MAINFRAME EXPERIMENTALISM

Early Computing and the Foundations of the Digital Arts

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THE ALIEN VOICE

Alvin Lucier's *North American Time Capsule 1967*

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FROM THE MAINFRAME TO THE EXPERIMENTAL

An aggressive zipping pulse sweeps up into a sirenlike whine and then slides into a grating gurgle. In the background, as if from a television on low volume, voices mumble unintelligibly, articulated sound without discernible content. A rush of sharp metallic hisses bursts in from the left like special-effects audio for an attacking alien reptile. The muffled, static-encrusted voice of what sounds like a radio announcer rises in the mix. For a moment, a jarring screech wavers like a connecting modem signal and then resolves into a stretched robotic monotone overlain by sibilant whispers and bursts of white noise.

So runs the first minute of Alvin Lucier's *North American Time Capsule 1967 (NATC)*. For another ten minutes, the piece continues its frenetic onslaught of vocal babble and speech-driven electronic mayhem, an exploration of the nonsemantic possibilities of the human voice and the creative potential of speech-processing technology.

Composed in 1967, *NATC* is among the early works for which Lucier is best known.[1] It occupies an intriguing and curious place both in Lucier's oeuvre and in the generational shift from the classic electronic music of the 1950s to the experimental electronics of the 1960s and '70s. Classic electronic music was wedded to a vast corporate and institutional infrastructure and relied on immense, immobile equipment housed in universities and research laboratories. The resulting compositions came to exist on tape as fixed and final products, with no possibility for live performance (save live playback) and no opportunity for improvisatory intervention. Despite their use of a novel medium, early electronic composers

such as Herbert Eimert, Milton Babbitt, and Karlheinz Stockhausen tended to pursue the aims of the classical avant-garde and, in particular, to extend the theory and practice of serialism. In opposition to this establishment, Lucier and his compatriots (among them David Behrman, Gordon Mumma, Frederic Rzewski, and Pauline Oliveros) formed a sort of musical counterculture. Following the lead of David Tudor, they favored cheap (or homemade), portable electronic gadgets and put them in the service of open-ended or process-based compositions intended for live performance. The experimentalists were unconcerned with traditional conceptions of musical form or with elaborately calculated logics of pitch, rhythm, and timbre. Instead, they reveled in the volatile unpredictability of the electronic signal and pragmatically explored the life of sounds and the nature of auditory perception.[2]

NATC shares some of the institutional and technological features of classic electronic music. Its one and only version was recorded at Sylvania Applied Research Laboratories on a bulky assemblage of mainframe equipment—a Vocoder prototype—that required the assistance of a professional engineer. Yet for all this, *NATC* bears the hallmarks of experimental composition, described by John Cage as initiating "acts the outcomes of which are unknown."[3] Lucier approached the piece without a written score (musical or technical), instead offering performers only the whimsical instruction "prepare a plan of activity using speech, singing, musical instruments, or any other sound producing means that might describe—to beings very far from the earth's environment either in space or in time—the physical, social, spiritual, or any other situation in which we find ourselves at the present time." The technical execution of the piece was handled by Lucier, who approached the Vocoder and its components as a neophyte knob-twiddler eager to discover what the machine could do. "I did what David Tudor would do with an organ," recalls Lucier, "you know, pull out all the stops and stuff. Tudor would have a table of electronics in which one thing was plugged into something else, so complex that he didn't know, when he turned a dial, what was going to happen. I had this extraordinarily complex machine still in its stages of completion, and [*NATC*] was just an opportunity for me to use it as an enormously wonderful and interesting piece of electronic equipment."[4]

This experimental attitude toward existing electronic equipment connects *NATC* with other key works in Lucier's oeuvre—for example, *Music for Solo Performer* (1965), which deploys medical EEG technology to excite percussion instruments; and *Vespers* (1968), which makes creative use of echolocation devices intended to aid the blind. It is also the first in an important series of pieces—composed by Lucier between 1967 and 1970—that explore the transformation of the human voice and the materiality of the vocal signifier. Even more profoundly, *NATC* provides a key to Lucier's worldview—musical and otherwise—and highlights his rigorous naturalism. In what follows, I situate the piece within this

historical, musical, and philosophical context in order to explore its interventions into theories of communication, ontology, and temporality.

TELEPHONY, CRYPTOGRAPHY, MUSIC: A BRIEF HISTORY OF THE VOCODER

NATC is among the first musical applications of the Vocoder. But, in 1967, the device already had a rich history. Indeed, the Vocoder played a key role in the founding of digital technology and the inauguration of electronic and computer music. In 1928, Homer Dudley, a telephone engineer at Bell Labs, set to work to solve a major problem in long-distance telecommunication: how to compress broadband speech signals (with a frequency range exceeding 3,000 Hz) for transport across the very narrow (200 Hz) bandwidth of transatlantic telegraph cables. From the beginning, Dudley recognized that speech can be separated into two basic components: a sound source (produced by the vibrating vocal cords) and its modulation (by the nose, throat, tongue, and lips). Instead of compressing speech itself, Dudley surmised that the solution to the problem would involve transmitting an *adequate description* of the voice's two components and then using that description to reconstruct a version of the voice at the other end. He initially attempted to describe and transmit information about the movements of the speaker's vocal apparatus, but this proved to be far too difficult.[5] He eventually hit on a purely electronic solution. Using a bank of narrow-band filters, Dudley sampled the energy levels of the speech signal at ten different frequency ranges (an eleventh sample registered the fundamental pitch of the voice), encoded these as a series of numbers, and then transmitted this coded description. At the receiving end, a synthesizer read the code and reconstructed the sound using an oscillator to re-create the fundamental frequency and a corresponding set of filters to shape it. Dudley named his device, patented in 1935, the Vocoder, a contraction of "voice coder" or "Voice Operated reCOrDER." Four years later, at the 1939 World's Fair in New York, Dudley unveiled a related device, the Voder, which consisted of the synthesizer component of the Vocoder connected to a pair of keyboards, a set of foot pedals, and a variety of switches. Demonstrated hourly by a skilled operator, the Voder amazed and horrified visitors with its robotic pronouncements in several different languages.[6]

With its ability to translate speech into code, Dudley's Vocoder lent itself to encryption and hence received renewed interest during World War II. In early 1943, at the invitation of the White House, the English mathematician, logician, and cryptographer Alan Turing arrived at Bell Labs to aid the development of a speech encipherment system. Turing instantly recognized the possibilities of Dudley's Vocoder, which he and his American colleagues proceeded to modify and connect to a cryptographic system. The result was a pioneering piece of digital

technology. Given a variety of enigmatic names—SIGSALY, Project X, Green Hornet—this top-secret collection of devices occupied forty equipment racks, weighed over fifty tons, and required its own air-conditioning system. SIGSALY was inaugurated on July 15, 1943, with a call between Franklin D. Roosevelt and Winston Churchill. By the end of the war, SIGSALY terminals had been installed at locations all over the world, including on the ship that carried Douglas MacArthur on his campaign through the South Pacific.[7]

In 1948, Dudley brought a version of his Vocoder to Germany, where he visited Werner Meyer-Eppler, a professor of phonetics at Bonn University. Impressed by the device, Meyer-Eppler used it during a lecture at the music academy in Detmold. Among the attendees was Robert Beyer, an editor from Cologne's Nordwestdeutscher Rundfunk (Northwest German Radio), who had long been interested in the possibility of electronic musical instruments. Beyer introduced himself to Meyer-Eppler, and the two began a collaboration to advance the cause of electronic music. Together they delivered lectures at the 1950 International Summer School for New Music in Darmstadt, where they met composer Herbert Eimert, who joined them in the project of founding an electronic music studio. A year later, at the newly renamed Westdeutscher Rundfunk (West German Radio), they began to build the studio, the first facility for purely electronic composition.[8]

A half-decade later, back at Bell Labs, the Vocoder found its way into the earliest experiments with computer music. Engineers in the acoustic research division were working with Dudley's and Turing's technologies to convert analog voice signals into digital data. In an effort to send several conversations down a single telephone line, they enlisted the aid of the computer. One evening, two of these Bell engineers, Max Mathews and John Pierce, attended a concert of piano music at nearby Drew University. Unimpressed by the performance, one whispered to the other, "The computer can do better than this." Taking up the challenge, Mathews began to experiment with using the computer as a music synthesizer and, a year later, launched MUSIC 1, the first computer program dedicated to sound synthesis.[9]

All of a sudden, a group of engineers and scientists had become composers. Linguist and psychoacoustician Newman Guttman produced the first piece of computer music in 1957, a seventeen-second demonstration titled "The Silver Scale." Pierce, head of Bell Labs' communication sciences division, responded in 1959 with a cheery anthem called "Stochatta." Mathews himself composed a series of longer and more abstract pieces in which the computer was made to approximate the sound of a singing voice. Then, in 1961, with Bell physicist John Larry Kelly, he recorded a computer version of the 1892 pop song "Daisy Bell (Bicycle Built for Two)." Using Vocoder technology, Kelly programmed the IBM 704 to sing the famous song over Mathews's calliopelike electronic accompaniment.[10] Novelist

Arthur C. Clarke, who happened to be visiting his friend Pierce, overheard the demonstration and incorporated it into his screenplay for *2001: A Space Odyssey,* in which, at the film's climax, the dying computer HAL 9000 offers "Daisy" as his swan song.

The World's Fair returned to New York in 1964, a quarter century after Dudley had debuted his Voder at that same event. Once again, Bell Labs exhibited its latest speech-processing technology, a new and improved Vocoder. It was there that Wendy (then Walter) Carlos, a student at the Columbia-Princeton Electronic Music Center, first encountered the device and became enthralled. After graduating from Columbia, she met Robert Moog, with whom she developed a close collaboration. Carlos's enormously successful 1968 record *Switched on Bach* was something of an extended advertisement for Moog's synthesizer, and the two went on to build a custom Vocoder intended specifically for musical use. In 1971, Carlos featured the Vocoder in her soundtrack for Stanley Kubrick's adaptation of *A Clockwork Orange.*

Within a few years, the Vocoder had become a staple of electronic music and of popular culture more broadly. Musical instrument manufacturers such as Korg, Bode, and Synton began producing portable versions that were eagerly deployed by Kraftwerk, Pink Floyd, Herbie Hancock, Zapp, Laurie Anderson, Neil Young, and countless other musicians. *Doctor Who*'s Daleks and Stephen Hawking brought the signature Vocoder sound—a squelched, tinny, and overly enunciated monotone—into the culture at large, where it heralded a cyborg future.

FROM THE EXPERIMENTAL TO THE MAINFRAME: LUCIER AT SYLVANIA

Little of the Vocoder's history was known to Lucier when he first encountered the device. In 1962, Lucier returned from a Fulbright in Rome, where he had befriended Frederic Rzewski and encountered the work of Cage, David Tudor, and La Monte Young, composers who challenged Lucier's classical training and suggested an alternative path. Back in the United States, Lucier accepted a position at Brandeis University as director of its Chamber Chorus. A 1963 chorus performance at New York City's Town Hall brought Lucier into contact with Robert Ashley and Gordon Mumma, emerging composers of electronic music and organizers of the ONCE Festival, a multimedia extravaganza held annually in Ann Arbor. Ashley and Mumma invited the chorus to the 1964 ONCE Festival, and, in 1966, Lucier reciprocated by asking Ashley, Mumma, and mutual friend David Behrman to Brandeis for a concert of works by the four composers. The concert was a success, and so, calling itself the Sonic Arts Group (later the Sonic Arts Union), the quartet launched a tour of the United States and Europe.[11]

The next February, at Boston's annual Winterfest, the Sonic Arts Group performed a concert sponsored by Sylvania Electronic Systems, a lighting, consumer-electronics, and telecommunications firm located near Brandeis in the Boston suburb of Waltham. Lucier's piece on the program was *Music for Solo Performer,* an utterly anomalous piece of electronic music powered by the electrical signals of the human brain. Sylvania representatives were delighted by the piece and commissioned Lucier to compose a new work for a Vocoder under development by engineer Calvin Howard.

Sylvania's Vocoder consisted of an array of components: a telephone receiver that registered vocal input; a spectrum analyzer able to sort and filter sonic frequencies; a pitch detector that determined the basic pitch of the auditory input; a voiced/unvoiced detector that distinguished (voiced, pitched) sounds produced by the vibrating vocal cords from (unvoiced, noise) sounds produced solely by the mouth, lips, and tongue; a digital encoder that translated this information into binary pulses; a digital decoder that translated the code back into auditory information; and a spectrum synthesizer that used this information to re-create the original input. Armed with an array of vocal material, musical instruments, and electrical appliances, Brandeis students spoke, sung, read, and played into the Vocoder receiver while Lucier and Howard flipped switches and twisted knobs to manipulate the various elements of speech and to transform it into abstract sound. Over the course of two days, Lucier recorded eight tracks of material that he later mixed down to produce the stereo version of the piece.

THE VOICE OF THE ALIEN/ALIENATING THE VOICE

True to its origins in telephony, the Vocoder has always been an instrument of communication, a teleological device aimed at the transmission of messages. However alien its means or its sound, the Vocoder is made to deliver intelligible speech. Dudley's Voder and Kubrick's Hal humanized the machine by making it talk. Carlos and Kraftwerk moved in the opposite direction, using the Vocoder to mechanize the human voice. Regardless, meaning and sense were to be preserved, and both machine and human were made to affirm their submission to the symbolic order.

Lucier's approach to the Vocoder was entirely different and significantly more radical. The score for *NATC* tells us that the piece is aimed at communication with aliens. But Lucier admitted that this is a red herring, "just a fanciful idea, a provocation for what the piece would be."[12] Even a cursory listen reveals the degree to which *NATC* undermines the aim of delivering intelligible speech. Instead of communication with aliens, *NATC* is concerned with alienating communication and with the alien nature of communication.

Rather than focus on the Vocoder's output, Lucier places himself (and the listener) in the middle of the process, where speech is transformed into electrical signals and code. While most telephonic and musical users have been fascinated with the Vocoder's capacity for vocal *synthesis*, Lucier is interested in it as a tool for vocal *analysis*. But this puts it too mildly. For in Lucier's hands, the Vocoder becomes a machine with which to liquidate speech and to abolish the identity of the speaking subject, shattering all syntax and pulverizing every symanteme, morpheme, and phoneme into fluid sonic matter.

Such a project connects Lucier to the rich history of sound poetry that stretches from Russian Futurism and German Dadaism to Lucier's contemporaries Henri Chopin, Bernard Heidsieck, and Bob Cobbing. In a helpful critical survey of this tradition, poet and theorist Steve McCaffery shows how early sound poetry shifted attention from the sentence to the word, renouncing syntactical and semantic meaning in favor of an exploration of the nonsemantic, material aspects of language. The advent of the tape recorder in the 1950s allowed sound poets such as Chopin to go further, abandoning the word in favor of sound.[13]

This same trajectory is followed in the series of vocal works composed by Lucier in the late 1960s and early 1970s, which begin with spoken texts that are then radically altered through electronic means. Lucier's 1969 composition *The Only Talking Machine of Its Kind in the World* is dedicated to "any stutterer, stammerer, lisper, person with faulty or halting speech, regional dialect or foreign accent or any other anxious speaker who believes in the healing power of sound." The piece invites a speaker to "talk to an audience through a public address system for a long enough time to reveal the peculiarities of [his or her] speech," and then asks friends to build a tape-delay system that would "annihilate" these peculiarities and hence relieve the anxiety of public speaking. As such, the piece shifts attention from meaning to the voice itself, and treats electronic instruments as therapeutic prosthetics that heal by transforming vocal tics into loops of abstract sonic material. A related piece, *The Duke of York* (1971), calls upon one performer to use electronic equipment "to alter the vocal identity" of a speaker by electronically modifying its material characteristics.[14] In the recorded version, a Roman letter, a Berlioz aria, and a 1950s American pop song are gradually and cumulatively tweaked, at first rather modestly through panning and filtering.[15] By the end of the piece, however, Lucier's voice has become a plaintive howl submerged in feedback and frenetic blasts of electronic noise. More radical still is *I Am Sitting in a Room* (1970), Lucier's most famous composition. The score calls for a speaker to read and record a short text that reflexively lays bare the procedure of the piece:

> 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.

The text is read into one tape recorder and then repeatedly played back into another—thirty-two times in the available recording, a 1980 version that features Lucier himself as the speaker.[16] Over the forty-five-minute duration of the performance, Lucier's voice—and particularly his characteristic stutter (fittingly manifested on the key words *rhythm* and *smooth*)—gradually becomes engulfed by the space. After ten cycles, speech has become a surging wash of metallic tones, like a slow, distorted steel drum routine. After twenty cycles, it has become a distant carillon dirge; after thirty, a nervous, squelchy drone.

Though *I Am Sitting in a Room* is often taken to be an exploration of sonic space akin to the earlier composition *Chambers* (1968), Lucier explicitly (and, of course, repeatedly) warns against this interpretation. More than the "demonstration of a physical fact"—discovery and amplification of a room's resonant frequencies—the piece concerns the dissolution of speech and the speaker into sound and space. What begins as a personal confession in a domestic setting gradually becomes pure, anonymous sound that overwhelms and eradicates the performer's personality.[17] Meaning and sense have dissolved into rhythm. Identity and self have been absorbed into space.

Of the compositions in this vocal series, only *I Am Sitting in a Room* achieves the power and radicality of *NATC*. But *NATC* goes further, explicitly reflecting on the alien nature of speech, language, and communication. According to philosophical tradition, speech is intimately tied to being and presence—specifically, to one's *own* being and *self*-presence. Our speech announces and affirms our living, physical existence and our conscious, mental intentions. Emanating from our very bodies as breath and vibration, speech is the expression of our interiority—the discourse of the soul, as Plato called it.[18] And yet the words we speak are not our own. Every word we utter is borrowed from a language, a historical and cultural reservoir that enables communication between fellow users.[19] Even speech, then, is a technology, a prosthesis. Writing is even more evidently so. Our written signs bear no natural relationship to our spoken sounds (which, by the same token, bear no resemblance to their meanings). Cast adrift from us, they are able to (indeed, are *built* to) signify even in our absence or after our deaths. Due to this structural alienation from our physical presence and animating intentions, the written sign can be understood in ways we never intended and drawn into contexts we never imagined or sanctioned. This is no less true of audio recording or phonography (literally, voice- or sound-writing). While it promises a return to

the presence of the voice, audio recording does so at the price of an uncanny disembodiment that allows the voice to survive the demise of the body and mind that are said to have animated it.[20] As part of the archive of recorded sound, the recorded voice is submitted to the possibility of endless sampling, splicing, and editing and all manner of sonic modification. Manifestly machinic, the recorded voice reveals the technological character of vocalization in general, the production of sound as a physical rather than a spiritual fact. As such, this machine is subject to mechanical failures of all sorts: glitches, scratches, erasures, broken parts, power failures, etcetera.

NATC draws attention to this communicative alienation. Words intended to identify their speakers to alien others are uttered into the Vocoder, a device built to transport them by electronic means to distant places and times. But the messages fail to reach their destinations or, at least, fail to reach them intact. For, along the way, they are sampled, clipped, bent, layered, and otherwise mangled. More than forty years later (presuming we are an instance of the temporal—if not the extraterrestrial—aliens the piece addresses), *NATC* appears to us not as a recording of North American inhabitants circa 1967 and not even as glossolalia or Babelian babble, but as glorious electronic sound, no longer signal but noise.

THE REAL: LUCIER'S NATURALISM

This dismantling of the symbolic order (the domain of language, meaning, signification, and communication) is not gratuitous or nihilistic. It delights not so much in the destruction itself as in the discovery that follows. For Lucier's project is aimed at uncovering what undergirds the symbolic order but is disavowed by it: what Jacques Lacan called "the real," the perceptible plenitude of matter and nature.[21]

A domain of articulate sound governed by formal rules, music, like speech, belongs to the symbolic. Both consist of selected sets of tones and utterances produced and received according to established cultural rules and norms. The musical score and alphabetic writing further reduce this sound world to a small collection of visual symbols: twelve notes, twenty-six letters, and a modest array of qualifying signs. As rational systems allied with culture and order, music and language have always been presented as evidence of human exceptionalism, proof that human beings are not mere animals but creatures with special endowments that elevate them above the rest of the material universe.

In the wake of Darwin and Nietzsche, the advent of audio recording helped to shatter this illusion and gave credence to a new materialism.[22] Of course, Thomas Edison and Charles Cros, fathers of the phonograph, conceived of their inventions as extending the power of the symbolic. Cros thought of the phonograph as a device for preserving "beloved voices" and "the musical Dream of the too short

hour."[23] And, for Edison, the phonograph was primarily a tool for the duplication of speech. (In his list of ten uses for the machine, only two—namely, "4. Reproduction of music" and "6. Music boxes and toys"—concern anything other than vocal utterance.)[24] Yet the phonograph disclosed an auditory world vastly larger and other than that of speech and music: the world of noise or of sound as such. As Friedrich Kittler notes in his philosophical genealogy of modern media: "The phonograph does not hear as do ears that have been trained immediately to filter voices, words, and sounds out of noise; it registers *acoustic events as such*."[25] The crackling of embers, the sputter of a motorboat, the reverberations of a room[26]—audio recording registers all this with the same facility that it captures a Bach cantata, a presidential address, or a child's first words. "Articulateness," writes Kittler, "becomes a second-order exception in a spectrum of noise." With audio recording, chords and ratios give way to frequencies and vibrations, logic to physics, and musical meter to physical time. "The real takes the place of the symbolic," Kittler concludes; the phonograph "subverts both literature and music (because it reproduces the unimaginable real they are both based on)."[27]

In Kittler's account, the Vocoder played a significant role in this opening up of the real.[28] For, with the Vocoder, the human voice becomes a data stream like any other. Significant speech is described, like all sounds, as frequencies and envelope curves that are transformed into noise and then back into intelligible data. The Vocoder takes any two acoustic streams and maps them onto each other, disregarding their provenance. In psychoanalytic terms, the Vocoder subtracts "the word" (sense, meaning, signification) and leaves "the object voice," the material flow of vibration, frequency, and sound.[29] In so doing, it presents a return of the repressed; for the symbolic order (like culture in general) is founded on a nature, materiality, and physicality that it relentlessly disavows. Listen, for example, to Ferdinand de Saussure, the father of structural linguistics: "It is impossible that sound, as material element, should itself be part of the language. Sound is merely something ancillary, a material that language uses. . . . Linguistic signals [signifiers] are not in essence phonetic. They are not physical in any way. They are constituted solely by differences which distinguish one sound pattern from another."[30] Banished from language, which wants to believe that it is "not physical in any way," this sonic materiality returns as the real opened up by recording technologies from the phonograph to the Vocoder, the tape recorder, and the computer.

If *music* is the symbolic, then the real is *sound*. And, indeed, along with pioneers such as John Cage and Pierre Schaeffer, Lucier's work marks an important transition from musical composition to a new domain: sound art. Sound art is the art of the auditory real. It is concerned not with the communication of musical values, but with an exploration of what Cage called "the entire field of sound" and the nature, movement, and transmission of sound as a material, physical substance.[31]

Lucier is sometimes described as a "phenomenological composer." But such a characterization is misleadingly idealist.[32] It misconstrues his work as concerned with the apprehension of sound rather than with sound itself. The idealist sees no way to get from the one to the other and, hence, either deems reality mental or rests content with the description of its appearances. Lucier's position, however, is closer to that of phenomenology's historical nemesis: materialism or naturalism. His reliance on science and his collaborations with natural scientists are well known, and, by his own account, Lucier often "do[es] little more than frame [scientific experiments] in an artistic context."[33] For Lucier (and for the naturalist in general), there is no strict division between subject and object, self and world, perception and substance. Human beings are *of* the world, not set apart from it as mental or spiritual spectators. In *Music for Solo Performer,* Lucier shows that the brain itself is a source of electricity and a musical instrument in its own right. *I Am Sitting in a Room* demonstrates the continuity between the human voice and its material surroundings. And *Music on a Long Thin Wire* (1977) allows those material surroundings—air currents, changes in air pressure or temperature, ambient vibrations, etcetera—to perform the piece without human intervention.[34]

True to his naturalism, Lucier also draws no rigorous boundaries among the human, the animal, and the machine. Instead his work consistently explores the continuum that stretches from one domain into the others. *Vespers* employs mechanical devices to endow performers with the sensory capacities of bats and dolphins. *Bird and Person Dyning* (1975) sets up a feedback system between a human performer and an electronic bird (itself a rich conjunction of the animal and the machine). Lucier's performances of *The Duke of York* present a personal and cultural history in which he successively channels the Roman emperor Augustus, the nineteenth-century Frenchman Hector Berlioz, and the mid-twentieth-century American pop singer Johnnie Ray. The piece ends with an extended series of electronically distorted whale calls that project a future union among human, animal, and machine.[35] *Quasimodo the Great Lover* (1970) adopts the long-distance communication of whales as a structural principle that is realized as a series of electronic relays. And *NATC* renders this interest in long-distance communication as an alliance among the human, the machine, and some future alien interlocutors.

TIME CAPSULES

But *NATC* is not only a piece about the transmission of signals over vast expanses of space. As its title suggests, it is also engaged in a theorization of time. Indeed, I want to suggest that, along with the series of pieces that historically and conceptually follow it, *NATC* proposes a theory of time and memory that underscores

Lucier's naturalism and that richly resonates with a tradition of philosophical naturalism that extends from Benedict de Spinoza through Henri Bergson and Gilles Deleuze.

Sonically, *NATC* comes off as garble, babble. And anyone who hears it will wonder what such babble could possibly communicate to future or alien beings. As we have seen, this garble is largely the result of Lucier's interest in vocal analysis, or the pulverization of the voice in the passage from meaning to sound. Yet the sonic chaos of the piece also has another source: a density due to aural simultaneity, the layering of eight separate tracks, each of which, presumably, registers a number of different voices. This interest in simultaneity and accumulation engages a conception of time and memory, as can be seen through a comparison of *NATC* with several other pieces that historically surround it.

(Hartford) Memory Space (1970), for example, calls upon each member in a group of performers to travel to a designated place in the city, to record (mentally, graphically, or electronically) the sounds of that space, and then to re-create those sounds in a concert situation by way of the voice or conventional musical instruments. In performance, each member of the ensemble presents his or her re-creation (or memory) simultaneously with all the others. As Lucier describes it: "I wanted [the performers] to stick as closely as possible to their remembrance of the environment, so I isolated [them] from one another. It was as if each of them were on an island but the audience could see and hear all those islands. The islands could be parts of the town, or places in the streets, and the audience would see and hear a composite of which the individual players were only a part."[36] True to its title, the piece thus conjoins time (memory) and space (geographical location). Indeed, it offers a spatial model of time and memory in the manner of Bergson's famous diagram of the cone. Bergson figures the present as the point of a cone (S), the base (AB) of which represents the totality of the past. Various slices or planes (A'B', A"B", etc.) represent regions of memory, each of which contains the totality of the past in more or less contracted or dilated form. Just as the present carries along with it the entirety of the past, each memory accesses this totality from a particular point or region. *(Hartford) Memory Space* operates in a similar fashion. Each performer presents a (remembered) part of the whole city, and the simultaneous performance of these parts offers an approximation of the total urban soundscape, which, however, still remains virtual, out of earshot.

Operating by the slow layering and accumulation of sonic information, *The Duke of York* and *I Am Sitting in a Room* temporalize this simultaneity, and Lucier's remarks about these pieces amplify the conception of time and memory laid out in *(Hartford) Memory Space.* He suggests that the synthesizer *(Duke of York)* and the tape recorder *(I Am Sitting in a Room)* are models of memory. "It struck me that tape is now memory," he told Douglas Simon; "you can store

information on tape just as you can store it in your brain, only it's more accessible. So tape for me was a substitute for using your brain to remember."[37] Similarly, reflecting on *The Duke of York*, Lucier remarked:

> I think the real reason I used [the synthesizer] is that it was called a *synthesizer*, probably from the old RCA synthesizer that was designed to imitate the sounds of musical instruments with a new technology. I had always hated that idea. It had seemed to me a waste of time to try to synthesize the sounds of perfectly good acoustical instruments with a new technology. But since *The Duke of York* has to do with the layering of one identity on another to make a composite image, I thought that the notion of synthesis was justified.[38]

Here Lucier clues us into the fact that the piece is not fundamentally about imitation but about memory as a form of synthesis or accumulation. ("Memories, it had to do with memories," he told Thomas Moore.)[39] And, indeed, this notion of memory is not subjective or psychological but what Deleuze calls "ontological," a kind of "Being-Memory" or "world memory."[40] The project began as a deeply personal project, an effort to tap into or to channel the musical memory of Lucier's then-wife Mary.[41] But, like Bergson's widening cone, the project quickly expanded "to include not only popular songs but any vocal utterances taken from poems, plays, operas, or any real or fictitious written material." From here, the piece became world-historical and even cosmic. "Theoretically," Lucier continues, "you could imagine that you had something to do with all the vocal utterances that were ever made and that you might bring yourself back through time to when you were a small animal." Finally, Lucier goes one step further: "I also had in mind that there's a single source of life, the idea of a single-cell splitting into two and then four and then eight, geometrically. This piece, however, would work back the other way. If you could do it infinitely, everyone would process that sound according to every memory they ever had, thereby going back to where they had a connection; it's a grandiose idea." The exploration of the personal memory of a loved one quickly connects Lucier to all human beings, our distant animal past, and, finally, the entire history of life on earth. The domain "my past" or "Mary's past" opens out onto the past-in-general. And, for Lucier, all of this is made possible by the synthesizer as an external model of memory and temporal synthesis.

Here again we see Lucier affirm a naturalism according to which nature forms a profound continuum, a field in which each entity and temporality enfolds every other. We find a model of memory that conceives it not as personal or psychological but impersonal, preindividual, ontological. And, challenging the traditional notion of time as centered on a present that passes into the unreality of the past, Lucier affirms a notion of the past as an immense totality that presses into the future.

It is this notion of time that *NATC* so richly exemplifies. If *The Duke of York* explores the virtuality of the past—its coexistence, through memory, with the present—*NATC* explores the virtuality of the future. Like *The Duke of York, (Hartford) Memory Space*, and *I Am Sitting in a Room*, *NATC* models memory and time as an intense accumulation and subsistence of sensory material. But, through the very notion of the time capsule, it projects this past into an unknown future. It collects elements from an infinite reservoir and offers it to imagined future others for their own creative selection and transformation. As such, it highlights the model of time inherent in experimental music in general, which initiates "acts the outcome of which are unknown." Opposed to the classical model of time (and the time of classical music) as the passage through a pregiven totality, *NATC* construes time as an open whole in which an infinite and accumulated past projects a future that is genuinely novel.

NATC, then, reveals Lucier's abiding interests and encapsulates his philosophical position. It inaugurates his project to dissolve the voice into sonic matter, announces his commitment to a thoroughgoing naturalism or materialism, and suggests a conception of time and memory that is consonant with this naturalism, according to which matter and temporality constitute a unitary whole that each entity, each moment, and each sound enfolds and expresses in unique and unforeseen ways.

NOTES

1. Though he had written chamber and orchestral pieces since 1952, Lucier counts his 1965 piece *Music for Solo Performer* as the proper beginning of his compositional career. See "Discovery Is Part of the Experience," in Alvin Lucier, *Reflections: Interviews, Scores, Writings* (Köln: MusikTexte, 1995), 28. *North American Time Capsule* was initially issued in 1968 on an LP titled *Extended Voices* (Odyssey 32 16 0156), a collection of experimental vocal pieces by Lucier, John Cage, Pauline Oliveros, and others performed by the Brandeis University Chamber Chorus under Lucier's direction. It was reissued on Lucier's 2002 CD *Vespers and Other Early Works* (New World Records, 80604-2).

2. For more on this contrast, see Georgina Born, *Rationalizing Culture: IRCAM, Boulez, and the Institutionalization of the Musical Avant-Garde* (Berkeley: University of California Press, 1995), 40–65. Along similar lines, Michael Nyman's seminal text *Experimental Music: Cage and Beyond* (Cambridge: Cambridge University Press, 1999; originally published in 1974) sharply contrasts "avant-garde" musical practice with "experimental music." See also my "The Jerrybuilt Future: The Sonic Arts Union, ONCE Group and MEV's Live Electronics," in *Undercurrents: The Hidden Wiring of Modern Music*, ed. Rob Young (London: Continuum, 2002), 35–44.

3. A paraphrase of Cage's famous remark in the 1955 essay "Experimental Music: Doctrine," in John Cage, *Silence: Lectures and Writings by John Cage* (Middletown, CT: Wesleyan University Press, 1961), 13.

4. Alvin Lucier, interview with the author, Middletown, CT (July 19, 2006).

5. See Manfred R. Schroeder, "Speech Processing," in *Signal Processing for Multimedia*, ed. J.S. Bynes (Amsterdam: IOS Press, 1999), 129.

6. In April 2006, AT&T launched a television ad celebrating its history of research on voice technology. The ad featured a mechanical hand playing Dudley's Voder. See www.research.att.com/~ttsweb/tts (accessed September 2006).

7. See Andrew Hodges, *Alan Turing: The Enigma* (New York: Simon & Schuster, 1983), 245ff; J. V. Boone and R.R. Peterson, "The Start of the Digital Revolution," www.nsa.gov/publications/publi00019.cfm#N3 (accessed September 2006); and Patrick Weadon, "The SIGSALY Story," www.nsa.gov/publications/publi00020.cfm#N3 (accessed September 2006).

8. See Peter Manning, *Electronic and Computer Music*, rev. and exp. ed. (Oxford: Oxford University Press, 2004), 39ff; and Joel Chadabe, *Electric Sound: The Past and Promise of Electronic Music* (Upper Saddle River, NJ: Prentice Hall, 1997), 35ff.

9. See Manning, *Electronic and Computer Music*, 187ff; Chadabe, *Electric Sound*, 108ff; and "Recollections by John Pierce," notes to *Music with Computers: The Historical CD of Digital Sound Synthesis* (Computer Music Currents 13) (Wergo WER 2033-2), 9.

10. Many of these early computer pieces were released in 1962 on the Decca LP *Music from Mathematics* (Decca DL9103). They are currently available on the CD *Music with Computers*.

11. See Alvin Lucier, "Origins of a Form: Acoustical Exploration, Science, and Incessancy," *Leonardo Music Journal* 8 (1998): 5.

12. Lucier, interview with the author, Middletown, CT (July 19, 2006).

13. See Steve McCaffery, "From Phonic to Sonic: The Emergence of the Audio-Poem," in *Sound States: Innovative Poetics and Acoustical Technologies*, ed. Adalaide Morris (Chapel Hill: University of North Carolina Press, 1997). Much of this history can be heard on the four-CD set *Revue OU: An Anthology of Sound Poetry 1958–1974* (Alga Marghen 045CD).

14. All quotations from Lucier's verbal scores are drawn from *Reflections*.

15. Alvin Lucier, *Bird and Person Dyning* (Cramps / Get Back GET 420).

16. Alvin Lucier, *I Am Sitting in a Room* (Lovely CD 1013).

17. Portions of this and the previous paragraph are borrowed from my essay "Alvin Lucier: Positive Feedback," *The Wire* 245 (July 2004): 44.

18. See Plato, *Phaedrus*, 276a. My account here borrows, of course, from Jacques Derrida's early work on speech and writing, presented in essays such as "Signature Event Context," in *Margins of Philosophy*, trans. Alan Bass (Chicago: University of Chicago Press, 1982), 307–30; and books such as *Speech and Phenomena, Of Grammatology, Dissemination*, and *The Post Card*.

19. In his book *A Voice and Nothing More* (Cambridge, MA: MIT Press, 2006), Mladen Dolar offers a psychoanalytic account of this "constitutive asymmetry in the voice, an asymmetry between the voice stemming from the Other and one's own voice" (81; cf. 73).

20. Describing his phonograph, Thomas Edison wrote: "This tongueless, toothless instrument, without larynx or pharynx, dumb, voiceless matter, nevertheless utters your words, and centuries after you have crumbled to dust will repeat again and again to a generation that will never know you, every idle thought, every fond fancy, every vain word that you choose to whisper against this thin iron diaphragm." Quoted in *The Washington Post*, April 19, 1878, 1, http://phonozoic.brinkster.net/a0031.htm (accessed September 2006).

21. My use of the terms *symbolic* and *Real* follows Friedrich Kittler's (Nietzschean) materialist reading of Lacan rather than the (Kantian) idealist reading favored by Slavoj Žižek, Alain Badiou, and others.

22. For more on this, see Douglas Kahn, "Histories of Sound Once Removed," in *Wireless Imagination: Sound, Radio, and the Avant-Garde*, eds. Douglas Kahn and Gregory Whitehead (Cambridge, MA: MIT Press, 1992), 14–26. Of course, phonography also inspired, and was inspired by, interests in the occult and spiritualism. See Erik Davis, "Recording Angels: The Esoteric Origins of the Phonograph," in *Undercurrents*, 15–24.

23. Charles Cros quoted in Friedrich Kittler, *Gramophone, Film, Typewriter*, trans. Geoffrey Winthrop-Young and Michael Wutz (Stanford, CA: Stanford University Press, 1999), 22.

24. Thomas Edison, "The Phonograph and Its Future." See also "The Perfected Phonograph," *North American Review* 379 (June 1888), www27.brinkster.com/phonozoic/a0045.htm (accessed September 2006).

25. Kittler, *Gramophone, Film, Typewriter*, 23; my italics. For Lacan's discussion of the materiality of language in relationship to telecommunications technology, see *The Seminar of Jacques Lacan, Book II: The Ego in Freud's Theory and in the Technique of Psychoanalysis, 1954–1955*, ed. Jacques-Alain Miller, trans. Sylvana Tomaselli (New York: W. W. Norton and Co., 1988), 82–83.

26. Hear, for example, Iannis Xenakis's *Concret Ph* on *Xenakis: Electronic Music* (Electronic Music Foundation EMF CD 003); Luc Ferrari, *Presque Rien* (INA-GRM INA C 2008); and Lucier, *I Am Sitting in a Room*.

27. Kittler, *Gramophone, Film, Typewriter*, 22, 24. Elsewhere, Kittler writes: "It is Edison's phonograph that first allows for the possibility of a methodical, distinct separation between the real and the symbolic." Kittler, "The World of the Symbolic—A World of the Machine," in *Literature, Media, Information Systems*, ed. John Johnson (Amsterdam: G+B Arts International, 1997), 139–40.

28. See Kittler, *Gramophone, Film, Typewriter*, 49–50.

29. See Dolar, *A Voice and Nothing More*, chap. 1.

30. Ferdinand de Saussure, *Course in General Linguistics*, pt. 2, chap. 4, sec. 3, quoted in Dolar, *A Voice and Nothing More*, 18.

31. Cage, "Future of Music: Credo," in Cage, *Silence*, 4.

32. In his liner notes to *I Am Sitting in a Room*, Nicolas Collins also objects to this characterization, though on somewhat different grounds. In an interview with Douglas Simon, Lucier describes himself as a "phenomenologist," though his characterization of this stance is more in line with a sort of scientific materialism. "The Poetry of Science: *Music on a Long Thin Wire* (1977)," in Lucier, *Reflections*, 194–96.

33. Lucier, "Origins of a Form," 8. Lucier refers to his *Queen of the South* (1972), which presents eighteenth-century German physicist E. F. P. Chladni's experiments in the visualization of sound; *Tyndall Orchestrations* (1976), which, in the manner of nineteenth-century Irish physicist John Tyndall, investigates the effects of sound on gas flames; *Music for Pure Waves, Bass Drums and Acoustic Pendulums* (1980), which, Lucier notes, "is simply an orchestration of an experiment I discovered in a British college textbook on the physics of sound"; and *Spira Mirabilis* (1994), based on biologist D'Arcy Thompson's drawings of insect movements. One might also include *Music for Solo Performer* (1965), based on the research of physicist Edmond Dewan; *Vespers* (1969), inspired by cognitive ethologist Donald R. Griffin's work on acoustic orientation and sensory biophysics; *Quasimodo the Great Lover* (1971), inspired by biologist Roger S. Payne's research on whale communication; and *Music on a Long Thin Wire* (1977), which began as a collaboration with physicist John Trefny.

34. Although he initially conceived of *Music on a Long Thin Wire* as a piece to be played by one or more performers, Lucier soon altered his conception. "I was not happy with any of these performances," he wrote in 1992. "The music never went beyond a kind of poetic improvisation. I finally decided to remove my hand from the musical process." The available recording consists of four realizations from 1979 in which "no alteration of the tuning or manipulation of the wire was made in any way. The wire played itself." Liner notes to *Music on a Long Thin Wire* (Lovely Music LCD 1011).

35. See Lucier's interview with Douglas Simon, "Composite Identities of Real or Imagined Persons: *The Duke of York* (1971)," in Lucier, *Reflections*, 120–22.

36. Lucier, "Imitating One Set of Sounds with Another: *(Hartford) Memory Space (1970)*," in Lucier, *Reflections*, 90.

37. Lucier, *Reflections*, 88.

38. Ibid.; my italics.

39. "Alvin Lucier in Conversation with Thomas Moore," www.research.umbc.edu/~tmoore/interview_frame.html (accessed September 2006).

40. In a commentary on Bergson, Deleuze writes: "Memory is not in us; it is we who move in a Being-memory, a world-memory." Gilles Deleuze, *Cinema 2: The Time Image*, trans. Hugh Tomlinson and Robert Galeta (Minneapolis: University of Minnesota Press, 1989), 98. On the notion of "ontological memory," see Gilles Deleuze, *Bergsonism*, trans. Hugh Tomlinson and Barbara Habberjam (New York: Zone Books, 1988), chap. 3.

41. See Lucier's description of his process of composition in his interview with Douglas Simon, "Composite Identities of Real or Imagined Persons: *The Duke of York* (1971)," 114ff.

10

AN INTRODUCTION TO *NORTH AMERICAN TIME CAPSULE 1967*

Robert A. Moog

A vocoder (contraction of "voice coder") is a device which analyzes, or breaks down, an audio signal into a number of slowly varying voltages which constitute a coded description of the audio input material, then synthesizes, or reconstructs, the original audio from the analyzer output. Vocoders are used primarily to encode and decode voice signals for efficient transmission over long distances. The vocoder concept itself in general, and existing vocoders in particular, are intended for and suited primarily to the processing of voice and voice-like sounds, an application where intelligibility is the only performance criterion.

In the simplest form of vocoder, the analyzer consists of a bank of bandpass filters, each of which passes a portion of the frequency spectrum. Voltages proportional to the amplitude of each of the filter outputs are derived. These voltages are the encoding of the spectral distribution of the audio input. A frequency discriminator circuit, which produces a voltage proportional to the fundamental frequency of the audio material, and a voiced/unvoiced decision-making circuit complete the analyzer portion of this type of vocoder. The analyzer outputs (which, because of the nature of the voice, are all slowly varying compared with the voice signal itself) may be transmitted by any of a variety of multichannel transmission techniques. The synthesizer portion reverses the process by first producing an excitation function consisting of the fundamental frequency plus all of the natural harmonics of the original audio input, and then feeding the excitation function through a bank of filters. The gain of each filter section is determined by the magnitude of the output of the corresponding filter in the analyzer portion.