that dominate our current technology-focused scientific discourse. cellF was not an AI musical robot driven by computer algorithms. At the same time, it lacked the complexity of natural intelligence and required a hardware body to provide stimulation for its '*in vitro* brain'. Neither artificial intelligence (AI) nor natural intelligence (NI), *cellF* is best understood as an entity possessing '*in-vitro* intelligence' (IVI). IVI is an intelligent system produced by bioengineered living neural networks that function as brains outside the body. We acknowledge that current instances of IVI represent a symbolic early form of development. However, the characteristics of its neural network suggest that it, or others like it, may demonstrate changes in functional plasticity just as naturally intelligent entities do (McKenzie et al, 2021, p. 925).

Furthermore, we envision a future 'post-corporeal' connection between body, instrument, space and time where creative production tools cease to be divorced from the biological body; instead, artist and artwork are the same. The complexities and nuances that these 'prepared' living entities can embody will give rise to a new kind of performative entity, an entity physically removed from the human but linked through lab-based processes in which biopsied material grown outside of the donor's body (*in-vitro*) control a creative, hybridised entity or specifically, a Surrogate Performer.

Surrogate Performers give rise to the possibility that *in-vitro* entities may manifest some inherited artistic traits from the donor's biological material while being able to produce, analyse and generate artwork in response to sensory stimuli in real time. We speculate that in the future, through this material agency, Surrogate Performers could potentially display artistic expressivity or creativity of their own.

Creativity requires cognitive effort, as one of its foundations is the ability to retain memories and beliefs while dynamically controlling or abandoning them. In part, this retention and abandonment serve to overcome distraction and "stickiness" of prior knowledge to create new concepts or ideas. Creativity is processed inside our brains and the dynamic plasticity that our experiences shape are still not yet fully understood. How does vital biological matter arrange itself into living beings with self-aware minds and rich inner life? How does the combined activity of billions of neurons, each one a tiny biological machine, give rise to a conscious experience and a creative mind?

Our approach further complicates this by proposing a scenario in which disassociated bodies are manipulated and reassembled into "*in-vitro* intelligent entities," or living neural networks grown outside the body. Through our artworks, we speculate that biotechnology will have the potential to relocate creative capabilities outside of our bodies.

In *Music for Solo Performer*, Lucier eliminated his body and used only his cognitive abilities to engage in a creative process. In his essay *The Propagation of Sound in Space*, Lucier reflected on the process, commenting that he "had to learn to give up performing to make the performance happen" to allow his alpha waves "to flow naturally from mind to space without intermediate processing" (2005, p. 418). He deliberately calmed himself, thus subtracting memories, biases and beliefs from his creative process so that "it was possible to create music without compositional manipulation or purposeful performance" (ibid).

We posit that the '*in-vitro* brains' respond to stimulations that change their functional plasticity and thus may have the potential to retain memories and experiences. *Music for Surrogate Performer* attempts to tackle these issues by removing the human completely and replacing it with a living '*in-vitro* brain' biologically linked to Lucier.

We first met Alvin Lucier in 2018 when we invited him to play with *cellF*. Lucier was fascinated by the possibilities and problems that *in-vitro* intelligent Surrogate Performers pose. We had planned to use his brainwave activity to stimulate *cellF*'s '*in-vitro'* brain directly and to collaborate with it in composing a new sound piece. The cognitive activity would emerge through the interaction between Lucier's brain (alpha waves) and cellF's '*in-vitro* brain*'* (the neural network's electric activity). Lucier commented that it felt like a natural progression of *Music for Solo Performer.* Unfortunately, due to the COVID-19 pandemic, the concert planned for September 2020 was cancelled[1].

We then agreed, with Lucier, to take advantage of the world's downtime to develop a new collaborative project with him titled *Revivification*. In this project, we proposed to immortalise Lucier by giving him new performative life through the material biological agency of his 'Surrogate Performer', a living entity that would continue to create art, as an artwork, continuously into the future.

The project's narratives, aesthetic and conceptual frameworks were developed with Lucier via fortnightly online meetings. In 2020, Lucier donated his blood and we isolated his white blood cells and then reprogrammed them to become stem cells using advanced stem cell technologies. We then transformed the stem cells into living neural networks or, as we refer to them, '*in-vitro* brains'. We plan to embody Lucier's '*in-vitro* brain' with a resonating, sound-producing body so that they work in synergy. Revivification offers the opportunity for Lucier, through biological agency, to be immortalised and become a living artwork. Revivification not only challenges the notion of human evolution but also gives Lucier a permanent embodied material presence that creates new compositions, new stories and new memories in a museum.

[1] The performance was set for 20/09/2023, in the New School in NYC.

Figure 2. Alvin Lucier donating blood for the Revivification & Music for Surrogate Performer projects, September 2020.

Sadly, Lucier passed away in December 2021 at the age of 90. Before his death, he expressed his wishes to his personal assistant and family that we continue with the development of this project as we planned. *Revivification* will be launched in early 2025 at the Art Gallery of Western Australia.

For the Biennale Music 2023, we decided to pay homage to this great composer and develop an interim new work that will celebrate one of his greatest pieces, *Music for Solo Performer*, while paying tribute to the plans we had for Lucier to perform with cellF.

In *Music for Surrogate Performer,* we grow Lucier's living neural networks (his '*in-vitro brain'*) over a specialised interface consisting of a grid of 8×8 electrodes. These electrodes allow recording the electric signals (action potentials) that the neurons produce within the network and simultaneously send feedback stimulations to the neural network – essentially a read-and-write interface to the '*in-vitro* brain'. Through its neural activity, this disembodied 'brain' will interface and control a similar setup of percussive instruments that Lucier used in the original performance in 1965. *Music for Surrogate Performer* places Lucier's Surrogate Performer in the centre of the space and suggests that through its biological agency, it will sit in for Lucier while performing his composition from 1965. It follows Lucier's intention (as manifested in *Music for Solo Performer*) by further deconstructing the performer's physicality and removing them completely.

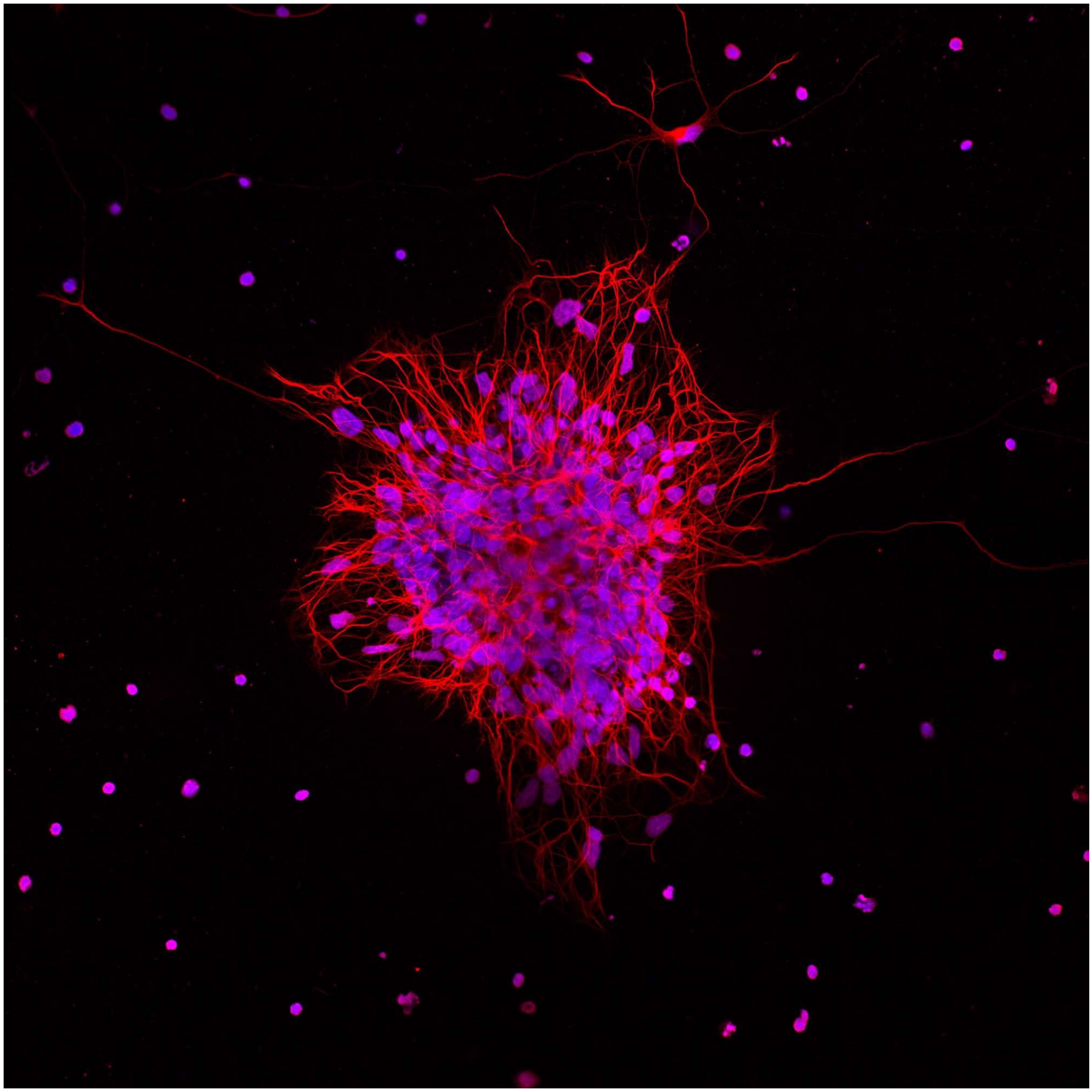

Figure 3. A neural network ('*In-vitro* brain') grown and transformed from Alvin Lucier's white blood cells.

Is it possible, thus, to conjure Surrogate Performers as presenting creative expressivity all of their own? And could they display artistic potential linked back to the original donor human themselves? We believe, outside of the metric of scientific discovery, these bioengineered entities may embody some kind of filament of memory crossing transformational processes, an as yet immeasurable essence connecting the donor to the final entity.

Music for Surrogate Performer intentionally provokes ethical, philosophical and legal discourse to build a better communal vocabulary surrounding these issues. But at the most basic level, in this instance, the question should be asked: how might such a scenario change our understanding of music and composition?

These bio-engineered entities extend beyond the seeming limits of our physical human body and reinforce the biological importance of human creative endeavour but also force us to consider our

responsibilities to these new liminal lives we create. What ethical and legal boundaries will need to be established around tasking these entities in the currency of productive performances for our gain? And what of ownership and rights around their output?

Music for Surrogate Performer is a tentative approach to reconcile and build a better understanding of an impending cultural shift; a trajectory that could see our human-ness and humanity challenged on many fronts. Yesterday's impossibilities are today's practicalities, and it is hoped that this one-off performance can spark the imaginations of those who witness it.

From the artists' perspective, however, it is a concerted move towards embracing the tragic loss of a hero while also pushing closer to a truly unique collaborative work. We are currently in the final stages of developing a piece conceived with Lucier before his passing. A work that plans to immortalise and coact with the late Lucier, to give him a permanent presence at the helm of avant-garde composition for years to come. In *Revivification,* his vital, creative soul will continue to live on and produce work long after his physical body has left us—Alvin Lucier's *in-vitro* intelligent Surrogate Performer.

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