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Material Synthesis Composition: Transduction, Corpus, and Withholding in *Did Sun Ra Fear Cryosleep?*

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Abstract

An instrument decides what part of the world is permitted to become sound. Each transducer, threshold, and sensor mapping isolates some property of a material and discards the remainder, according to choices made by whoever built the device. Material Synthesis Composition (MSC), the method outlined in this paper, anchors the work in those exact choices: I map the behavior of a material substrate onto compositional structure, and a human performer and a machine listener work within those dynamics. MSC grows out of Speculocultural Technopoiesis (ST), my doctoral framework, which examines how Black speculative traditions and sonic ways of knowing can direct the modification of audio tools. Writing as an experimental media artist, I take composition to include selecting materials, modifying instruments and algorithms, fixing the mappings, and conducting the session. The case is *Did Sun Ra Fear Cryosleep?*, the water movement of the interactive triptych *Organic Memory*, in which an earthen orb dissolves in a vessel while a hydrophone, an electret microphone, and three water-quality sensors monitor its disintegration. Five abstractions reduce that chemistry to rhythm, register, tempo, voice count, and drone color; against them, Somax2 improvises from a corpus of NASA sonifications. Drawing on studio sessions with a prototype, the paper sets out the transduction, the mappings, and the recorded corpus I withheld.

Keywords: material synthesis composition; speculocultural technopoiesis; transduction; corpus curation; machine improvisation; research-creation

1. The First Time It Awoke

At a desk beside the big window of the Digital Media Grad Lab, I turned one of the earthen orbs over in my hand. It was coarse, and it crumbled a little wherever I pressed. When I let it drop into the vessel, the hydrophone took in the entirety of its descent: one heavy plunk at the surface, then a scatter of dull knocks as the orb struck the wall and came to rest on the floor. A hiss followed, faint and then thickening, as the orb began to effervesce and shed itself into the water. The sensors registered the change, and beneath everything the drone started to gather. One by one the voices entered, the cell engine began to step, and out of the noise of the orb falling apart the motif surfaced. Grit still clung to my fingertips when I looked down, a remnant of the object the piece was now composing from.

Everything argued here rests on that session and on the dissolution tests that preceded it. The instrument remains a prototype. I confine my claims here to what occurred in the lab, with the sensor mappings and machine listening configured as described below.

An instrument decides what part of the world is permitted to become sound, and at that decision, cultural position (along with its subsequent modifications of practice) enters a computational system. Grimshaw and Garner treat sound as an emergent perception, contingent on the apparatus and conditions that mediate it (Grimshaw & Garner, 2015). Each microphone, algorithm, and interface in a signal chain translates one form of energy into

another, and each translation is partial. Someone chose what it would preserve, usually the engineer who specified the device and seldom the person playing it. Because I modify the hardware and the process of the piece, every discarded frequency and kept rhythm is a deliberate act.

2. What I Mean by Composition

My practice as an experimental media artist and creative technologist spans physical computing, instrument building, installation, and writing, with sound threaded through all of it. Composition, for me, begins with the choice of what goes into the vessel (along with the vessel itself). It continues through the transducers I modify to register that material, the algorithms I configure or manipulate to isolate its properties, and the session I conduct once those constraints are fixed. Pitch organization and notated structure form one province of composition; mine comprises material selection, sensor mapping, algorithmic modification, and interaction.

Should mapping a material property to a musical event count as a compositional decision, and I contend that it does, then designing an instrument belongs to the same order of work as writing a melody and warrants the same scrutiny: what the mapping retains, what it jettisons, and on whose terms. Thor Magnusson describes the digital instrument as an epistemic tool, embodying a theory of music and delimiting what a player can think and play (Magnusson, 2019). Under that description, any sound is the sum of conversions that a particular person allowed to occur.

3. The Instrument

Three interactive sonic sculptures make up *Organic Memory (Triptych)*, each paired with a material and a tempo. Earth, rock, and soil furnish *Buffalo Soldier*, which listens through piezoelectric discs at a geological pace; water and dissolution furnish *Did Sun Ra Fear Cryosleep?*, heard through hydrophones at a chemical pace; hair and gesture furnish *Don't Play with My Hair*, read by machine encounter whose input is from piezo contact mics at the pace of a human hand. Across all three, the same rhythmic cell recurs over the same fashion of low drone, stretched or compressed to the tempo of its material. Working versions of Movements I and III exist and remain in development. Of the three, only the water movement can be observed from first contact to exhaustion within a single session, and so it anchors this paper.

Into a water vessel, a participant or I lower an object. For this movement I cast orbs of clay and charcoal, mixing the aggregate by hand and letting it dry until each orb is friable enough to shed grains at a touch (Figures 1 and 2). Effervescent tablets, salt, and wax-cast, these variable material forms each dissolve at a characteristic rate, if they dissolve at all, and I select among them for the tempo they yield. Physical dissolution dictates this aspect of the compositional structure.



Figure 1. Cast orbs of clay and charcoal, the dissolving objects for *Did Sun Ra Fear Cryosleep?*



Figure 2. Mixing the orb material by hand. The grain of the mixture determines how the orb sheds and therefore how fast the piece moves.

Beneath the surface listens a hydrophone I created from a piezoelectric disc and copper-tape shielding. (Figure 3). This custom device picks up the structural resonance of forming bubbles and the agitation in the water, while a MAX4466 electret microphone mounted in the lid captures what escapes into the air. For the chemistry, the system relies on three industrial water-quality sensors: turbidity, total dissolved solids (TDS), and temperature. A Freenove ESP32-S3 running MicroPython polls them and transmits OSC bundles over UDP to a laptop. A hand-soldered JFET circuit or a Cloudlifter CL-1 forces the hydrophone signal up to line level.

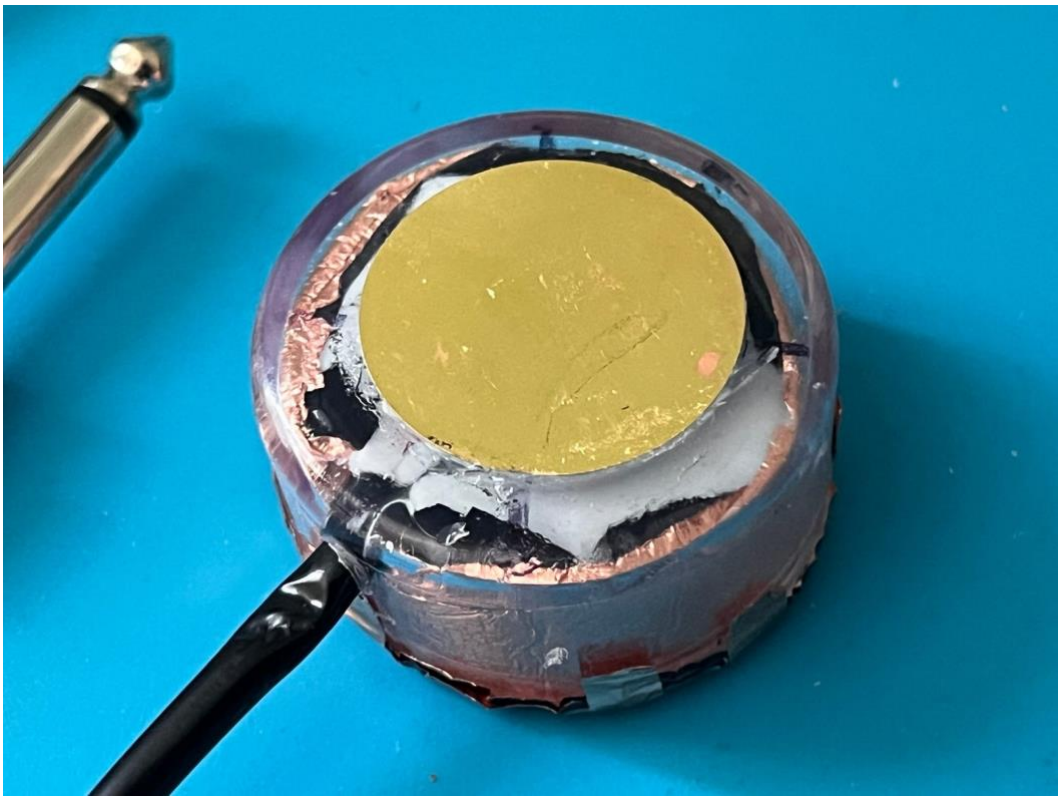


Figure 3. The hydrophone I made for this movement: piezo disc, copper tape shielding, potting compound, quarter-inch connector.

The composition proper resides in Max/MSP. Machine listening falls to the Data Knot package, which performs onset detection and extracts descriptors of loudness, spectral centroid, flatness, and pitch confidence. A granular drone layer captures and periodically freezes hydrophone material; a compositional engine steps a rhythmic cell and dispatches triggers to five instrumental voices. Alongside them, Somax2, IRCAM's co-improvisation system, listens to the dissolution and answers from an audio corpus using the hydrophones raw spectral analysis as the onset inputs of the audio listener (IRCAM STMS Lab, n.d.). Output passes through a Steinberg UR22C. Figure 5 shows the complete rig as installed for exhibition: vessel and sensor array, the laptop running the Max patch, and the display.

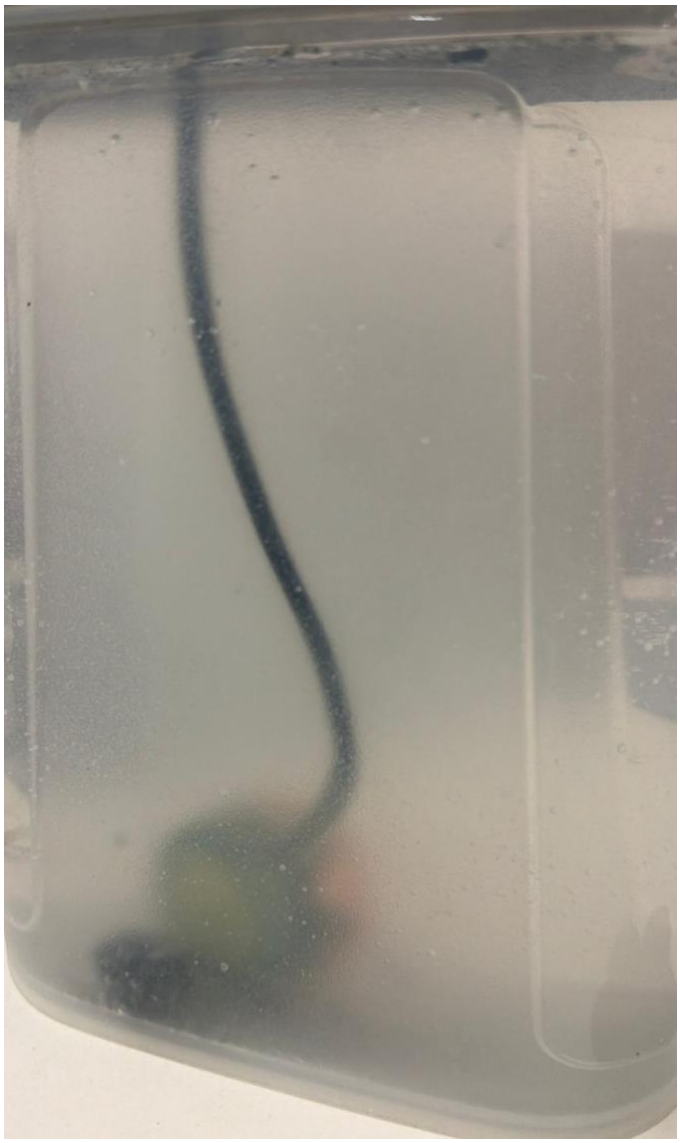


Figure 4. A dissolution in progress. The hydrophone cable descends to the orb at the vessel floor; the clouding water is what the turbidity sensor reports on.

Turbidity and TDS sensors exist to certify water as potable or polluted. I force them to report on what a dissolution is doing musically. As an orb breaks apart, the water clouds around it, and the turbidity sensor tracks that clouding (Figure 4). Philip Agre's critical technical practice describes building while remaining alert to the founding assumptions of a tool (Agre, 1997). A purity sensor enforces a strict binary of clean or contaminated water. I sever the raw data from that ideology.



Figure 5. Hardware to signal chain setup for *Did Sun Ra Fear Cryosleep?* at the Society for the Neuroscience of Creativity (SfNC) 2026 Philly Creates summit poster session.

4. Material Synthesis: What the Material Is Permitted to Become

David Tudor described his principle for contact transducers plainly: “I try to find out what's there and not to make it do what I want but to, you know, release what's there” (Kuivila, 2004, p. 21). Following that principle, Tudor deferred to whoever designed the device, letting a transducer's inherent sensitivities set the limits of the work. My practice pulls the other way. Where a transducer cannot register the material I need it to hear, I open it, reshield it, rewire its preamp, or relocate it, and I keep altering it until it registers. Hardware defaults make aligned ideologies invisible. My interventions operate against those defaults, forcing the cultural position to the forefront.

Five abstractions operate on the dissolution, each preserving one property of the event and discarding the rest (Table 1).

Abstraction	**What it keeps**	**What it discards**	**Compositional role**
Onset detection (piezoelectric hyrophone, Data Knot)	A threshold crossing at the moment a bubble forms	The continuous effervescence between crossings	Advances the rhythmic cell one step
Three-band spectral energy (hydrophone)	Which of three frequency ranges dominates at that moment	The spectrum itself, and everything below the energy gate	Selects the voice group and scales its dynamics
Turbidity	How active the dissolution is at present	What substance is dissolving	Sets the fire rate of the cell, which is the tempo arc

Total dissolved solids	How much has dissolved since the water was clean	The order and rate at which it happened	Raises the ceiling on how many voices may be active
Temperature	Slow ambient drift	Every fast event	Offsets drone pitch and freeze duration

Table 1. The five abstractions in Movement II, with what each one keeps and discards.

The onset detector locks the rhythmic cell to the physical dissolution. A highly reactive tablet executes the eight-step pattern in seconds; a dense wax form extends it. The sequence is fixed, leaving the physical material to govern the tempo. Turbidity governs how often the engine may fire, and because I map it that way, the turbidity envelope of each dissolution traces the tempo arc of the piece. TDS, by contrast, climbs monotonically and resets only when I change the water. It is the water's chemical memory, registering accumulation and indifferent to activity, and I assign it to the number of voices authorized to sound, so that the ensemble thickens as the object vanishes.

Every one of these mappings discards more than it preserves. Onset detection compresses a continuous field of fizzing into a sequence of threshold crossings, and by choosing it I assert that dissolution consists of discrete events. The three-band analysis collapses a spectrum into one of three verdicts. TDS condenses an hour of chemistry into a single ascending number, erasing the order in which anything occurred. I treat these reductions as compositional decisions. Each one earns its place by what it allows a particular substance to do in a particular vessel. Don Ihde calls this the amplification/reduction structure of instrumental mediation: an instrument magnifies some aspects of what it mediates and diminishes others (Ihde, 1990, pp. 48-50). The sensor executes the reduction instantly. Ihde describes this mechanism in theory. I dictate the exact parameters of the selection.

Grisey describes spectral music as offering “a formal organization and sonic material that came directly from the physics of sound, as discovered through science and microphonic access” (Grisey, 2000, p. 1). In his account, physics supplies the material and science the method, and the tradition that material renews is “occidental music” (p. 3). My transduction performs the same operation from a different lineage: the cell descends from a tune with a contested history, and I choose the substances I dissolve for what they mean to me. The earth rhythm of one soil, the chemistry of one water, and the gesture of a single body resist transposition. Grisey holds that “sounds and their own materials” generate new musical forms (p. 2); in material synthesis, the materials that generate form are the ones I selected for their cultural weight. That precise physical friction dictates the composition. Material synthesis operates entirely on that limit.

5. The Corpus: What the Machine Is Permitted to Consume

Somax2 improvises from a corpus. In this movement it listens through Data Knot's descriptors of the dissolution and responds with fragments of NASA's data sonifications, in which NASA teams translate telescope images from Webb, Hubble, and Chandra (nebulae, star clusters, black hole regions, supernova remnants) into sound (National Aeronautics and Space Administration [NASA], 2025). Selecting that corpus is compositional in the same way that setting a sensor mapping is, one layer higher. A sensor mapping bounds the physical input. A corpus bounds the algorithmic response.

My original design called for a second corpus: recorded African American spirituals with water imagery, together with the ring shout tradition documented on *Slave Shout Songs from the Coast of Georgia* (McIntosh County Shouters, 1984). The NASA recordings and the shout recordings share a coordinate, light and bodies crossing impossible distances and altered by the crossing, and an improviser trained on both would answer from that position. I declined to use the second corpus. Somax2 segments a recording into descriptor frames and recombines those frames by similarity; given a shout recording, it would sever the performers' voices into fragments and redeploy them in a manner that strips them of the collective structure on which the ring shout depends. I withheld the recordings from the system for those reasons.

That decision takes its terms from the tune behind the triptych's rhythmic cell. “When Johnny Comes Marching Home” appeared in Boston in 1863 credited to Louis Lambert, a pen name used by the Irish-born bandmaster Patrick Sarsfield Gilmore (Lambert, 1863). Figure 6 shows the cell as I take it from the published score. By Gilmore's own account, he adapted the melody from an African American spiritual; the Library of Congress, which preserves that account, also notes the melody's close likeness to the Irish song “Johnny, I Hardly Knew Ye” (Library of Congress, n.d.). No evidence now available can adjudicate between the two stories. Which story the record favors is plain, though. Histories of the tune repeat the Irish lineage, and the spiritual persists only as a remark Gilmore made about his own work, unconfirmed by any later source.

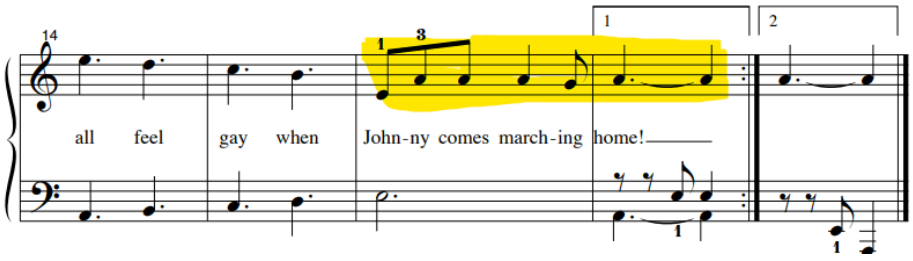


Figure 6. The cell as I extract it from “When Johnny Comes Marching Home,” read short-first: a triplet pickup opening onto sustained tones, with a single short note among them. Each dissolution onset moves the engine one step through it. Score excerpt from Lambert (1863).

The rhythmic cell originates from a tune with an unverifiable Black lineage. I did not patch that historical uncertainty with a machine-ingested corpus of Black voices. Two other artists define the parameters for what happens next.

In *Being*, an AI entity counter-programmed on texts by bell hooks, Audre Lorde, Cornel West, and Lucille Clifton and conceived as a digital griot, Rashaad Newsome locates cultural position in the corpus, deliberately and with care (Jensen, 2020). George Lewis locates it elsewhere, in the behavior of the program.

> Musical computer programs, like any texts, are not “objective” or “universal,” but instead represent the particular ideas of their creators. As notions about the nature and function of music become embedded into the structure of software-based musical systems and compositions, interactions with these systems tend to reveal characteristics of the community of thought and culture that produced them. (Lewis, 2000, p. 33)

Lewis goes on to describe programming and performing with *Voyager* as “computer music-making embodying African-American cultural practice” (p. 33), and he traces that practice into the program's architecture. An aesthetic of multidominance, which Lewis takes from

Robert L. Douglas, shapes a program constructed as sixty-four asynchronously operating single-voice players, all generating music in real time (p. 34); absent outside input, the system's musical behavior "is internally generated" (p. 36). *Voyager* has no corpus of recorded musicians to draw on. On this point my system follows his. Its cultural position resides in what I chose to dissolve, in the cell I chose to step, in the properties I permit the sensors to notice, and in the corpus withheld.

A recorded shout answering a dissolving orb offers an immediately legible sign of Black sonic practice. Withholding it forces the cultural argument off the surface of the audio and into the architecture of the instrument.

Injecting those recordings into the signal chain requires three strict architectural parameters. First comes consent and provenance: a Folkways recording of a living tradition has performers and communities attached to it, and a license to reproduce a track confers no permission for an improviser to elaborate on it indefinitely. Second is the direction of benefit, which for a dissertation project means asking what flows back to the Georgia coast communities whose practice would be doing the work. Last is the form of the encounter; a system that searches a corpus by descriptor similarity reduces a shout to texture and discards the collective structure of the practice. Until I can design a system that satisfies all three, the NASA corpus is what Somax2 hears.

6. Distributed Authorship and Organic Music

Julius Eastman described the method he called *organic music* in his own words:

> that is to say the third part of any part, so the third measure or the third section, the third part, has to contain all of the information of the first two parts and go on from there (as cited in Hanson-Dvoracek, 2011, p. 96)

I borrowed Eastman's additive logic for the algorithm that generates the sound. *Femenine* (Eastman, 1974) develops from one thirteen-beat figure over motorized sleigh bells that keep pulsing for the full length of the work; my score develops from the *Johnny* cell, with its triplet pickup and its longer tones punctuated once by a short note. Voice groups accumulate through use. Within each band, a round-robin counter cycles through the available voices, so a material producing only low-frequency content activates the bass voices and leaves the upper group silent until the dissolution changes character. The architecture forces Eastman's principle into the routing, locking the session's history directly into the audio texture.

Composition in this routing is shared, and I designed it to be. The choice of orb and its constructed physical material structure is directly responsible for its rate of dissolution that then sets the tempo. The water's dissolved solids authorized how many voices could enter; the spectral character of the bubbles determined which. Somax2 answered from the NASA corpus at an influence level governed by the above-water microphone, and I mixed the result. Karen Barad describes agencies that come into being through their relation as "intra-actions" of agential systems (Barad, 2007). In that session, intra-actions take the form of a signal chain.

7. Lessons From the Prototype

Routing onset detection directly to the hydrophone failed. Effervescent dissolution floods the signal chain with a continuous noise field devoid of clean threshold crossings. The detector either misfired constantly or locked up entirely. I forced the hydrophone to isolate the

bubbles' structural resonance by hard-filtering the noise bands and clamping the threshold parameters in Max. Standard machine listening demands discrete instrumental attacks. A dissolving object supplies only a continuous collapse unless properly accounted for.

Each dissolution test I log as audio accompanied by JSON metadata recording material, water, container, and preamp configuration. Of all the variables, transducer configuration and container-sensor configuration altered the results most. Wired in parallel, the piezo discs yielded a fuller low end than the same discs in series. On a plastic container, a contact piezo picked up the wall's resonance more strongly, but also allowed for greater environmental noise in. Seltzer in tap water generated dense high-frequency activity that pushed every onset detector I tried toward false triggers, and that result sent me to figure out a filtering solution. The logs serve as the absolute provenance of the hardware's behavior. I rely on this archive to debug the system the moment a mapping stops making musical sense.

The third movement maps the identical pipeline to human gesture. In Don't Play with My Hair, a contact microphone registers the act of self-touch, feeding Data Knot and Somax2 the body's friction instead of an effervescent collapse. The operation stems from a single studio note:

> I have noticed that when I perform this ritual of self-touch I have come to recognize that oftentimes it is different based on my current “mode of existence.” When I am bored, I caress and twirl. Stressed, I yank and pull. I think this is a way of reading myself, of seeing myself, in a sense. I wonder if a machine can read me in a similar way or maybe I can make it.

Routing the descriptor analysis to my own body breaks the existing architecture. The water abstractions require a complete rebuild because an onset threshold completely discards the duration inherent to human gesture. This friction proves the abstraction is an active constraint. Aimed at a dissolving orb, the algorithm enforces one mode of listening; aimed at a hand in hair, it enforces another. In both systems, I explicitly dictate what the machine perceives.

The residue on my fingers remains completely outside the signal chain. Defining an instrument's architecture requires documenting the physical matter it abandons at the threshold.

8. Documentation

Video documentation of a dissolution session with the drone, cell engine, and voices (Somax2 not active), together with the dissolution test recordings, is archived at https://zenodo.org/records/23042830 with DOI: https://doi.org/10.5281/zenodo.23042830 (Woodland, 2026).

9. Conclusion

Co-creativity in this system is the act of enforcing physical and algorithmic limits: dictating which transducer registers an event, which threshold shears it, which chemical metric governs the ensemble, and which recordings the machine ingests. These exact choke points hardwire a cultural position into the instrument. I locked the shout recordings out of the architecture. Somax2 improvises from NASA data precisely because I enforced that void, forcing the system to compose entirely around the absence.

References

Agre, P. E. (1997). Toward a critical technical practice: Lessons learned in trying to reform AI. In G. C. Bowker, S. L. Star, W. Turner, & L. Gasser (Eds.), *Social science, technical systems, and cooperative work: Beyond the great divide* (pp. 131-157). Lawrence Erlbaum Associates.

Barad, K. (2007). *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Duke University Press.

Eastman, J. (1974). *Femenine* [Musical composition].

Grimshaw, M., & Garner, T. (2015). *Sonic virtuality: Sound as emergent perception*. Oxford University Press.

Grisey, G. (2000). Did you say spectral? (J. Fineberg, Trans.). *Contemporary Music Review, 19*(3), 1–3. https://doi.org/10.1080/07494460000640311

Hanson-Dvoracek, A. (2011). *Julius Eastman's 1980 residency at Northwestern University* [Master's thesis, University of Iowa]. https://doi.org/10.17077/etd.ldsf5wgi

Ihde, D. (1990). *Technology and the lifeworld: From garden to earth*. Indiana University Press.

IRCAM STMS Lab. (n.d.). *Somax2*. Retrieved September 28, 2026, from https://www.stms-lab.fr/projects/pages/somax2

Jensen, B. (2020, December 7). *HAI visiting artist Rashaad Newsome: Designing AI with agency*. Stanford Institute for Human-Centered Artificial Intelligence. https://hai.stanford.edu/news/hai-visiting-artist-rashaad-newsome-designing-ai-agency

Kuivila, R. (2004). Open sources: Words, circuits and the notation-realization relation in the music of David Tudor. *Leonardo Music Journal, 14*, 17-23. https://doi.org/10.1162/0961121043067424

Lambert, L. [Gilmore, P. S.]. (1863). *When Johnny comes marching home*. Henry Tolman.

Lewis, G. E. (2000). Too many notes: Computers, complexity and culture in Voyager. *Leonardo Music Journal, 10*, 33-39. https://doi.org/10.1162/096112100570585

Library of Congress. (n.d.). *When Johnny Comes Marching Home Again*. Retrieved September 28, 2026, from https://www.loc.gov/

Magnusson, T. (2019). *Sonic writing: Technologies of material, symbolic and signal inscriptions*. Bloomsbury Academic.

McIntosh County Shouters. (1984). *Slave shout songs from the coast of Georgia* (A. Rosenbaum, Rec. & Annot.) [Album]. Folkways Records.

Murail, T. (2005). Target practice (J. Cody, Trans.). *Contemporary Music Review, 24*(2-3), 149-171.

National Aeronautics and Space Administration. (2025, June 3). *Data sonifications*. https://www.nasa.gov/data-sonifications/

Woodland, D., Jr. (2026). *Did Sun Ra Fear Cryosleep?: Studio documentation and dissolution tests* [Audiovisual material]. Zenodo. https://doi.org/10.5281/zenodo.23042830