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Editing Guidelines Please use Times New Roman fonts with font size 12. Manuscripts should be formatted and prepared using *The Chicago Manual of Style,* 17th edition (2017) as a guide. References should follow Author-Date format. Specific citations should be provided in text in parentheses. Footnotes should be used sparingly and reserved for explanation beyond the text of the article. All references should be listed after the text of the article in a section labeled "References." Any computer code should be placed in fixed-width format to facilitate readability. Images, figures, musical examples, and other graphics should be sent as separate attachments for ease of layout. The approximate location of each graphic should be indicated in the text by a (sequentially numbered) label and a brief caption.

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Submission All submissions, including articles, reviews, review proposals, and items for *Tips and Tricks* should be emailed to the Editor-in-Chief, Drake Andersen: journal@seamusonline.org.

About SEAMUS

Founded in 1984, the Society for Electro-Acoustic Music in the United States (SEAMUS) is a national non-profit organization of composers, performers, and teachers of electro-acoustic music representing every part of the country and virtually every musical style. Electro-Acoustic music is a term used to describe those musics that are dependent on electronic technology for their creation and/or performance. Many members of SEAMUS—like Jon Appleton, the guiding light in the conception of the Synclavier—are recognized world leaders in their fields. All are dedicated to the use of the most advanced technology as the tools of their trade.

SEAMUS seeks to provide a broad forum for those involved or interested in electronic music. Through its journal, newsletter, national meetings, and its national archive at the University of Texas, SEAMUS seeks to increase communication among the diverse constituency of the relatively new music medium.

The Society's objectives include:

To encourage the composition and performance of electro-acoustic music
To develop a network for technical information and support
To promote concerts and radio broadcasts of electro-acoustic music both in the US and abroad
To create an exchange of information through newsletters and other means of communication
To establish and maintain a national archive and information center for electro-acoustic music
To attract a wide diversity of members and supporters
To advocate licensing and copyright concerns

SEAMUS strives to address not only relevant technology but also the non-technical issues pertinent to the electro-acoustic music community. In a field usually dominated by technical concerns, it is refreshing to hear paper sessions devoted to aesthetics, collaboration, education, and the ethical and social issues facing electro-acoustic musicians. The provocative sessions provide fuel for lively discussions during the national meetings.

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From the Editor

I am pleased to share the publication of Journal SEAMUS Volume 34. This issue features several fascinating articles, each of which explores the intersection of creative and technological concerns in a different way. The first article, authored by Kevin Anthony, Eleanor Smith, Jinxin Fu, and Jonathan Goldberg, examines how spatialization can be treated as a structural developmental parameter in musical composition using Anthony's recent composition *Canyon Overture* as a case study. Jared Tubbs's contribution introduces a promising and accessible model for listening to algorithmic music called "abductive mental modeling." Paulo Chagas's article reimagines telematic collaboration as a form of ritual, offering both rich documentation of his creative project *Sound Imaginations: Telematic Immersion* and a humanistic analysis of its inspirations. Also included in this issue is Ian Guthrie's review of SEAMUS 2025, held from March 21–24 at Purdue University in West Lafayette, Indiana.

The cover art for this issue was contributed by Lemon Guo from the work ">19980" by Lemon Guo (music) and Mengtai Zhang (visuals), photographed by Kunning Huang.

I would like to extend my gratitude to Journal SEAMUS's new review board members, including John Gibson, Caroline Miller, and Eli Stine.

Have an idea for a new article, series, or other content? We would love to hear from you! Please feel free to write us any time with your inquires or submissions: journal@seamusonline.org.

And finally, as always, our deep appreciation goes out to the Journal SEAMUS staff, SEAMUS leadership, and the SEAMUS community. I look forward to hearing from you!

Drake Andersen, Editor-in-Chief

Beyond Novelty: A Framework for Intentional Spatialization in Immersive Electronic Music Composition

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Abstract

We introduce a fundamental framework for electronic music composers to infuse spatio-musical elements with intentionality, moving beyond novelty. By moving beyond spatial novelty, composers can unlock the full expressive potential of immersive audio, offering listeners a deeply engaging and intentional auditory experience. This framework centers on actionable terms and concepts in three key areas: (1) axis-domains, (2) degrees of localization, and (3) domains of stratification. To illustrate these concepts, the paper presents a case study of *Canyon Overture* (2025), an immersive electronic composition by Kevin Anthony, commissioned for the interdisciplinary Within the Canyon project at Brigham Young University. This work demonstrates how structured spatialization techniques can shape listener perception, create dynamic spatial forms, and enhance performer-audience interaction. By providing a vocabulary for spatial design, this framework supports composers in developing immersive music with greater intentionality. Our framework aims to equip the modern electronic composer with both foundational terms and practical strategies for intentional spatialization, fostering immersive and expressive musical narratives.

Introduction

Immersive audio technologies provide composers with powerful tools for shaping spatial experiences in music. With advancements in object-based audio, wave field synthesis, and multichannel spatialization, composers have access to an expanded spatial canvas that allows for precise placement, movement, and interaction of sound objects. As spatialization becomes more integral to musical practice, a structured approach can help composers develop spatial relationships with the same level of intention applied to pitch, rhythm, and timbre.

This paper presents a framework for intentional spatialization, designed to assist composers in integrating spatial elements into their creative workflows. The framework focuses on three core principles:

- Axis-Domains: Defining spatial motion along one, two, or three dimensions.
- Degrees of Localization: Shaping the clarity or diffusion of a sound's perceived position.
- Domains of Stratification: Layering spatial, spectral, and temporal elements to influence immersion and intelligibility.

By establishing a vocabulary for spatial design, this framework offers a foundation for composers to shape immersive auditory experiences with clarity and intention.

Background

The field of immersive audio composition has seen significant advancements, driven by both technological innovation and artistic experimentation. Historically, acoustic compositions have long leveraged spatialized setups to enhance the listening experience (Torick 1998). From Giovanni Gabrieli's antiphonal choral works in St. Mark's Basilica to Stockhausen's Gruppen for three orchestras, composers have explored the spatial dimension of sound as a fundamental musical parameter. The twentieth century saw further developments with Xenakis, Boulez, and Takemitsu, who integrated spatialized performance configurations to shape musical structure and listener perception. These precedents establish a lineage that contemporary immersive audio compositions build upon, reinforcing the importance of spatialization as both a technological and aesthetic consideration (Roads 2001).

Contemporary Research on Immersive Audio

Building upon the above lineage, Natasha Barrett's work on spatio-musical composition strategies emphasizes the role of spatialization as a core structural element in electroacoustic music, rather than merely a secondary effect (Barrett 2002). Barrett highlights how composers can manipulate spatial relationships between sound objects, distinguishing between spatial illusion and spatial allusion to create dynamic auditory experiences. This aligns with James Dashow's perspective on spatialization as an expressive resource, where spatial movement and acoustic characteristics are treated as integral compositional parameters, rather than as post-production enhancements (Dashow 2013).

Recent studies have also explored object-based audio and algorithmic spatialization as tools for immersive composition. Fan (2019) introduces a novel compositional framework that integrates object-based spatialization with real-world positioning systems, allowing for dynamic listener interactivity. This is further supported by Mathew et al. (2014), who propose a morphological analysis of audio object control strategies for 3D audio environments. These works contribute to the growing field of interactive and generative spatial composition, demonstrating how algorithmic processes and adaptive spatialization techniques can enhance both artistic control and listener engagement.

The integration of immersive audio in extended reality (XR) environments has also been a growing area of interest. McKnight (2020) describes Stowaway City, an immersive audio experience designed for multiple tracked listeners, utilizing a hybrid system of binaural headphone rendering and a spatial loudspeaker array. This approach is complemented by Turner et al. (2021), who discuss challenges in spatial audio production for immersive media, emphasizing the need for practice-led research in designing effective spatialized sound environments. Similarly, Wycisk et al. (2022) develop the Immersive Music Experience Inventory (IMEI) to quantify the listener's experience of immersion in various 3D audio formats, bridging the gap between technological innovation and perceptual research.

Additionally, Wakefield and Smith (2011) introduced COSM, a toolkit designed for composing immersive audio-visual worlds. Their research explores the interplay between spatial audio and virtual environments, offering composers tools to integrate spatial sound with interactive visual elements. This work highlights the potential for immersive audio beyond traditional concert settings, extending into interactive media and experimental performance contexts.

Imminent Methodology

Curtis Roads (2001) has commented on the relatively unexplored state of immersive compositional practices, noting that while spatialization technologies have advanced significantly, their integration into compositional methodology remains underdeveloped. He argues that spatialization should not be an afterthought but a fundamental aspect of compositional design, requiring new approaches to musical form and structure (239).

These discussions invite a broader practical conversation about the necessary terminology and conceptual frameworks required for immersive music composition. As immersive audio technologies continue to evolve, there is a pressing desire for standardized terms and methodologies that allow composers to effectively engage with spatialization as a structural component of musical composition. The establishment of clear definitions for spatial axes, degrees of localization, and spatial stratification can provide composers with a shared vocabulary to navigate the complexities of immersive sound design. By addressing these conceptual needs, future research and creative practices can build a more cohesive and structured approach to immersive audio composition.

Framework for Intentional Spatialization

This framework is designed to help composers integrate spatialization into their work with clarity and intention. Binaural renderings are gaining popularity at the consumer level, and advancements in spatial audio systems such as L-ISA, Dolby Atmos, Soundscape, and Spacemap Go are making immersive audio more accessible in public venues and educational institutions. With these developments, composing for immersive systems is becoming more feasible. To support this, the framework we introduce focuses on three main ideas: defining spatial dimensions through axis-domains, controlling degrees of localization, and leveraging stratification techniques. This section will introduce these ideas then discuss how they are leveraged for musical expression.

Axis-Domains

Spatialization can be categorized into three primary axis-domains: one-axis, two-axis, and three-axis configurations. This applies to one or more related sound objects.

- One-axis: confines movement to a single linear plane, typically left-to-right in stereo systems, which is effective for simple directional motion and focused spatial trajectories.
- Two-axis: expands movement to a two-dimensional perimeter around the audience, allowing for increased spatial depth and motion flexibility, such as in quadraphonic or surround configurations.
- Three-axis: introduces height as an additional dimension, enabling fully immersive sound fields where sound objects can move in three-dimensional space.
- Axis-offset: describes the technique of freely orienting a lower dimension of motion inside of a higher dimension.

Axis-domains define the spatial dimensions in which sound objects move and interact. Use of axis-domains provides structure for a sound object's spatial attributes, governing movement, orientation, and evolution. This concept helps organize material into distinct spatial layers, reducing masking and enhancing clarity. It also allows for structured development along specific axes, ensuring spatial movement serves a compositional function rather than existing as an arbitrary effect. A section that begins with constrained linear movement and gradually expands into a broader two-axis or three-axis spatial field creates a sense of structural development. This controlled expansion or contraction of spatial placement mirrors the musical archetypes of tension and resolution.

Degrees of Localization

Sound localization is the ability to perceive and identify the location of a sound. Each of the following degrees of localization reflects a combination of the acoustic properties of the environment, the characteristics of the sound

source, and the assumed perceptual abilities of the listener.

- **Strict Localization**: refers to a scenario where the sound source can be pinpointed with high precision. The sound appears to emanate from a very specific point in space, and listeners can easily determine its origin with little to no ambiguity. This level of localization is often associated with sound sources in acoustically controlled environments or with sounds that have distinct spectral characteristics, allowing for precise auditory spatial awareness.
- **Moderate Localization**: describes a situation where the sound source can be identified within a general area, but not with absolute precision. The sound seems to come from a broader region, and while listeners have a good sense of the direction and possibly the distance of the sound, there is some ambiguity regarding its exact point of origin.
- **Loose Localization**: pertains to a condition where the sound source is difficult to place accurately in space. The sound appears diffuse or spread out, making it challenging for listeners to determine where it is coming from.
- **Total Envelopment**: describes a scenario where the sound object no longer has a location. Instead, the sound is perceived to be entirely omnipresent.

Domains of Stratification

In the nuanced world of sound design and composition, the concept of stratification is well established and goes beyond merely separating sound objects for clarity; it becomes an artful manipulation of sound to create immersive, dynamic, and emotionally resonant auditory experiences. Spatial, spectral, and temporal stratification interact in a complex relationship where the goal is not always perfect separation but rather a balance between intelligibility and envelopment. Composers use stratification dynamically, sometimes reinforcing clarity and at other times blending elements to evoke specific emotions, guide attention, or dissolve the boundaries between realistic (allusory) and imagined (illusory) sounds.

Spatial Stratification

Spatial stratification involves positioning sound objects in distinct areas of the auditory field to either enhance localization or create immersive environments. Clear spatial separation allows listeners to perceive individual sources with high accuracy, improving focus and intelligibility. However, blending sound objects spatially can foster envelopment, simulating natural acoustic environments where sounds overlap organically. A composer might employ spatial destratification to create an atmospheric wash of sound, making localization ambiguous, or use exaggerated spatial separation to emphasize individual elements within a mix.

Spectral Stratification

Spectral stratification involves the distribution of frequency content across different spatial regions. When frequency bands are carefully separated, each sound maintains its unique spectral identity, preventing masking and reinforcing timbral contrast. Alternatively, overlapping spectral content can be used deliberately to merge sound sources, forming composite textures that suggest unity or cohesion.

Temporal Stratification

Temporal stratification governs the timing of sound events, affecting how auditory layers interact over time. Aligning sound onsets closely can create cohesion, reinforcing rhythmic structures or enhancing simultaneity. Conversely, staggering onsets or offsetting rhythmic patterns introduces separation, contributing to a greater sense of depth and articulation. By manipulating temporal relationships, composers can shape listener perception of form and movement.

The Art of Stratification and Destratification

The interplay between stratification and destratification offers a powerful means of sculpting the listening experience. Dense, destratified soundscapes evoke complex and immersive environments, such as the indistinct blend of a city soundscape or the layered textures

of a dense forest. Clear stratification, on the other hand, allows for moments of focus, separation, and definition, drawing the listener's attention to specific sonic elements. Mastering these techniques enables composers to navigate the full spectrum between clarity and immersion.

Case Study: *Canyon Overture* by Kevin Anthony (2025)

Within the Canyon was a multidisciplinary performance project exploring electroacoustic and immersive audio in natural and staged environments. The work included several performances, beginning on-site in a Utah slot canyon and later adapted for the immersive venue The Box at Brigham Young University. Across both settings, the project emphasized the integration of spatial sound, choreography, video, and interactive media to create a unified immersive experience.

The first iteration took place in the canyon itself, where two cellists performed three commissioned works, each situated in a distinct location. Audience members walked between sites alongside choreographed dancers. The subsequent performance series in The Box featured sold-out shows, incorporating 270-degree projected video from the canyon (including drone and gimbal footage) and a live spatial audio system. The collaborative effort included faculty and students from music, dance, theater and media arts, and biology.

Canyon Overture (2025)

Canyon Overture (2025) composed by Kevin Anthony is a three-part composition for an immersive format performed live with cello, interactive projection, and electroacoustic performance. Figure 1 shows the control setup.

Figure 1. *Canyon Overture* performance control setup showing MIDI and GameTrak controllers for voice control and spatialization, Max patch with L-ISA integration, 270° projection, and close-mic'd cellists.

- **Section 1** introduces interactive live sampling of cello performance. As dancers appear to "grab" and displace the sound onto the perimeter of the venue, they simultaneously trigger an ink-blot projection that reveals footage of the canyon. This illusion is achieved by advanced MaxMSP patches controlled by two performers. Using granular synthesis, MIDI controllers, and GameTrak controllers, performers manipulated pitch, panning, distance, volume, and filtering.
- **Section 2** allows audience members to participate, guided by dancers through gestural movement. In the first part of this section, selected audience members are invited to "grab" and move sounds around the perimeter of the venue in the same way dancers do in Section 1. Electroacoustic performers translate the motion of each participant into spatial audio control via GameTrak tethers, adjusting panning and distance to reflect the movement in real time. In the second part of this section, dancers guide the full audience in a grow/shrink gesture exercise that gradually builds toward a hyperchaotic sound mass. These gestures are mimicked by the electroacoustic performers who alter the pitch and filtering of sampled sounds via a two-dimensional pitch bend system. All samples increase in volume, intentionally lose localization, and surge into a moment of total immersion.
- **Section 3** is an inversion of Section 1. Dancers "retrieve" the displaced sounds and return them to the cellists, who mimic the processed granular audio as it fades into silence.

Spatialization Techniques

Recent performances of Canyon Overture demanded precise application of this paper's framework:

- **Strict Localization** was critical for the first deposited sound. This moment introduced the audience to the spatial illusion and was achieved with close-mic'd, textured cello samples featuring extended techniques rich in upper partials.
- **Spectral Stratification** played a critical role in preserving the illusion as more sounds accumulated. Older sounds were assigned greater distance in the spatial system (via L-ISA), which reduced high frequencies and volume using filtering and gain compensation. This preserved the clarity of new sound placements.
- **Manual Spatial Control** was performed live. To support stronger use of the proposed framework's principles, the system was redesigned to avoid automation and give electroacoustic performers full control over panning, distance, elevation, filtering, and volume. This shift enabled more sensitive, responsive, and intentional manipulation of spatial and spectral attributes, allowing performers to execute nuanced spatial gestures in real time.
- **Temporal Stratification** was modulated using randomized granular playback. The grain clouds exhibited a strange simultaneity—on an aggregate level, the textures merged into a cohesive whole, contributing to temporal destratification. However, at the micro level, individual grains, some of which played in reverse at a determined ratio, introduced perceptual differentiation. This layered structure created a tension between temporal clarity and ambiguity, reinforcing the spatial and spectral complexities of the immersive texture.
- **Total Envelopment** occurred during the climactic build of Section 2. Pitch bends, volume surges, and spatial convergence created a moment of overwhelming density and immersive wash.
- **Final Localization** in Section 3 required extreme filtering and attenuation of background sounds to allow clear re-integration of samples into the live cellists' playing.

This performance demonstrated how a theory-driven framework for immersive music can become an invaluable compositional and performative tool. The structure and terminology proposed in this paper allowed the composer and electroacoustic performers to communicate clearly and respond sensitively in real time, crafting a perceptual experience that was deeply immersive and intentionally shaped. Rather than relying on automation or spectacle, the success of Within the Canyon emerged from an applied understanding of localization, stratification, and spatial motion—principles that, once internalized, offered powerful creative leverage.

Reflection and Further Research

The framework outlined in this paper presents a step toward a more deliberate and expressive practice of spatialization in electronic music composition. The case study *Canyon Overture* demonstrates the value of shared terminology and adaptable tools in both creative and collaborative contexts. However, further research is needed to evaluate the framework's utility across a broader range of genres, technologies, and aesthetics.

Future work could explore how this framework integrates with algorithmic and AI-based spatialization systems, especially those that respond to performer or audience behavior in real time. Comparative studies of how different audiences experience intentional spatialization in diverse settings—concert halls, XR environments, or headphones—would also provide insights into perceptual and emotional impact. Additionally, pedagogical applications of the framework could support new models for teaching spatial audio composition.

As immersive audio continues to expand across disciplines and platforms, the need for structured, intentional spatial design will only grow. This framework represents a foundational step toward that goal, offering composers a language and set of tools to craft immersive works that are not only novel but narratively and emotionally grounded.

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Abductive Mental Modeling: A Listener-Friendly Approach to Algorithmic Music Analysis

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Introduction

In her chapter of *The Oxford Handbook of Algorithmic Music*, Laurie Spiegel makes a poignant statement regarding her approach to algorithmic music composition: "to make sense of using algorithms… it would be wise to stay connected to our natural musicality and to go back to the question of why we create music at all" (Spiegel 2018, 106). She argues that one of the important features of music is that it "can be structured to represent in an abstract form something we experience or perceive in the world around us, a narrative drama or a data set or structure or set of relationships that can be represented in sound" (Spiegel 2018, 107). For Spiegel and many others, music is something that is meant to be perceived and shown to others to communicate or represent ideas. Algorithmic music is capable of communicating its ideas through not only the individual instance that a listener hears in one performance, but also through its many variations that are all created from the same abstract process.

The applications of algorithms in music range widely in scale and effect: for example, we can use algorithms to generate hours of non-repeating music, or to slightly raise the pitch of a recording. Some technologically informed composers can now communicate their ideas or their understanding of the world through compositions that employ unique algorithms for every parameter they can imagine, creating countless variations of a work. With this powerful application of technology in music comes an inherent challenge regarding these works' perception, analysis, and discussion: those with knowledge of the technology being employed are able to discuss the work through esoteric means, and those who lack the technical expertise are often left on the outside looking in. Finding an approach to analyzing algorithmic music that offers possible insights to listeners regardless of their level of technical expertise would be helpful for discussion and further analysis of the works in question. Such an approach would provide an entry point to those without knowledge of a composition's algorithms and insight into the possible listener experiences for those who are further informed on the processes behind the music. This article offers up one such approach, labelled Abductive Mental Modeling, which encourages listeners to draw conclusions on an algorithmic work through combining their observations across multiple listenings.

Algorithmic Music and Common Features

In order to create a listening approach for algorithmic music, there must first be an understanding of what exactly the term "algorithmic music" entails—no easy task in and of itself. In their opening chapter for The Oxford Handbook for Algorithmic Music, Alex McLean and Roger T. Dean examine the two words separately, identifying the "unfathomable diversity of approaches, cultures, techniques, forms, and activities" within music and defining an "algorithm" as "a well-defined set of operations or rules" (Dean and McLean 2018, 5). Their conclusion is a rather broad one: "the words 'algorithmic music' stand for a rich field of activity, defined by the urge to explore and/or extend musical thinking through formalized abstractions." This definition more closely identifies algorithmic music as a practice rather than a genre, covering any music that makes use of algorithms and processes at some point in its creative process regardless of any sonic parameters or context involved. This definition includes musical dice games from the eighteenth century, which allowed for random generation of music such as minuets, trios, and waltzes by drawing from a pool of individual measures. The

application of matrices to various musical parameters in serialist works and minimalist process-based works such as Reich's Clapping Music and Terry Riley's *In C* can all be considered algorithmic in practice. Even some of the more experimental works of the 1950s and 60s can be considered algorithmic: for example, LaMonte Young's *X for Henry Flynt* is essentially the text score version of the common "for loop." In addition to these pieces are the works that are conventionally seen as algorithmic works, such as Brian Eno's *Generative Music* and scores created by Francisco Vico's *Iamus* computer cluster.

Utilizing formalized abstractions adds an additional layer of complexity to analyzing music in this practice. In addition to the end result that the audience perceives, there is also merit to examining the algorithm that is not only capable of creating the work, but also many additional variations. In *The Oxford Handbook of Computer Music*, Dorin et al. use the biological analogs of genotype, mechanism, substrate, and phenotype to describe the process of realizing these abstractions. The genotype is the "data specification of the process", or the rules or code through which the work itself is created (Dorin et al. 2009, 356). This genotype is then rendered through a mechanism—performing forces such as a Max patch or the performer(s) reading a score. Finally, this genotype rendered through a mechanism becomes the phenotype when it is heard through a substrate: the combination of room acoustics, listener position, and speaker placement for electronic components that leads to the perception of the work. Though the substrate is important, its impact upon the work's interpretation is highly dependent upon the level of interaction the composer creates between the substrate and the genotype of the work. For the sake of clarity, this article will primarily use "algorithm" to discuss the genotype of a work and "instance" to discuss a work's phenotype as executed through a mechanism and substrate.

Algorithmic music practice is by no means a monolith. There are a wide range of techniques, systems, and approaches for creating these abstractions, and each composer's process will overlap and contrast with another's in different ways. Even with this diversity, there are some general means to describe the relationship between a work's algorithm and an instance it generates. One of the most informative aspects to parse in an algorithm is what portions of the instances it generates are part of an inherent structure (or "hard-coded") and what portions are more variable in nature. In creating the algorithm, the composer can predetermine any amount of the end result's details, both on surface-level features such as individual sounds as well as larger-scale matters like form. Works such as Steve Reich's *Clapping Music* are almost entirely fixed in nature, with only slight variations allowed for tempo and the source of the clapping sound. In contrast, tempo information and chord progressions are the only inherent structure utilized in improvisation sessions with Jon A. Biles' GenJam algorithm, an "interactive genetic algorithm jazz improviser" that can perform alongside with a co-improviser (Biles 1998, 232).

Rather than being driven by inherent structure, GenJam is an example of algorithmic music's capability to incorporate variation in its instances. Generally, the inclusion of variation in algorithmic composition can be divided into two different methodologies: interactivity and randomness. Interactivity involves the use of outside forces such as a performer to affect the instance of a work; randomness draws from stochastic processes created within the algorithm itself. The effects of this influence can vary in nature and scope. Some works only allow variability through affecting certain parameters of the algorithm before it is executed, while other works allow for interaction throughout the work even as it is being performed for an audience. GenJam's algorithm involves interactivity both before and during each instance's generation: an external force chooses the chord progression for the chart beforehand, and then an improviser provides input that is then sent through the genetic algorithm to be modified and played back during a performance.

The most important consideration when making use of interactivity and randomness in a composition is parameter mapping: what variables or aspects of the composition are being affected by these features, and how directly do they affect the sonic output of the work? In her chapter of *Auditory Display: Sonification, Audification, and Auditory Interfaces*, Carla Scaletti discusses parameter mapping by

assigning "orders" to parameters based on their relative distance from the audio signal:

- In a **0th-order mapping**, the data stream itself is listened to as a stream of digital audio samples.
- In a **1st-order mapping**, the data stream controls a parameter or parameters of a synthesis model (e.g., the data controls the amplitude of an oscillator).
- In a **2nd-order mapping**, the data stream controls parameters of a synthesis model that controls the parameters of another synthesis model (e.g., the data controls the amplitude of an oscillator that, in turn, controls the frequency deviation of another oscillator). And so on. (Scaletti 1994, 234–35)

In general, the higher order of mapping that any data stream (whether it is created by interactive or stochastic means) is assigned, the larger amount of variability or dynamism made available to the sounds the data affects. An analogy for this dynamism can be found in the measurement of derivatives for displacement in physics. For the 0th order, we measure displacement itself; for the 1st order, we can measure velocity, the rate of change in displacement over time; for the 2nd order, we can measure acceleration, the rate of change in velocity (or the rate of change in the rate of change of displacement) over time. This can technically continue ad infinitum: for example, "jerk" is the term given for the 3rd order of displacement that measures rate of change in acceleration, though higher orders such as this are less commonly encountered. Deciphering how much dynamism aspects of a work utilize without knowledge of the work's process can be quite difficult depending on the work's nature and presentation; regardless, contemplating the dynamism of an element of a work—particularly one that heavily features some level of interactivity or randomness—may bring helpful insights to the listener.

An approach for listening to and discussing algorithmic music should seek to examine these aspects of the music to provide insight into both the abstract algorithm that leads to the work as well as its individual instance that is perceived by the audience. For works that center around an algorithm or algorithms, this approach would offer listeners the ability to discuss the performance they are hearing and relate it to the corpus of possible performances that they understand to be available within the algorithm. For compositions that only feature algorithms in certain portions or parameters, these tools could provide a new perspective with a similar understanding of the possible variations within that specific portion of the work. This new perspective can be synthesized with a more traditional approach for the work's non-algorithmic features for a more holistic view of the composition in question.

Methodological Influences

The Abductive Mental Modeling process draws inspiration from two sources: Robert Hatten's approach to markedness in music, and P. N. Johnson-Laird's theory of mental models. In his 1994 book *Musical Meaning in Beethoven: Markedness, Correlation, and Interpretation*, Robert S. Hatten proposed a new approach to music analysis that utilizes the linguistic concept of markedness. Fundamental to the concept is the idea that certain features of a language—in this case, music—are unequally valued, creating asymmetrical oppositions in which a "marked" feature stands out or is perceived as more significant in comparison to an "unmarked" counterpart. Composers will often work to intentionally create points of markedness in their works through manipulating its contents—for example, changing the meter or key, shifting the register or instrumentation of the melody, or changing the texture of an accompaniment. To some degree, however, markedness is a subjective matter, as it is ultimately the listener that is dictating what they perceive to be significant or salient.

Another important feature of Hatten's approach to markedness in music is his use of types, tokens, and competency. Hatten describes the relationship between type and token in a manner very similar to prior discussion of genotype and phenotype:

> A type is an ideal or conceptual category defined by features or a range of qualities that are essential to its identity… A token, on the other hand, is the perceptible entity that

> embodies or manifests the features or qualities of the type… Thus, type and token exist at two fundamentally different levels, but their relationship allows us to pass smoothly from one to the other. (Hatten 1994, 44)

A listener's understanding of the relationship between the type(s) and tokens at play in a work leads to a development of competency. Two competencies are outlined in Hatten's writing, which hold a similar relationship to each other as types and tokens: stylistic competency, labelled as the understanding of "general principles and constraints of a style," and strategic competency, which relates to a work's "individual choices and exceptions" (Hatten 1994, 29). These two competencies are employed in tandem to create a hermeneutic spiral leading to a greater understanding of a work. One's understanding of a style's available types (their stylistic competency) guides their understanding and interpretation of tokens of the style (their strategic competency), which then further refines their understanding of the types in consideration, leading to a perpetual process of information gathering and refinement. Hatten's utilization of these concepts encourages the collaboration of the more "objective" structural analysis of a composition with a more contextual exploration of style and expressive meaning. While the expressive nature of algorithmic music is often up for debate, these concepts that Hatten uses in his approach are readily applicable to the world of algorithmic music and will be of great assistance in guiding a methodology for listening to a genre of music with a uniquely wide range of variability.

In his chapter of *The Oxford Handbook of Algorithmic Music*, Palle Dahlstedt discusses the usefulness of humans being able to solve problems related to programming in their heads by simulating the necessary computations. He explains that the "mental processing, prediction, and simulation" we attempt in our minds "are the kinds of mental models a composer will need to work consciously with in programming generative algorithms and using algorithmic tools… and the models that an advanced listener may form in her mind from repeated listening" (Dahlstedt 2018, 50). The term "mental model" comes from a theory of the same name introduced by Kenneth Craik in 1943 and further explored forty years later by P. N. Johnson-Laird in his book *Mental Models: Towards a Cognitive Science of Language, Inference, and Consciousness*. The theory of mental models has been applied in a variety of fields ranging from cognitive science and psychology to system dynamics and human-computer interaction, and represents an essential aspect of Abductive Mental Modeling.

Dahlstedt's writing on mental representation centers around two forms discussed in Johnson-Laird's writing: mental images and mental models. Dahlstedt summarizes the essential traits of mental images by defining them as "a configuration of perceptual-like features, in analogy with a real-world image" that can be either "a memory of something previously perceived or a construction of known elements" (Dahlstedt 2018, 50). One common example of a mental image may be a set of directions such as a morning commute—a stable construction of the roads and turns taken to move from one point to another. Now, imagine instead that an important intersection for this commute is blocked, leading the driver to have to take major detours. In this process of rerouting, the driver would now be considering the larger network of possible alternative paths, considering which new route would be best. This shift from a static set of directions to consideration of multiple paths is a shift from mental image to mental model, which Dahlstedt characterizes as "a more elaborate, dynamic, and active construction used to make predictions or generate expectations" (Dahlstedt 2018, 51). Just as a phenotype is the perceptual output of a genotype, or an instance is the perceptual output of an algorithm, a mental image could be understood as the perceptual output of a mental model—a prediction generated from this construction. Being an active, dynamic construction means that these mental models are capable of adjusting as the modeler gains more information. Johnson-Laird confirms this, stating that mental models are structured according to our understanding of an analogous state of affairs, changing in dimension and complexity with our understanding of the dimensions and complexity of the problem or system in question (Johnson-Laird 1983, 156). With their dynamic nature and

basis in perception, mental models will be a helpful contribution to a listening approach centered around the listening experience.

Abductive Mental Modeling

When approaching an algorithmic composition with an intent to gain a greater understanding, the underlying goal is to better comprehend the work's process (or genotype), the range of possibilities this process allows, and how it leads to the creation of the instance (or phenotype) that the listener experiences. With an understanding of the various common features of algorithmic music, Hatten's approach to musical markedness, and Johnson-Laird's theory of mental models, we can synthesize a new listening approach that is built from the listener's experience, encouraging critical listening to algorithmic works that leads to the formation of one's own personal understandings of the composition. Abductive Mental Modeling draws its name from abduction, a process of exploring theories outlined by Charles Sanders Peirce, a semiotician who influenced much of Hatten's writing on markedness in music.[1] In the abductive process, an interpreter attempting to make sense of a set of observations begins by crafting a hypothesis which is continually refined as further observations are made. It is this process that Abductive Mental Modeling seeks to orient the listening experience around in order to critically engage with the algorithm and instances of a work.

Abductive Mental Modeling begins with the listener's first encounter with an algorithmic work. During this time, the listener should begin observing the composition, taking note of features of the composition that come across as structural or marked to their ear. After this first listening, the listener should begin the process of creating a mental model through abductive reasoning, piecing together some kind of process that represents what they believe the work's genotype to be based on their current understanding. This mental model can take whatever shape or form that provides the most accurate and helpful representation of the listener's understanding of the work.

Since the initial mental model created by the listener is determined by their perceptions of markedness and structure in the work, this first model will vary widely in both structure and complexity depending on the listener's prior experience. For a "perfectly naïve" listener who has spent no time listening to music with the intent to better understand it, their mental model after one listening is likely to be extremely minimal in nature. This listener's perception of markedness will primarily entail more striking contrasts or common recurring elements found in the work or pieces of the work that somehow relate to their knowledge or life experiences outside of the composition. In contrast, a highly informed listener with a great deal of experience in algorithmic music may already have a relatively refined mental model in their head from their prior research (or perhaps creation) of the work, even if they have yet to do any listening. This listener may already understand aspects of the work that are marked through compositional decisions; for them, markedness may also be found in the work by discovering results in the instance that are unexpected or unique interactions with the mechanism and substrate through which the algorithm is executed. Most listeners will land somewhere in between these two extremes, having some experience in listening to and analyzing music but no prior experience with the work being approached aside from a quick scan of its program notes. Their initial mental model will probably be closer to that of the perfectly naïve listener, but their experience with interpreting and understanding music (or even more specifically, whatever genre the work falls into) may bring with it additional details and observations that they can keep in mind for additional listenings.

During this first listening—as well as any others—there are chances for the listener to come to erroneous conclusions. This is particularly plausible for listeners who are not highly informed; with many algorithmic works, there is potential for coincidences to occur that may lead the listener to draw conclusions from the instance

[1] For a primer, see Douven 2021.

that will not hold true for every output of the algorithm. Unless the listener has studied the algorithm to the point of being able to interpret that particular instance as a coincidence, then there is a possibility that their model will incorporate this coincidence as a more essential part of the work than it is in reality. This possibility may even be available for the composer, depending on the construction of their algorithms: if their work has some kind of error or bug that they did not have in mind, even their refined model may contain misconceptions. For most listeners, these will be inevitable during the process of approaching an algorithmic composition through one's own listening; this is welcome, as identifying any inconsistencies with additional listenings to the work following the creation of an initial mental model will form an essential part of the Abductive Mental Modeling process.

For every subsequent listening after the creation of the mental model, the listener works through a continuous feedback loop with the work in question:

1. Listen to the work, attempting to understand what is heard through the lens of the current mental model and making note of any possible additions to the mental model or phenomena that are inconsistent or unexplainable;
2. Refine the mental model to better fit the work, accounting for new observations and previously inconsistent or unexplained phenomena;
3. Reinterpret what is heard from the earlier listening through the newly refined mental model, reflecting upon how this changes the understanding of what was heard in the work and what might be heard in further instances.

By working through these three steps, the listener effectively creates a hermeneutic spiral for their own personal understanding of the work. Each listening provides a greater comprehension of the available variations in instances afforded by the work, helping to form a more accurate mental model for the algorithm being employed. At the same time, forming a more accurate mental model helps the listener gain a better understanding of how each instance is the result of the algorithm's execution. While the amount of growth in stylistic and strategic competency on each listen will vary depending on the complexity of the work and the listener's ear, each listening provides another chance for the listener to reinforce or augment their mental model by following through this three-step feedback loop.

Two Case Studies

Many algorithmic works are presented in a manner that makes gleaning information about their creation and process difficult. Some works center around incredibly complex algorithms for their structure or sound creation; others are only shown through one particular instance rather than multiple versions or performances of the algorithm; others still have little to no documentation of involved processes in program notes or online discussion. There is no clear solution to these issues, even for the most experienced of algorithmic music analysts; for the sake of offering a wide-ranging listening approach, this treatise will primarily involve works that feature some level of accessibility, be it through relative simplicity or documentation of discussion and analysis done by others. This article will examine two works, with one featuring a large amount of inherent structure and another centering around interactivity.

***I am sitting in a room* by Alvin Lucier (1969)**

While Alvin Lucier's *I am sitting in a room* may not be the first piece one thinks of when asked to think of algorithmic music, the work is undoubtedly driven by a defined process. Most instances begin with a paragraph that was spoken in the original performance of the work, read by Lucier himself:

> I am sitting in a room different from the one you are in now.
>
> I am recording the sound of my speaking voice and I am going to play it back into the room again and again until the resonant frequencies of the room reinforce themselves so that any semblance of my speech, with perhaps the exception of rhythm, is destroyed.

> What you will hear, then, are the natural resonant frequencies of the room articulated by speech.
>
> I regard this activity not so much as a demonstration of a physical fact, but more as a way to smooth out any irregularities my speech might have. (Lucier and Simon 1980, 30)

This excerpt outlines *I am sitting in a room* for the listener, helping steer them towards a more accurate mental model even from their first listening. If they are listening to a recording of the first performance, they will hear the paragraph recorded and then played back eight additional times, for a total of nine iterations of this text. Each reading of the paragraph takes roughly one hundred seconds, with the work as a whole lasting fifteen minutes and twenty-three seconds (UbuWeb 2021).

The work itself is very slow in its development. During the first listening, the main points of markedness will likely be the moments when the playback of one recording ends and the next one begins. Here, the contrast between the recording that has just finished and its new iteration with additional resonances and filtering from the room in which the recording takes place will be at its most stark, marking the structural looping point for the listener. The number of times in which the piece loops the text may not be as relevant or easy to keep track of on the first listen due to the length of each reading the work as a whole. With this in mind, the initial mental model created by the listener will likely revolve around the work's looping nature and the gradual process of the room's resonant frequencies overpowering the text. Figure 1 shows one possible illustration, with the text inside of the box representing the salience and perceptibility of the work's text and the thickness of the box representing the resonant frequencies of the room in which the recording was taking place.

After this first listening, it may appear that the most salient aspects of *I am sitting in a room* have already been captured by our listener; that being said, the only way to be certain is to continue through the Abductive Mental Modeling feedback loop, finding another phenotype of the work and listening for any inconsistencies or unexplainable phenomena. For example, Lucier has published another recording of *I am sitting in a room*—this time, a version that is forty-five minutes in length, featuring thirty-two repetitions of the same text (Lucier 1980). Anyone who listens to this recording after hearing the original will likely realize after the first fifteen minutes that this version features more instances of playing the text back through the resonance of the room. While the number of repetitions was not accounted for in the listener's original mental model, this contrast in length may lead to the observation that the genotype of the work allows for different amounts of repetition in each instance. The listener may also notice that the resonant frequencies being emphasized by the second recording are different from that of the original, leading to an additional conclusion—which may have already been reached, but was not expressly stated—that the piece does not have any specifications for the type of room it can be

Figure 1. A potential listener's initial mental model for *I am sitting in a room*.

recorded in.[2]

Listening to additional phenotypes for *I am sitting in a room* provides the opportunity for a greater understanding of what Lucier leaves open for the creator of this new instance to decide. One instance may use a different text from the original, or speak the text in a different language;[3] another may move through multiple rooms instead of only one, or may place the microphone used for recording in different places over the course of the work; yet another may create a live performance of the work, rather than a recording. All of these possibilities are included in Lucier's score on its second page of instructions:

> Make versions in which one recorded statement is recycled through many rooms.
>
> Make versions using one or more speakers of different languages in different rooms.
>
> Make versions for which, in each generation, the microphone is moved to different parts of the room or rooms.
>
> Make versions that can be performed in real time. (Lucier and Simon 1980, 31)

With these different possibilities in mind, a mental model that is further informed from these listenings may look something like Figure 2.

While this model is only a slight deviation from what was initially put together by the perfectly naïve listener, the additions elucidate the different possibilities within the genotype to the work—the possible differences in text used, resonances taken advantage of, and repetitions taken to complete the work.

I am sitting in a room is a relatively simple piece driven largely by a looping structure. There is little to no randomness present in the work, and the main sources of variability or interactivity come from decisions made before the work such as choice of spoken text, room, or microphone position—smaller details that will affect the way in which resonances of the room take over the work, but not the overall process and sonic shaping that is prescribed by the inherent structure of the composition. The looping structure is graspable after the first listening, but the variety of different approaches that are sanctioned by Lucier's score can only be recognized by continuing to listen to additional phenotypes and listening for the differences. The application of Abductive Mental Modeling to *I am sitting in a room* allows for the listener to realize these potential variations through their subjective listening experience, even if they have no access to Lucier's original instructions.

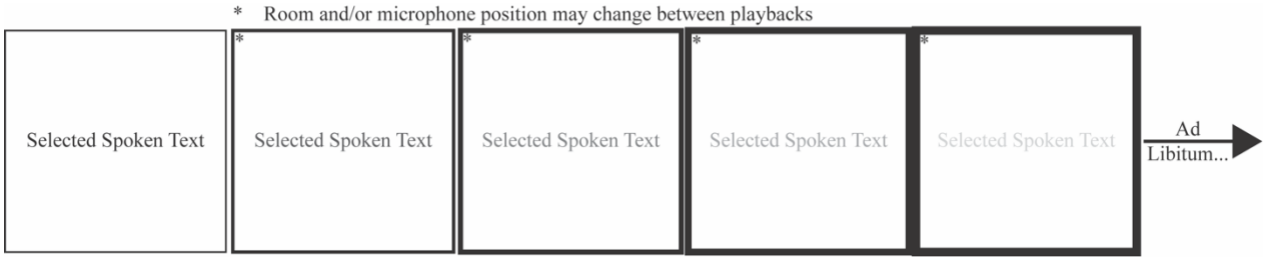

Figure 2. A potential further refined mental model of *I am sitting in a room*.

[2] Decisions that performers of a work make prior to the work being performed (in this case, matters such as microphone location and room choice) fall into an odd middle ground between the being structural and being an interactive aspect of the work. For the sake of this document, these will be classified as generally structural decisions as long as they are not part of the performance itself.

[3] While the aforementioned text is part of the score, the instructions above it state: "Use the following text or any other text of any length."

***Atomically Arranged* by Jared Bradley Tubbs (2024)**

My work *Atomically Arranged* is an algorithmic composition for alto saxophone and live electronics (and, optionally, video) run through the Max/MSP signal processing software that draws inspiration from crystal structures. The piece begins with the performer clicking on different crystal names in a user interface; this types in an eight-digit code using the numbers zero through three. Once finished inputting the code, the performer presses a button to begin, which initializes some fixed media drones in the higher and lower registers. During one's first listening (and potentially watching), the piece may come across as relatively straightforward in form: marked structural elements can be heard as the performer shifts between one of three unique four-chord progressions, with each four-chord progression having a different mix of electronic effects that are applied to the saxophone's sound. Each step of the chord progressions is visually accompanied by a graphic score that holds the title of a crystal and a set of sheet measure fragments that the saxophonist reads, and their level of activity grows over the course of the progression. Between some of these chord progressions, a "diamond" graphic score appears, with the saxophonist's performance being generally more active and the electronic effects more dense during this time. The work ends with the performer repeating one musical fragment as the fixed media and live electronic effects fade away. After this first experience with the piece, a possible first mental model can be seen in Figure 3, which accounts for these sectional chord progressions, the interjections of "diamond" sections, and the fading of the electronics as the saxophonist repeats a musical fragment at the end.

Compared to *I am sitting in a room*, additional listenings to *Atomically Arranged* will likely lead the listener to make more drastic adjustments to their initial mental model. The original mental model functioned under the assumption that the original structure of four-chord progressions and "diamond" interjections would be the same each time. Additional listenings prove that this the original sequence was specific to the individual instance; while there are always eight sections for each instance, the form of these sections appears to change for each performance. With enough listenings, aided by the visuals that accompany the work, the listener may be able to observe that the code that is entered at the beginning of the work is a layer of interactivity for the performer that has a direct impact on the form: each number from zero to two in the code corresponds to a specific four-chord progression and set of electronic effects, and the number three corresponds to a "diamond" interjection. Additionally, each of the four-chord progressions are given a set of four crystal-related graphic scores that the performer moves between. The movement between these crystals within each progression is more difficult to understand just from listening; sometimes, a performance moves between all four possible crystals, and other times certain stones are more commonly repeated. A more refined mental model should find a way to account for the malleability in both large-scale (regarding entire sections and chord progressions) and small-scale (regarding

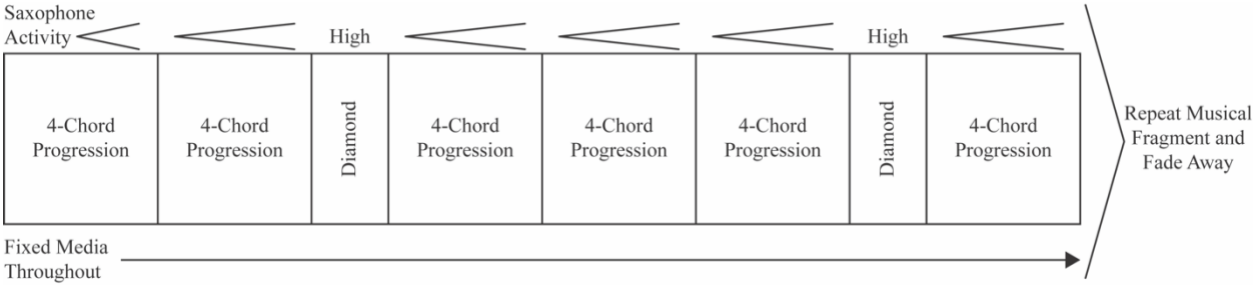

Figure 3. A potential listener's initial mental model for *Atomically Arranged*.

movement between graphic scores within a section) form for the work, which may require a more abstract representation such as Figure 4.

Atomically Arranged features a level of interactivity that affects the entire form of the work in addition to the smaller-scale decisions that the performer makes while reading the graphic score. This new mental model eschews a representation that favors a clear, left-to-right temporal structure like the model made for *I am sitting in a room* in order to more accurately account for the available movement between each section and the form's relationship to the code that is entered by the performer. There are still some aspects of the work that are left out of the mental model—for example, there is no explanation for how the crystal graphic scores are moved between within sections—but these aspects rely on features such as Markov chains, which are difficult to grasp without knowing the algorithm behind the work. Even without this knowledge, approaching the work through Abductive Mental Modeling gives the listener a chance to better understand the wide range of instances that are available as well as the extent to which the performer's interactions with the piece impacts the generated performance.

Conclusion

Abductive Mental Modeling combines the concept of mental models with an adapted form of Robert S. Hatten's approach to musical markedness to create a listening approach that encourages critical listening and allows the listener to engage with algorithmic music without a high level of technical knowledge. Ideally, listeners will be able to utilize this approach to actively engage with algorithmic music, forming a greater understanding of the work and its possibilities with each additional listen. A central goal of Abductive Mental Modeling is for the approach to function regardless of prior experience with algorithms and music; if

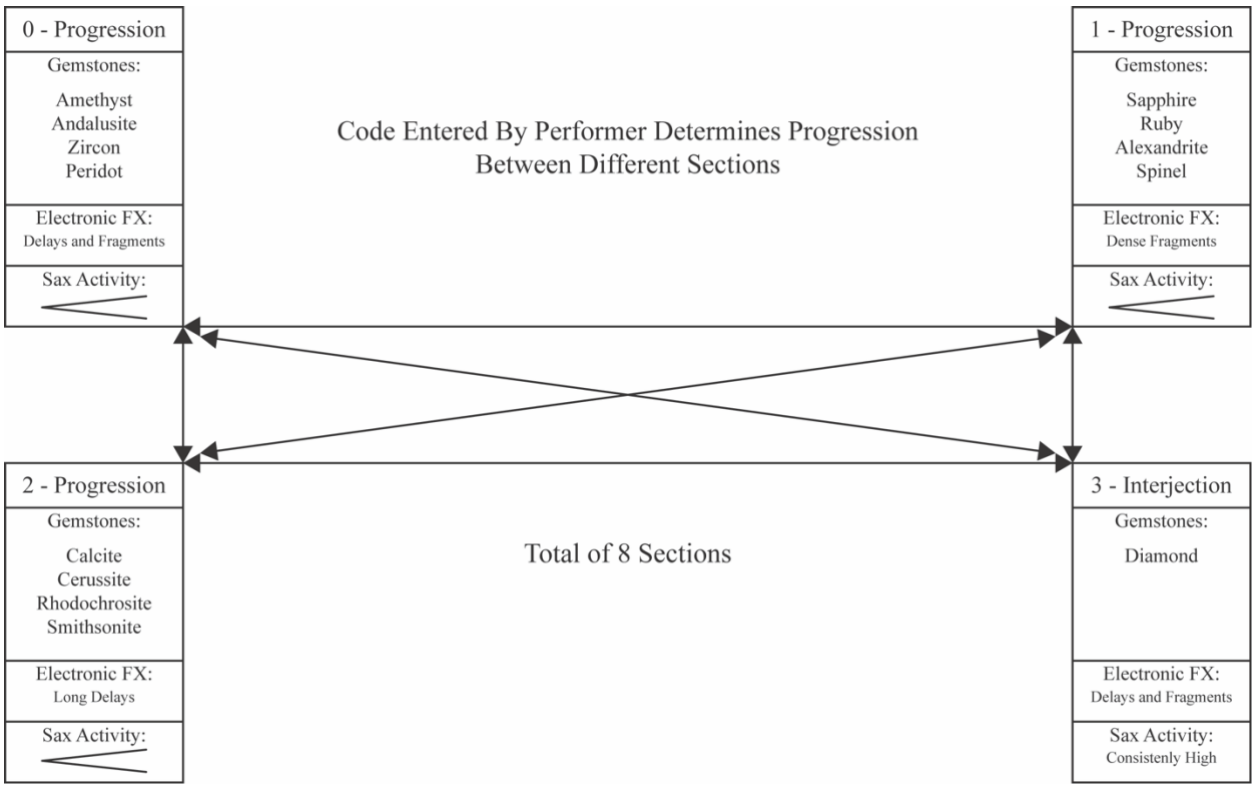

Figure 4. A potential further refined mental model for *Atomically Arranged*.

observations about the work are being made and reflected upon, the listener is contributing to their own hermeneutic spiral of understanding. It is the author's hope that an approach such as this could be used to assuage fears of a technological knowledge barrier among those interested in algorithmic music practices and further foster the algorithmic music community.

Acknowledgements

This paper is adapted from the author's dissertation, titled *Abductive Mental Modeling: Applying Musical Markedness to Algorithmic Music*, submitted to the University of Georgia in 2024 (Tubbs 2024). Significant modifications have been made to adapt the content for this publication.

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Audiovisual Immersion: Exploring Telematic Rituals

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Abstract

This paper offers an extensive examination of telematic rituals through the four-year research project (2020–2024) culminating in the film *Sound Imaginations: Telematic Immersion*. By synthesizing theoretical frameworks—such as Byung-Chul Han's critique of ritual erosion in the neoliberal age, Jacques Attali's symbolic categories of music, Walter Benjamin's reflections on mechanical reproduction, and Vilém Flusser's concept of telematic dialogue—this study situates telematic audiovisual immersion within broader discourses on ritual, artistic research, and technological mediation. A comprehensive narrative of the *Sound Imaginations* project details its inception, global field recordings across five continents, telematic performance processes, and reflections from the world premiere. Analysis of a condensed version of the film, guided by official captions, highlights how live-electronic transformation, asynchronous polyphony, and enhanced 3D visuals enact contemporary ritual forms. The paper concludes by envisioning artificial intelligence as pivotal to the evolution of future audiovisual rituals, enabling novel communal resonances and expanded creative agency within telematic environments.

Introduction

The *Telematic Audiovisual Immersion* interdisciplinary project, developed in collaboration with the Brazilian flutist Cássia Carrascoza over the period 2020–2024, set out to interrogate the boundaries between physical presence and mediated interaction through a series of compositional, performative, and technological experiments, culminating in the feature-length film *Sound Imaginations: Telematic Immersion*. Grounded in the conviction that music functions as a ritualistic medium—one capable of forging social bonds, mediating presence, and cultivating resonance—this project sought to create immersive audiovisual environments that dissolve the traditional dichotomies of presence/absence, here/there, near/far, and sender/receiver. Links to the feature-length film and two alternate versions are provided below.

The project builds upon my extensive research into electroacoustic music, intermedia, audiovisual compositions, and telematic music (Chagas 2014a). Central to my theoretical journey has been the conception elaborated in my book *Unsayable Music*, which emphasizes music's capacity to express beyond linguistic and conventional boundaries. In my subsequent article (Chagas 2014b), I underscore the significance of audiovisual forms within contemporary music creation. I posit that audiovisual composition, by integrating sound and visuals into a unified perceptual experience, transcends traditional auditory boundaries and enriches expressive possibilities, allowing composers and audiences to explore deeper emotional, symbolic, and conceptual interactions.

Further developing these themes, my article on telematic music (Chagas 2014c) highlights the convergence of electronic music techniques and the interactive dynamics inherent in chamber music practices. In this work, I explore the potential of *telematic dialogue*—described by Vilém Flusser—as enabling musicians in geographically separate locations to engage simultaneously in reciprocal creative exchanges (Flusser 2011). This telematic dialogue, characterized by real-time interactions mediated through technology, embodies a profound shift from conventional linear music-making towards spontaneous, multi-dimensional improvisational practices.

My 2021 article (Chagas 2021) introduces the concepts of the "electroacoustic paradigm" and the "telematic paradigm," informed by

Thomas Kuhn's notion of paradigms (Kuhn 1970). Here, I argue that electroacoustic and telematic practices signify substantial paradigm shifts in music, fundamentally altering how composers, performers, and audiences perceive sound creation, performance, and reception. The electroacoustic paradigm positions technology as central to musical creativity, while the telematic paradigm extends this technological mediation to encompass remote interactivity, real-time communication, and global artistic collaboration. Together, these paradigms delineate a theoretical evolution towards innovative artistic possibilities and new forms of communal resonance.

Sound Imaginations: Theoretical Foundations, Methodologies, and Artistic Outcomes

The research project "Sound Imaginations" (2016–2019), which I conducted as a Senior Fellow at the Center for Ideas and Society at the University of California, Riverside, began as an interdisciplinary exploration of sound from the perspective of *listening*. My initial theoretical groundwork emphasized listening as an active engagement with our acoustic environment (Chagas 2005), crucial for human communication across language, music, and sound art. Following Douglas Kahn's notion of sound as a pervasive phenomenon—"all space becomes indelibly, inaudibly, or pervasively filled with voices and sounds awaiting to be heard" (Kahn 1999, 200)—I situated music as a profound expression of our desire to comprehend sound's ubiquity, resonating across spatial and temporal scales from molecular vibrations to cosmic phenomena (Chagas 2021, 12).

To further define listening, I employed Michel Chion's influential model, distinguishing three interconnected modes: *causal*, *semantic*, and *reduced* (Chion 1994). Causal listening refers to identifying a sound's source, such as recognizing a person's voice or mechanical noise. Semantic listening entails interpreting sounds symbolically, akin to linguistic structures or culturally encoded sonic signals like Morse code or musical motifs. Lastly, reduced listening, derived from Pierre Schaeffer's musique concrète tradition (Schaeffer 1966), centers purely on sound's intrinsic characteristics—its timbre, texture, and affective resonance—abstracting it from its origins and meanings. This phenomenological stance, inspired by Husserl, advocates for "acousmatic" listening, a practice recalling Pythagoras's method of teaching disciples behind a curtain, privileging sonic perception over visual or causal associations (Chagas 2014a, 128). Chion further underscores reduced listening's potential to intensify emotional and aesthetic engagement, notably in audiovisual contexts like cinema, where sound profoundly influences audience perception and affective response (Chion 1994, 31).

My theoretical framework extended into considerations of how contemporary technologies transform listening practices. With the proliferation of digital devices and pervasive sound systems in everyday environments, I explored sound studies as an emerging interdisciplinary field that investigates how we culturally produce, consume, and interact with sound and silence (Sterne 2012). I highlighted Jonathan Sterne's notion of "sonic imagination," advocating for pluralistic methodological approaches guided by curiosity and reflexivity rather than rigid disciplinary boundaries. Additionally, building upon R. Murray Schafer's pioneering concept of "soundscape" (Schafer 1994), and Steven Feld's "acoustemology"—a union of acoustics and epistemology emphasizing sound as a primary modality of knowing and being (Feld 2003)—I positioned soundscape not merely as passive auditory environments, but active cultural fields where sound mediates human experiences and social interactions.

In the second stage, inspired by Holger Schultze's framework of "listening cultures" (Schultze 2015), I conducted extensive fieldwork across diverse global locations—São Paulo, Riverside (California), Moscow, Mannheim, and Pune—to document various cultural practices of listening. Equipped with an Insta360 ONE X camera and a Sennheiser Ambeo ambisonic microphone, I captured 360° 3D videos and immersive audio across distinct sonic environments: from bustling urban streets to serene temples, vibrant public parks to industrial landscapes. Employing first-person methodologies (Varela and Shear 1999), I foregrounded my subjective sensory experience as integral to data collection. The portable

recording equipment served as extensions of my embodied perceptual apparatus, emphasizing that objective sonic data are inseparable from subjective experience, thus creating a dynamic interplay between researcher and acoustic environment.

This methodological and theoretical engagement aligns with Jean-Luc Nancy's understanding of listening as an act of *re-sounding*—a resonance that goes beyond mere reception, instead opening the self to the alterity of sound and its reverberation within and between bodies (Nancy 2002). In this sense, as I later explored in *From Sacrifice to Telematic* (Chagas 2024), listening is not only perception but transformation—each act of attention a ritual gesture that reconfigures space, subjectivity, and relational presence.

The field recordings served not only as source material for theoretical reflection but also as the foundation for the project's culminating artistic event: *Sound Imaginations: Audiovisual Immersive Installation*, presented at the Culver Center of the Arts from February 29 to March 5, 2020. This installation brought together my conceptual investigations and first-person fieldwork, integrating ambisonic sound and 360° video from all five recording locations into a unified spatial experience. Developed in collaboration with curator Nikolay Maslov, the installation unfolded in three phases: editing and selecting audiovisual materials, curating thematic groupings, and designing a multisensory exhibition architecture.

As documented by UCR News writer Sandra Baltazar (2020), the installation sought to connect disparate parts of the world through a sensory and symbolic experience of sound and image. Baltazar aptly noted that the project invited audiences to "listen with their eyes and see with their ears"—a formulation that speaks directly to the project's underlying goal: to dissolve the boundaries between auditory and visual perception, and between geographically dispersed communities. In this sense, the installation was not merely a display of immersive media but a ritual space of re-sounding, where voices, places, and presences reverberated across cultural and spatial thresholds.

The heart of the installation was a 26-minute audiovisual composition with 7.1 surround sound, projected onto a central screen and surrounded by thirteen looping silent videos distributed throughout the exhibition space. Each sequence was carefully edited to create dynamic trajectories through 3D visual fields, employing panoramic shifts, layered movements, and spatial transformations. Visitors were enveloped in an immersive environment that destabilized fixed associations between sound and image. For instance, images of São Paulo's lush Trianon Park were paired with the sonic density of urban traffic, generating perceptual tension between serenity and chaos. Likewise, footage of Moscow's urban streets combined with birdsong recorded in Pune, India, blended distinct sonic and visual realities, prompting viewers to question assumptions of location, identity, and simultaneity. These compositional choices underscored the installation's ambition: to create a reflective and polyphonic space where sound, image, and presence were continuously reconfigured.

Conceptually, the installation extended my exploration of audiovisual immersivity across both physical and virtual dimensions, constructing a space in which visitors could encounter and reflect on diverse modes of listening and seeing. Rather than presenting a set of definitive conclusions, the work proposed an open-ended experience—an invitation to engage with the interplay of sound, image, and space as a dynamic and culturally situated process. By activating perceptual ambiguity and emphasizing the simultaneity of disjointed realities, *Sound Imaginations* fostered a ritualized encounter with difference and resonance. In doing so, the installation not only furthered my research in sound studies but also generated new artistic methodologies, positioning sonic environments as sites of inquiry, transformation, and human connection.

Theoretical Framework: From Sacrifice to Telematic Rituals

My exploration of the relationship between music and ritual begins with an understanding that rituals serve as fundamental symbolic practices connecting individuals and fostering community.

Music performances, whether in concert halls, public spaces, or informal gatherings, embody this ritualistic function, creating shared experiences and reinforcing sociocultural bonds. Through narratives, rhythms, and collective embodiments, music cultivates shared memories, identities, and meaning, thus becoming a cornerstone of communal life.

However, contemporary rituals have been profoundly affected by the neoliberal information age, characterized by Byung-Chul Han as dominated by data and algorithmic mediation (Han 2019; 2021). Han emphasizes rituals as essential "symbolic techniques for making oneself at home in the world," relying heavily on repetition and recognition to stabilize our experience of time (2019, 10). Neoliberalism disrupts this stability by prioritizing instantaneous connectivity and fleeting interactions over enduring communal ties and symbolic potency. Under the information regime, traditional rituals erode, replaced by transient digital exchanges that fragment communal experiences into isolated, data-driven interactions. This erosion diminishes our capacity for meaningful resonance and structured communal temporality, isolating individuals and creating an increasingly narcissistic society.

Jacques Attali's symbolic categories of music further illuminate the evolution of ritual through the history of music, outlined as *sacrificing*, *representing*, *repeating*, and *composing*. According to Attali, music initially functioned as a simulacrum of ritual murder—"noise is a weapon, and music is the formation, domestication, and ritualization of that weapon" (Attali 1985, 24). Music served as a societal stabilizer by controlling disruptive forces. Transitioning into the "representing" phase, music became linked with economic and social harmony, guided by the tonal system to create and resolve societal conflicts symbolically. However, this system eventually ruptured under intense dissonances introduced by modernist composers, ushering music into a "repeating" phase marked by mechanical reproduction. Recorded music turned into personalized rituals of consumption, embedding music deeply into individual identities and fostering cultural uniformity through repetition.

Attali's fourth category, *composing*, heralds an optimistic future, envisioning a shift towards spontaneous creation and improvisation facilitated by digital technologies. Composition, according to Attali, emerges as an act of resistance to societal repetition. It encourages a democratization of creativity through digital platforms that blur distinctions between composers and audiences (Attali 2001, 226-28). This vision aligns with John Cage's philosophy advocating for the autonomy of sound, reinforcing the idea that music creation should exist beyond market constraints and traditional power structures, empowering individuals to engage actively and democratically with musical creativity.

Walter Benjamin's seminal insights into mechanical reproduction complement this analysis, particularly concerning the erosion of art's "aura"—the unique authenticity historically tied to ritual. Benjamin describes how technological advancements, notably photography and film, dissolve art's aura by replacing physical presence with virtual interactions. This transition from ritual-based authenticity to mechanically reproduced virtual experiences liberates audiences, shifting them from passive observers to active participants. However, Benjamin also warns of potential alienation arising from technological mediation, emphasizing that new ritual forms emerging from reproduction technologies must critically engage with the apparatus to maintain meaningful communal engagement (Benjamin 2008).

Building upon Benjamin's warnings and Attali's optimism, Vilém Flusser introduces *telematic dialogue* as a transformative paradigm of contemporary creativity. Flusser envisions telematic communication—enabled by telecommunications and intelligent apparatuses—as a revolutionary dialogue fostering freedom through dynamic interaction and resisting entropy. He employs chamber music as a model, illustrating complex, embodied communication characterized by simultaneous and interactive participation across geographically dispersed participants. Unlike traditional musical practices structured linearly, telematic performances unfold simultaneously in multiple spaces, privileging real-time improvisation and collective decision-making

over fixed compositions (Flusser 2011, 162-63). This telematic dialogue expands ritualistic practices into virtual domains, allowing for novel forms of collective creativity and presence.

Raymond Ascott further elaborates on telematics as a *telematic embrace*, a powerful metaphor for remote interdisciplinary collaboration and global consciousness (Ascott 2003). Coupled with Han's advocacy for an ethics rooted in resonant communal bonds, Attali's vision of democratized musical creativity, and Benjamin's critical awareness of technological mediation, telematic audiovisual immersion emerges as a potent contemporary ritual form. It offers structured temporalities and embodied resonance within digitally mediated environments, countering the isolating effects of neoliberal society. Thus, telematic immersion revitalizes communal experiences, fostering interconnectedness and meaningful cultural exchanges in a digitally fragmented world.

Audiovisual Immersion: Telematic Rituals and the Film *Sound Imaginations: Telematic Immersion*

The artistic culmination of our research with Cássia Carrascoza was the 77-minute feature-length film *Sound Imaginations: Telematic Immersion*, premiered at UCR ARTS on November 9, 2024. This audiovisual work synthesizes telematic recording technologies, live electronic sound processing, and immersive visual compositions to explore contemporary rituals of mediated presence, embodying what Roy Ascott describes as the *telematic embrace*, an interdisciplinary, interconnected form of artistic collaboration and dialogue.

The production commenced amidst the global disruption of the COVID-19 pandemic in late 2020. Flutist Cássia Carrascoza performed from a São Paulo studio equipped with a chromakey (green-screen) environment, captured by a high-definition camera and DPA 4099 microphones mounted on the flute(s). Performances were transmitted using high-bandwidth internet and JackTrip software for pristine, uncompressed audio streaming, essential for nuanced real-time electronic processing (Chagas and Carrascoza, 2023). The signals were received in Riverside, California, where I employed custom-designed Max/MSP patches. These patches intricately combined live flute sonorities with electronic textures, particularly employing delay and feedback algorithms, effectively overcoming streaming compression limitations. Figure 1 demonstrates the complexity of the Max/MSP processing employed in *Mojave*, *Sound Imaginations Improvisations*, and *Virtual Studies*.

Sound Imaginations: Telematic Immersion comprises four interrelated compositions: *Mojave*, *I Hear You Breathe, Sound Imaginations Improvisations*, and *Virtual Studies*, each exploring varied dimensions of telematic ritual and audiovisual immersion.

The first piece in the film, *Mojave* (2021), was developed from field recordings made in the Mojave Desert in January 2020. It exemplifies the aesthetics of audiovisual immersion through telematic collaboration. Cássia Carrascoza's flute performance—featuring extended techniques on flute and bass flute, such as multiphonics and whistle tones—was filmed on-site, physically engaging with the desert landscape, while I composed and processed the accompanying electronics remotely using delay and feedback algorithms. The spatialized electronic sound design and real-time telematic interaction between São Paulo and Riverside create a multilayered texture that oscillates between synchronicity and latency, presence and absence. As discussed in *With Love: Electroacoustic, Audiovisual, and Telematic Music* (Chagas and Carrascoza 2023), *Mojave* reflects the expressive potential of elemental environments and remote collaboration. The audiovisual synchronization is intentionally fluid—at times aligning precisely, at others diverging subtly—fostering a sensory experience of continuous decentering and spatial expansion. The work's meditative pacing and textural minimalism evoke a sonic ritual shaped by the vastness of the desert, where silence, breath, and sound interact as equal partners in an expanded audiovisual field.

The second work, *I Hear You Breathe* (2022), intensifies intimacy and corporeality through black-and-white imagery and meticulously crafted electronic soundscapes. Amplification of the bass flute through two strategically placed DPA microphones—one at the head joint and the other at the foot joint—enabled the capture and electronic enhancement of subtle sonorities

typically inaudible acoustically, such as breathing, residual and whistle tones. The electronic processing via Max/MSP included sophisticated treatments such as dynamic compression, pitch tracking, interpolating oscillator banks, variable pitch shifting, frequency modulation synthesis, and bit-depth/sample rate reduction, significantly enriching the sonic palette and conveying nuanced expressive gestures of breath (Carrascoza and Chagas 2023). Figure 2 illustrates the patch used for the third movement. It unfolds a complexity of elements and events including several parallel processes of variable pitch shifting through delays, the degradation of the bass flute signals through sample rate and bit-depth reduction and the addition of a frequency modulation (FM) synthesizer in the second part of the movement.

Visually, *I Hear You Breathe* creates a layered audiovisual space through a combination of Zoom's virtual background feature and real-time visual processing in TouchDesigner. Edited black-and-white imagery is projected behind the flutist, unifying her live performance with her recorded presence and crafting a dialogue of multiplied temporalities. This visual environment deepens the piece's thematic exploration of presence and absence, intimacy and distance, and ritual embodiment. The visual composition followed four guiding principles:

1. A constrained physical space and minimal bodily and instrumental movement, captured through close camera framing, intensify the viewer's sense of intimacy and attentiveness.
2. Multiplicative layering introduces simultaneous temporalities, staging a dialogue between past and present. Close-up visuals—such as the eye of the mask—generate a visceral proximity that heightens affective engagement.
3. Ritualistic imagery, most notably the live act of painting a mask, dramatizes a

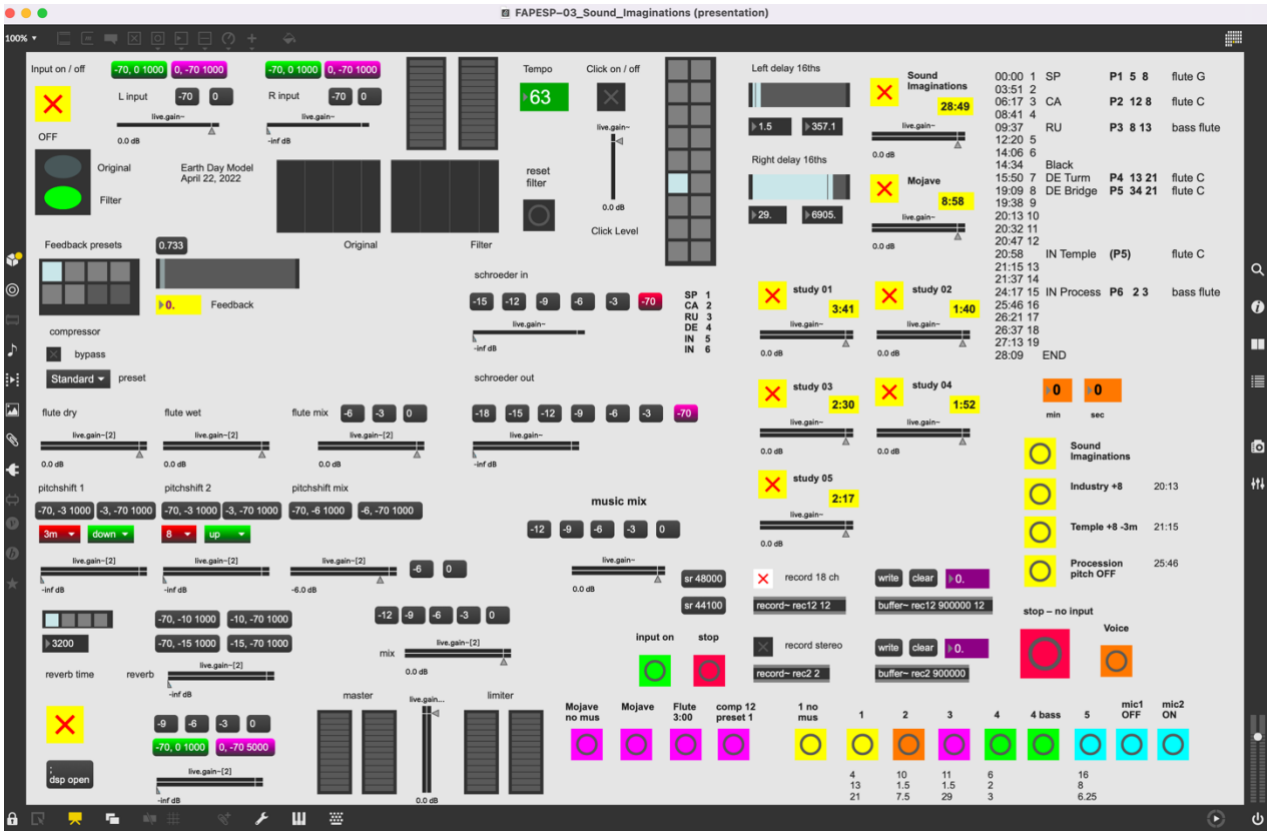

Figure 1. Screenshot of Max/MSP Patch for *Mojave*, *Sound Imaginations Improvisations* and *Virtual Studies*.

symbolic transformation. This gesture visually bridges the divide between performer and audience, enacting a form of telematic embodiment.

4. Visual feedback algorithms processed through TouchDesigner introduce subtle temporal delays and repetitions, creating visual echoes that mirror the sonic layering and enhance the meditative atmosphere of the work.

The third work, *Sound Imaginations Improvisations* (2022), synthesizes the core of our telematic collaboration, embodying a ritual of reciprocal creation across temporal, spatial, and technological divides. Originating from the video series created for the immersive installation *Sound Imaginations*, this piece integrates live performances on flute, alto flute, and bass flute—performed in São Paulo—with a multilayered electronic environment processed in real time in Riverside, California. The compositional structure is intentionally open, allowing performers to shape audiovisual textures through spontaneous interaction. This framework reflects Jacques Attali's notion of "composition" as a form of liberated, creative action—an emergent process rather than a fixed artifact. Here, improvisation is not merely a musical technique but a creative strategy of resistance against repetition and commodification, giving rise to unpredictable, affective sound events.

Improvisation, in this context, functions as both a creative and perceptual condition. Drawing on Edgar Landgraf's reading of Hans Ulrich Gumbrecht's "form-as-event," the improvisatory act is a convergence of presence

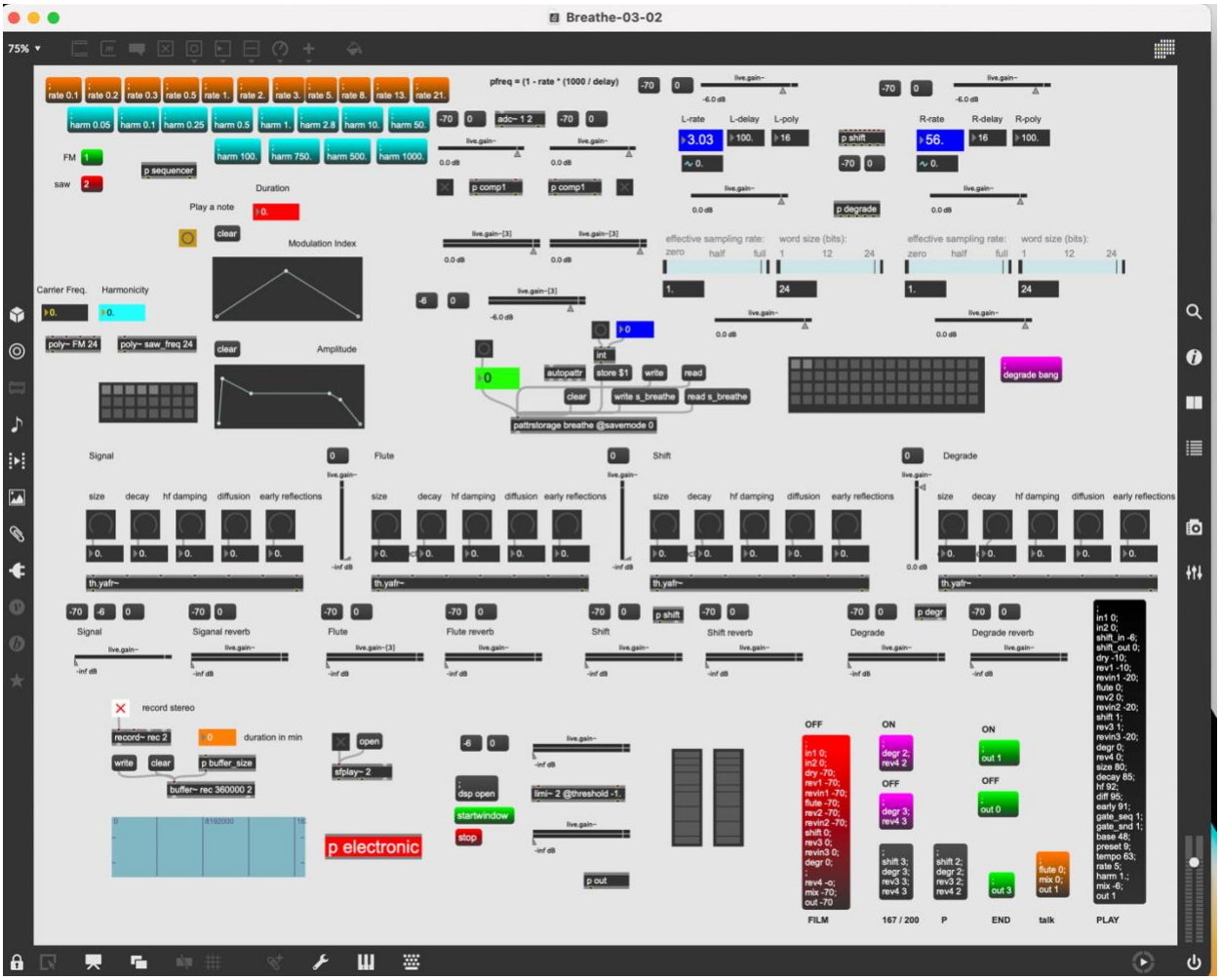

Figure 2. Screenshot of Max/MSP Patch for *I Hear You Breathe*, Third Movement.

and emergence—its value lies in the singularity and irreversibility of the moment. As Landgraf notes, "improvisations stage the emergence of new forms as an event: they are singular, momentary, and contingent," privileging the intensification of presence over the transmission of fixed meaning (Landgraf 2011). The unfolding texture of *Sound Imaginations Improvisations* resists prefiguration, manifesting instead as a performative ritual in which sonic and visual materials are continuously restructured through embodied interaction.

This model of interaction also challenges traditional notions of authorship and control. In line with Vilém Flusser's theory of telematic dialogue, creation occurs not through unilateral expression but through dialogical co-production distributed across networks and apparatuses. "The telematic dialogue," Flusser writes, "is not a discourse about things, but the production of things in a dialogical manner. It is not a means of communication, but of creation" (Flusser 2011, 86). In *Sound Imaginations Improvisations*, form arises from relational processes rather than pre-designed structures: signals, gestures, and responses flow simultaneously across continents, producing a fluid polyphony of shared agency. Latency becomes expressive, synchronicity becomes flexible, and *affective proximity* emerges as a central aesthetic force. Despite geographic separation, the performers' interplay produces an intimate sonic embrace—a resonant ritual of co-presence enacted through telematic improvisation.

Virtual Studies (2020) concludes the film with an introspective meditation on virtuality, embodiment, and multiplicity. Originally conceived for telematic performance, the work exists as part of a larger cycle for flute, bass flute, live-electronics, and 3D video, developed to explore the expressive possibilities of distributed environments. Central to the piece is the concept I call *non-synchronous polyphony*—an aesthetic strategy uniquely suited to telematic contexts, where layered canonic melodies and real-time signal processing create overlapping temporalities rather than unified rhythmic structures. These non-synchronous interactions generate a texture in which delay, feedback, and asynchronous timing function not as technical limitations but as compositional tools for expanding the field of perception.

The flute and bass flute lines—performed live—are subjected to real-time digital manipulation through delay and feedback algorithms, producing a dense sonic web of echoes, fractures, and spectral traces. The result is a multidimensional acoustic space in which causality is blurred and presence becomes relational rather than fixed. The electronic layer is not merely an accompaniment but a co-agent in the unfolding process, shaping a dynamic interplay between immediate gesture and resonant aftermath.

This sonic architecture is mirrored in the visual domain. The 3D video component was constructed from layered footage filmed in the Mojave Desert, edited with subtle speed variations and overlapping frames to emphasize spatial ambiguity and perceptual multiplicity. These visual textures evoke a parallel sense of non-linearity, resisting coherent sequencing in favor of fragmented repetition and drift. Space in *Virtual Studies* is never singular or stable—it is constantly shifting, dissolving the boundaries between real and virtual, proximity and distance, self and other.

Ultimately, *Virtual Studies* offers not a resolution but a space for reflective listening, where acoustic and visual phenomena unfold through processes of temporal displacement and spectral entanglement. In this sense, the piece not only underscores the themes of digital mediation and virtual embodiment but also proposes an expanded understanding of polyphony—no longer grounded in simultaneity, but in *asynchrony, transformation*, and *relational presence.*

In addition to the full-length film, I edited two shorter versions to serve distinct communicative purposes: a presentation version and an official trailer. The presentation version of *Sound Imaginations: Telematic Immersion* (2024, 12 minutes) offers a condensed format of the full film, enriched with captions that articulate the underlying conceptual framework of each segment. These captions serve not only as interpretive guides but also as theoretical anchors, elucidating key themes such as mediated presence, spatial ambiguity, temporal cyclicality, and communal resonance. By framing each

audiovisual ritual within broader philosophical and cultural discourses, the presentation version underscores the project's central inquiry: how telematic media can reimagine and revitalize ritual forms in a world increasingly defined by digital fragmentation and disembodied interaction.

The complete film, presentation version with captions, and official trailer are available at the following links:

- **Complete film** (Chagas and Carrascoza 2024a)
- **Presentation version** (Chagas and Carrascoza 2024b)
- **Official trailer** (Chagas and Carrascoza 2024c)

Conclusion: AI and Future Audiovisual Immersion

Sound Imaginations: Telematic Immersion presents the culmination of a long-term artistic research project and proposes a model for how telematic rituals can generate new forms of collective expression, symbolic resonance, and creative intimacy. At the heart of this approach lies the concept of *audiovisual telematic immersion*, which emerges from the convergence of three interrelated practices: *live-electronic music*, *audiovisual composition*, and *live performance*. Through this project, I have developed original techniques and aesthetics specifically tailored to this convergence—*non-synchronous polyphony, improvisational strategies for live-electronic processing*, and *multi-perspectival audiovisual layering*—all aimed at deepening the expressive potential of telematic collaboration.

It is in the interplay between these elements—synchronous and asynchronous, material and virtual, structured and improvised—that the project finds its ritual power. Live-electronic processing expands instrumental expressivity; audiovisual composition weaves a multidimensional perceptual fabric; and real-time performance, distributed across distances, restores the immediacy of human connection within mediated space.

In this framework, telematic communication is not merely a functional conduit but an aesthetic and symbolic medium, capable of transforming fragmented digital presence into shared ritual experience. The project affirms that technologies of distance can paradoxically produce new forms of intimacy, presence, and community.

Looking ahead, artificial intelligence offers vast potential to deepen this aesthetic terrain. AI-driven spatial audio may enable personalized sound environments that respond dynamically to listeners' emotional and physiological states. Machine learning can generate evolving visual worlds, supporting interactive and adaptive 360° experiences. More profoundly, AI can assist distributed composition by interpreting telematic input, generating improvisational prompts, or co-authoring real-time musical responses. These capacities align with Flusser's vision of dialogic interaction, where meaning emerges through reciprocal gesture across a communicative web.

However, as we embrace these new tools, it becomes essential to maintain an ethical framework that prioritizes human agency, artistic intentionality, and symbolic richness over spectacle or automation for its own sake. The integration of AI must serve not only technological advancement but also a renewed sense of ritual, helping to repair the symbolic ruptures of a hypermediated, neoliberal world.

In this light, *Sound Imaginations: Telematic Immersion* is not only a reflection on what is technologically possible but a proposition for how *telematic, immersive*, and *AI-augmented art* might cultivate new forms of togetherness—anchored in listening, presence, and the poetic recomposition of the shared digital sphere.

Acknowledgments

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Reviews

SEAMUS 2025: My First 24 Hours

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Every electroacoustic professor talks about it. Every dedicated digital music composer has experienced it. I always wanted to experience it myself—and this year, I did! SEAMUS is indeed an overview of anything and everything happening in musical multimedia, and in under 24 hours, I saw and heard everything from fixed media to interactive video, music, and performance.

One of the more innovative works I came across was Hamish Robb's *Octophonic Etudes I, II, III*. For those who want to get adept at mixing multiple channels, Robb's eight-channel composition was quite fascinating and eye-opening. Just take the task of controlling eight channels at the same time, and then having the dexterity to manipulate the faders much like a pianist approaches the keyboard. It really had to be seen to be believed. This is a living testament to how the digital world can *enhance* and *justify* the live concert experience, rather than replace it.

There were also works for fixed and live-manipulated video and sound, such as Cecilia Suhr's *Human vs. Transhuman: Act One*. While some material was pre-recorded, many other visual and sonic elements were manipulated by Dr. Suhr's movements *and* the pitch content of her vocalizing. Again, material that should be

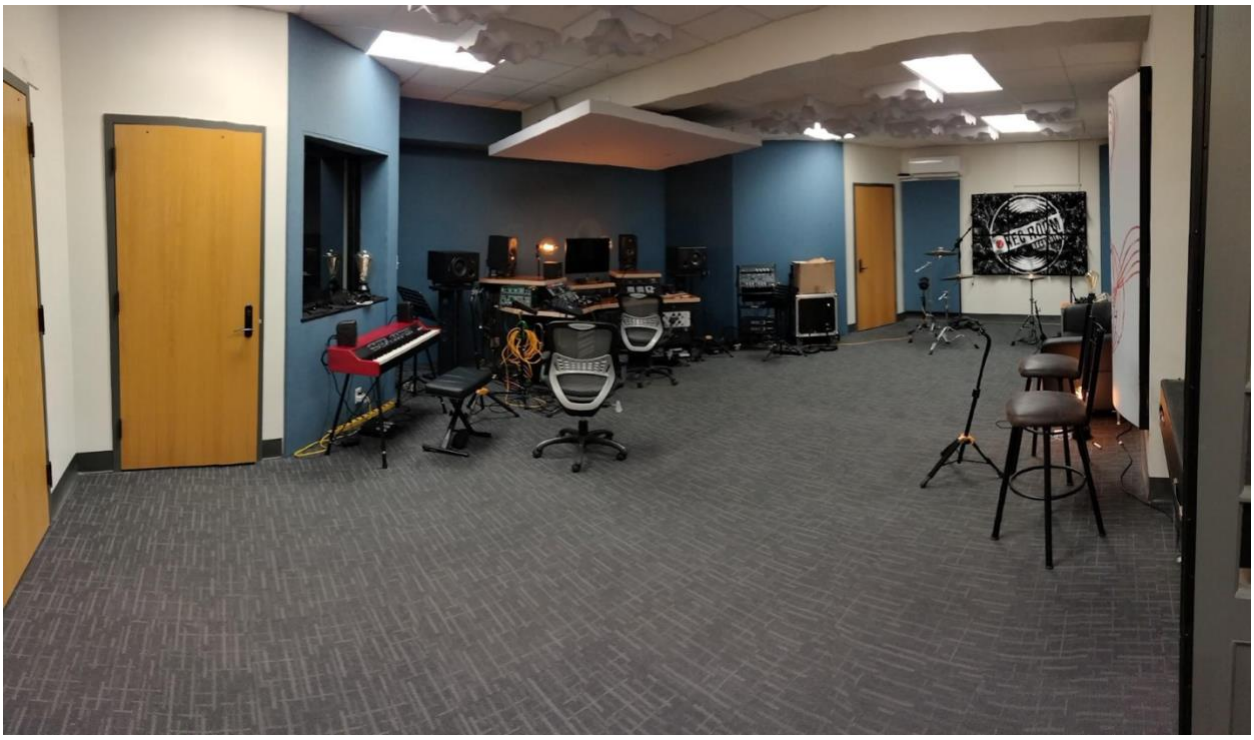

Figure 1. Recording Studio, The Arts Foundation.

Figure 2. The Listening Space, SEAMUS 2025.

seen live. I imagine she will be performing again sometime on a stage near you! Click here to access this work on the composer's website.

Interestingly, many of the winning compositions of this year and previous years utilized fixed media entirely. A message here to all composers, especially up-and-coming students is: It is the *quality* of music that matters at this conference, *not* merely the technical building blocks. Indeed, the best music has always endured based on its aesthetic appeal and practicality, not simply the novelty of the technology used to create it.

The conference venues themselves were full of surprises as well. For example, tucked away in Lafayette's "TAF" (The Arts Foundation building) was a state-of-the-art recording studio, which was totally abandoned while everyone heard concerts upstairs (Figure 1).

Evidently, from the concert programs to the venues, this conference exhibited the digital age inside and outside of academia, as something that can be embraced by the community. Indeed, the location of this conference is living proof that we *can* have more artistic communities—and digitally-equipped ones, too. An artistic community can thrive on more than just a community orchestra.

Perhaps the most overlooked part of this conference, though, was the Listening Space (Figure 2). Complete with eight-channel surround sound, you could experience fixed media and video in a small yet immersive space.

There also was an opportunity to manipulate all eight speakers with a sound board (Figure 3). This was an electroacoustic playground!

Figure 3. Close-up of the mixing board in the Listening Space, SEAMUS 2025.

However, I never saw anyone there. Not a single soul. Nearly half of the conference music existed here. With so much to experience, it was sad to see the some of the most entertaining and entrancing music spaces overlooked.

In just 24 hours, I got to experience a world of electroacoustic music. Many styles, many approaches, many approaches, and many stories. I can only imagine what the four days exhibited. For anyone wondering whether what you have heard about SEAMUS is true, the answer is: It is, and even more so!

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