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1. PROJECT DESCRIPTION

Bending Nature is a sound installation that integrates the sounds of nature, the natural environmental acoustics of the gallery space, feedback loops between speakers (used as both input and output devices), the vibrations of feedback loops generated by speakers as input and transducers as output, and computer-controlled automation to create resonance within an alternative space of the art gallery. Through this work, the architectural structure of the gallery transcends its conventional functions of displaying artworks and hosting visitors, transforming into a massive speaker or a musical instrument. The visual composition of *Bending Nature* embraces minimalism, with black speakers, cables, gray transducers, and amplifiers contrasting sharply against the white gallery architecture. These elements function both as tools and sculptural forms (black, white, gray), blurring the lines between technology, art, and architecture. This transformation builds upon the legacy of pioneering works by artists such as Lucier and Neuhaus, whose experiments with electroacoustic feedback are regarded as an alternative history of electroacoustic music within the broader context of electronic music. Their explorations catalyzed the emergence of sound installation as a distinct art form, shifting the focus from timbre to spatiality and liberating sound art from the constraints of the traditional concert hall. This shift is deeply tied to the nature of electroacoustic feedback systems, which embed electronic devices within the spatial dimensions of sound propagation, thereby invoking the "agency" of technology in shaping creative practice.¹ Artists associated with the Sonic Arts Union, such as Robert Ashley (Wolfman), David Behrman (*Wave Train*), and Gordon Mumma (*Hornpipe*) as well as minimalist composer Steve Reich (Pendulum Music), have explored feedback as a phenomenon deeply intertwined with spatiality.² These works demonstrate how feedback systems can engage with spatial and environmental dimensions, highlighting the interplay between sound, space, and technology. By situating Bending Nature within this lineage, the installation extends these explorations, further investigating feedback's spatial and perceptual implications within a site-specific context.

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 ¹ Saladin, M. "Electroacoustic Feedback and the Emergence of Sound Installation: Remarks on a line of flight in the live electronic music by Alvin Lucier and Max Neuhaus", *Organised Sound* 22, No.2, 2017, pp.268-275.
 ² Nyman, M. *Experimental Music: Cage and Beyond*, Cambridge: Cambridge University, 1999, pp. 99-103.

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Maryanne Amacher's groundbreaking work in sound art provides a critical context for *Bending Nature*. Amacher transformed architectural spaces into resonant instruments by embedding sound systems within walls, floors, and corridors.³ Her exploration of how sound interacts with architectural materials and spatial configurations directly informs *Bending Nature*'s approach to using feedback and surface transducers within an alternative gallery space. By extending Amacher's legacy, *Bending Nature* reinterprets the relationship between sound, space, and technology, emphasizing the interplay between physical feedback and digital control to create a dynamic, site-specific sound environment.

2. CONCEPTUAL FRAMEWORK AND AESTHETIC OUTCOMES

In *Bending Nature*, the tactile experience is a core component of the work. Creators enter the architectural space, physically touching the materials of the building and using sweep frequency techniques to test the resonance points of the structure precisely. Audiences experiencing *Bending Nature* can not only listen to the interwoven sounds of nature and technology but also feel the vibrations of the building materials through touch and even sense the subtle tremors underfoot as they walk on the stairs. This tactile experience not only enhances the audience's participation but also makes the work itself more vivid and dynamic. Tim Ingold argues that making is not merely the process of transforming materials into finished products but a dynamic interaction with materials, similar to the growth of living organisms. Through experiments and case studies, he demonstrates how touching and sensing materials can help us understand their characteristics and potential, leading to the creation of works that possess a sense of life.⁴ Trevor Pinch, in his research on circuit bending, points out that circuit bending is a practice of modifying the circuits of electronic devices to produce unusual sounds. This practice not only challenges the concept of traditional musical instruments but also creates new sounds through chance and experimentation. Bending feedback loop circuits and tactile experiences in an art gallery (as an alternative space), face the same indeterminacy and experimentation as circuit bending.⁵

The above two perspectives are fully embodied in *Bending Nature*, where creators establish a profound interactive relationship with materials by touching the building's materials and using sweep frequency techniques to test resonance

³ <u>https://www.foundationforcontemporaryarts.org/recipients/maryanne-amacher/</u>

⁴ Ingold, T. Making: Anthropology, Archaeology, Art and Architecture. New York: Routledge, 2013, pp. 17-31.

⁵ Pinch, T. "Bring on Sector Two!" The sounds of bent and broken circuits, Sound Studies, 2:1, 2016, pp. 36-51, DOI: 10.1080/20551940.2016.1215595

points, thereby creating a vibrant sound installation. The entire resonant building, interwoven with technological devices, natural sounds, the sound of nature environmental sounds, humans, and tactile experiences, is like a growing organism and also resembles a large bending circuit board.

In *Bending Nature*, the role of feedback lies in how feedback loops, while operating, bend (carry) the sounds of nature (whose selection inevitably embodies the artist's aesthetic sensibilities), ambient noises of the gallery space, and audience-generated sounds. These integrated feedback undergo iterative processing within the specific acoustic properties of the museum's architecture (akin to Alvin Lucier's *I Am Sitting in a Room*), transforming into vibrations—epistemological vibrations and resonance—that merge with the building's material and spatial fabric.

However, such iterations in *Bending Nature* unfold across multi-nodal networks, as the installation employs multi-channel speaker (as input output) feedback loops and speaker (as inputs) transducer (as output) feedback loops. These systems intertwine to construct a non-anthropocentric network, where humans and non-humans (speakers, transducers, architectural acoustics) act as nodes negotiating their own "visibility" (audibility) within the system.⁶ Through this interplay, they collectively mediate the emergence of the building's sonic identity—its resonances, vibrations, and acoustic agency. The work dissolves human-centric hierarchies, allowing the architecture itself to become an active participant in shaping and being shaped by the feedback-driven sonic ecology.

3. TECHNICAL SETUP

In the sound installation *Bending Nature*, the technical setup is meticulously designed to provoke the inherent sound characteristics of the gallery architecture itself, integrating physical and electronic feedback systems. The following devices were employed to achieve this:

4 surface transducers (8 Ω , 50 W, 75mm, shown in Fig. 1)

8 raw speakers (8 Ω , 20 W; 8 Ω , 50 W; 4 as sound input and 4 as sound output) 8 power amplifiers

A laptop running a Max/MSP patch with simple delay, feedback, and pitch-

shifting effects to control the electronic feedback loops Behringer UMC1820 audio interface

⁶ Johnson, J. 'Mixing Humans and Nonhumans Together: The Sociology of a Door-Closer'. Social Problems, 35 (3), 1988, pp.298-310.

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Figure 1. Surface transducer

Fig. 2, 3, and 4 illustrate the spatial arrangement of the installation. In these schematics, dashed lines denote wooden walls or doors, rounded rectangles represent surface transducers, and other icons indicate large or small raw speakers. Labels such as I/O/OS refer to input, output, or output via surface transducers, respectively. Fig. 5 shows the audio connections.



Figure 2. Sides (wall)





The raw speakers mounted on the walls (I3, I4, O1-O4) were fixed with fishing lines, while those with diaphragms facing the wall (I1 and I2) and surface transducers (OS1-OS4) were directly attached via screws. This configuration

enabled two distinct physical feedback loops (I1-OS1 and I2-OS2) to interact with the gallery's wooden doors and ceiling, while the other inputs (I3 and I4) captured ambient sound to form electronic feedback loops mediated by the computer.

Crucially, the placement of all devices was optimized to resonate with the architectural structure's "sweet spots," enhancing the vibrational and acoustic properties of the building materials. This approach minimizes reliance on digital effects, emphasizing the raw sound of the architecture itself. Simple single-tap delay lines, low-pass filters, and pitch-shifting algorithms in the Max/MSP patches were sufficient to amplify and transform these resonances, creating a dynamic interplay between the building, its environment, and the audience.

By leveraging both physical and electronic feedback systems, this technical setup dissolves the boundaries between human, technological, and architectural agency, aligning seamlessly with the conceptual framework of *Bending Nature*.

4. CONCLUSION AND MEDIA LINKS

Bending Nature is an architectural sound installation situated in a confined, irregular space. By repurposing part of the raw speakers as microphones and surface transducers placed directly on the walls activate the architectural texture, the work merges natural sounds with feedback loops and creates a resonant dialogue between the building and its environment. Through a visually minimalist presentation, viewers are immersed in a dynamic, everchanging soundscape that challenges spatial perception and offers a novel sensory experience of sound and structure.

MEDIA LINK(S)

Video: <u>https://drive.google.com/file/d/1JbwXkMbPtP_W7_M_XMba5FB4uqgP-rS9/view?usp=sharing</u>

ETHICAL STANDARDS

Please note, that if any elements of the submitted work involve research with people or animals, authors should include a section "Compliance with Ethical Standards" before the References, including (if relevant): information regarding sources of funding, potential conflicts of interest (financial or non-financial), informed consent if the research involved human participants, statement on welfare of animals if the research involved animals.

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