"Memorable Equinox": John Lilly, Dolphin Vocals, and the Tape Medium

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In the later 1950s and 1960s, the American neurologist John Cunningham Lilly (1915–2001) undertook an unorthodox set of experiments on bottlenose dolphins (*tursiops truncatus*). The centerpiece of this research was their bioacoustic practices, including hearing and phonation. Lilly's work sits at the crossroads of many vectors in postwar American culture: the birth of the counterculture from the spirit of Cold War militarized science; the cybernetic dream of flattening the differences between animal, human, machine, and alien intelligence; the exploration of otherness through drugs and madness; and the cultural transformation of dolphins from cute sea mammals to "sexually liberated, stereophonic, non-manipulative superintelligences" (Burnett 2012: 609). Sound technologies, especially tape, were the *condi-*

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tio sine qua non of Lilly's cetacean research. He used tape obsessively in his efforts to decrypt dolphin communications and later to liberate human consciousness from its tendency to get stuck in repeating loops. Strangely enough, he hardly noted the technical infrastructure of his quest for alternate worlds: many of his fantasies of immediacy and contact depended on signal-processing devices. As a tape and sound artist, explorer of the human-nonhuman border, and builder of technological interfaces, Lilly is a figure of vital interest for media history (see Müggenburg and Vehlken 2011; Shiga 2013a; Clarke 2014; Peters 2015: 64ff, 74–78, 92; Grebowicz 2017; and Müggenburg 2016, 2018). He is particularly important as part of the neglected history of tape recording, the most important sound medium between the 1950s and the 1970s. In this essay, I follow Lilly's by turns macabre and loopy quest for the dolphin's voice and show his place in a wider intellectual confluence around tape as a privileged medium for listening to fragmentary and alien voices around 1960.

Media theorist Friedrich Kittler famously argued that twentieth-century sound media, such as radio, vinyl, tape, amplifiers, vocoders, as well as rock and roll, were "the abuse of army equipment" (Kittler 1999: 96–97, 110–14; 1988). Lilly's dolphin research belongs in this lineage. He sat at the heart of militarized bioacoustics, receiving financial support from such agencies as the National Aeronautics and Space Administration, National Institute of Mental Health, the Air Force Office of Scientific Research, and the Office of Naval Research. His research was, concludes historian D. Graham Burnett, "inextricable from (and dependent on) Cold War military bioscience" (2012: 530). Both the US and USSR were interested in dolphins as passive intelligent agents or weaponizable assassins and studied their hydrodynamic design and skills at echolocation. Many of Lilly's techniques—isolation, tape loops, sensory deprivation, LSD, and direct stimulation of the brain by electrode—have affinities with top-secret intelligence work from the period (Burnett 2012: 518, 530; Lilly 1978: 87–97). Lilly sits at the cross-fade between the CIA and the counterculture.

The militarization of the ocean in the two world wars spurred innovations in underwater listening. As late as 1953, Jacques Cousteau could publish a book called *The Silent World* about his undersea adventures but here, as usual, Minerva's owl took flight at dusk: this was just the moment that the sea was starting to be full of noises. Sound devices such as hydrophones displaced nets, diving, and fathom ropes as the media of underwater investigation, and despite the postwar boom in submarine photography, in which Cousteau was a key player, sound remains the privileged medium

for sea science (see Shiga 2013b; Ritts and Shiga 2016). Lilly's use of postwar sound equipment such as spectrographs, hydrophones, oscilloscopes, vocoders, and multitrack tape recorders deserves more detailed study than I can give it here, but he was clearly immersed in state-of-the-art sound technology. (He acknowledges assistance from Wilden A. Munson, a Bell Labs sound engineer who had collaborated with Harvey Fletcher, the dean of twentieth-century acoustics, on work important for volume control in hi-fi stereo.) The laboratory Lilly built in the US Virgin Islands was a veritable sound recording studio and a prosthetic interface for dolphin-human coupling, including a vocoder to shift pitch between human and dolphin auditory ranges. Though he dissected dolphin cadavers and did a wide range of often cruel experiments on them, which brought intimate acquaintance with their physical nature, dolphins remained slightly magical, unattainable beings for him. Dolphins to Lilly could be like sirens in Kittler's late work on music and mathematics or angels to theologians—transcendent beings between earth, sea, and sky who dwell in sonic bliss, beings who embody the secrets of mindful communication.

The Wages of Phonocentrism

Lilly first encountered a beached dolphin in the late 1940s and was impressed at the large brain of the animal, though he didn't have an opportunity to operate on one until the mid-1950s. Dolphin brains are bigger than human brains, but Lilly seems never to have understood that neuronal packing density and the ratio of brain size to total body volume, the so-called encephalization quotient, are as important measures of intelligence as raw brain size, which he often celebrates in dolphins (see, for example, Lilly 1967: 18, 55, 100). A neurologist, surgeon, and psychoanalyst fascinated by the anatomy and physiology of the brain, he made his scientific name in the early 1950s with experiments on the brains of macaque monkeys. Monkeys were the shock troops of his desire to penetrate to the voice. He explains how in the first of his two books about cetacean intelligence, *Man and Dolphin: Adventures on a New Scientific Frontier*. In this international bestseller, whose eager readers included Soviet scientists and military administrators, Lilly described his gruesome method: "the monkey is held in restraint and a small length of hypodermic-needle tubing ('sleeve guide') is hammered into the skull so that the brain's cavity is just penetrated, and not the brain itself. A metallic, insulated, shielded electrode with a bared tip is inserted through a small hole in the skin, through the guide, and into the

brain. The depth of penetration of the electrode is controlled with a small drive unit placed on the outer edge of the sleeve guide" (1961b: 64). The aim was to map the brain, especially its pleasure and pain centers (for more on Lilly's 1950s research, see Müggenberg 2018: 149–52).

Lilly was especially interested in getting the monkeys to speak. "I made use of this system in attempting to teach a monkey to vocalize in an anticipatory and demanding fashion" (1961b: 64). If the harnessed creature emitted a spontaneous "bark," it got a reward of an electrical jolt to its pleasure center. Though monkeys quickly learned to control levers to turn on the pleasure juice—sometimes with Lotus-Land effects, as ferocious animals would turn into docile blobs and stay put for weeks on end—no vocal results were forthcoming, even after hundreds of trials over a six-month period. "We concluded that voluntary vocalization is an extremely difficult if not impossible process for a monkey" (65). Finding a voice was, for Lilly, worth a string of ruined animals. His blithe narration at the time was unaware of how despicable a later generation, and he himself, would find such experiments.

Lilly's experiments with dolphins got off to an even rockier start in 1955. In trying to map the dolphin brain, he and his team killed five of them in quick succession. Essentially the dolphins suffocated, partly due to the small restraining tank that held them, but mostly because the general anesthetic Lilly used turned off their respiration, which marine mammals control voluntarily. Unlike humans who have autonomic breathing and can generally slip into sleep or anesthesia without the risk of ceasing to inhale, breathing is always conscious for dolphins, because their marine existence involves extended periods of holding their breath. (That dolphins were yogi-like breath-control artists would become one part of their mystique.)

Both chagrined and saddened at the deaths, though profiting from the opportunity to do extensive autopsies, Lilly decided to try the same method on dolphins that he had on monkeys. He hammered sleeve guides into the skulls of two dolphins after administering a small dose of a local anesthetic. He even tried hammering on his own skull and "discovered that even without a local anesthetic the pain associated with the procedure is not great. However, the noise of a hammer blow on a needle, when conducted by bone to one's ears, is extremely loud and rather startling" (71). (His interest in auto-experiment would later take form in long immersions in a sensory isolation tank and in massive self-administered doses of LSD and ketamine.) The ambition of interspecies communication was, in Lilly's thinking, not that different from mind control: "It was up to us to determine whether the large-brained animals were as amenable to such motivational

'brain-washing' by electrical means as the smaller-brained monkey" (68). Lilly was mining gray matter, pushing electrodes gradually deeper into unexplored territory until he evoked some kind of response. The motor system was the favored place to start and his team soon found "areas that control movement of the flipper, the eye, the tongue, the back muscles, the flukes, and even the erection of the penis" (73). But other parts of the brain such as speech controllers were harder to localize: "until you have found the first motivationally active zone, you are shooting in the dark" (74).

To study dolphins, Lilly built a "Communication Research Institute" in the US Virgin Islands in 1959 with grant money (and some of his own; he came from a well-to-do Minnesota banking family). This partly wet and partly dry dolphin research park was blasted out of an island, *Fitzcarraldo*-style, and was packed with photographic, sound-recording, and other data-gathering equipment. (It still exists in a dilapidated state.) *Man and Dolphin* is an upbeat and sometimes narcissistic book, at points serving as a photo album of the Lilly family (he was on his second marriage, which was soon to fall apart), showcasing science, sunshine, and sea life in a 1960s sort of commune that brought earthlings and extraterrestrials of the oceanic variety together in a beloved community. This operation led to a spread in *Life* magazine, including photos of his son and daughter feeding and petting the animals. *Life* noted, "Recording equipment is always turned on so that there is a constant record of all dolphin sounds" (*Life* 1961: 65). In an accompanying essay, Lilly announced the stakes of the project to the world: "we are trying to make first contact with an alien, nonhuman species. That we can conceive of doing so is an important step in man's own evolutionary maturity" (Lilly 1961a: 68). The institute was a destination for intellectual celebrities such as anthropologist Gregory Bateson, astronomer Carl Sagan, and a young Ted Nelson, the IT visionary, who worked on an unfinished film documentary about the sex lives of dolphins (Peters 2015: 76).

There was plenty of noir beneath the sunshine, however. For the dolphins, as Lilly would later regret, the institute might well have been a black ops site. He was trying to get the dolphins to "sing," as the gangland parlance has it. After one long and unsuccessful Saturday of probing in a dolphin's brain, Lilly returned to the lab early on Sunday morning, "cranked the electrode down another millimeter, and started stimulating." He had hit the phonocentric jackpot. "The dolphin was more exuberantly vocalizing than ever I'd heard before. Whistles, buzzings, raspings, barks, and Bronx cheer-like noises were emitted. (Until we were able to play this tape back at a later session, many of the novel and exciting facts of the experiment were yet to

be realized)" (Lilly 1961b: 75). In this electrically induced and recorded bit of dolphin glossolalia, Lilly claimed to hear—thanks to the taped playback—the unmistakable signs of a vocal will to communicate. He began his manifesto in *Life* thus: "It is my firm conviction that within the next decade or two human beings will establish vocal communication with another species. That species might possibly be from another world; it could also be from this one" (Lilly 1961a: 68). The dream was always of *vocal* communication with the other, whether from sea, land, or outer space.

For Lilly, vivisection was the royal road to the voice. Jacques Derrida's *De la grammatologie* was published the same year as Lilly's *Mind of the Dolphin: A Nonhuman Intelligence* (1967), his second, even farther-out book on dolphins. Derrida (1997) famously argued that anchoring self-consciousness and "presence" in the voice was not only a bit of metaphysical mischief but also complicit in Western schemes of violence and imperialism. Derrida's apparently overwrought connection between the love of the voice and violence comes into focus in the context of Lilly's animal experiments. As if monkey and dolphins were enemy agents, Lilly sought ways to get them to divulge the secrets that lay hidden inside. What he thought of as a neurological investigation looks to us like another sorry chapter in the long annals of the relation between torture and truth (duBois 1991).

Though Lilly later renounced operating on dolphins, remorsefully believing that he had been running a concentration camp, he seems to have never thought twice about his orality fascism or at least fixation. His policy toward monkeys and dolphins was equivalent to the "oralist" practices of educators of the Deaf, an equally sorry chapter in the encounter of intelligent beings equipped with differential sensory equipment. Alexander Graham Bell was one of many nineteenth-century educators of the Deaf who required them to speak vocally as a condition of "proper" communication and suppressed their own well-developed manual and gestural systems of communication (Padden and Humphries 2006). The history of abuses against the Deaf uncannily anticipates Lilly's treatment of dolphins.

Lilly's encounter with these intelligent marine mammals resembles other first-contact episodes when a colonizer with superior gear both first brutalizes then romanticizes a colonized population (see Bryld and Lykke 2000: 48–89, 189–206 passim). What could fit the classic pattern more perfectly than the colonizer forcing the colonized to speak in the master's tongue? Though he didn't have much political sensitivity to the larger resonances of his work, Lilly clearly did sense the anthropological parallels to

his work. He suggested that learning how to speak with dolphins might teach men and women to communicate better and clumsily compared dolphins to nonwhite races: "For a long time," Lilly opined, "presumably [dolphins] will be in the position of the Negro races in Africa who are attempting to become westernized" (1961b: 125). Dolphins were his inkblot for his experiments with otherness—his version of it, anyway.

Taped Access to the Other

Excited by his Sunday-morning discovery of phonation, Lilly rigged levers the dolphins could operate in order "to self-stimulate," a task which the creatures almost instantly mastered (compared to the slower learning curve of monkeys). Only when he interrupted the self-stimulation would the dolphins vocalize. The first time a male dolphin broke the lever, "an explosive series of air-borne vocalizations began to erupt from his blowhole." These sounds were audible to human ears thanks to sound technology: "A microphone was placed over his blowhole with an amplifier leading to a loudspeaker so that the rather weak sounds that he produced could be heard easily throughout the room. I was using a stereo tape recorder, one channel to record the dolphin noises, the other to record my observations for transcription by my secretary" (Lilly 1961b: 77–78). (Note the two tape tracks of listening-in and of scientific soliloquy, one aquatic and the other terrestrial.) Lilly needed the acoustic apparatus because humans lived in an air-flesh medium and dolphins lived in an aqueous one. If dolphins "are to meet us in air we must furnish them with 'flesh-conduction' earphones so that they can hear us in air. If we are to meet them in water we must be furnished with some means of talking under water" (112). The lack of natural translating media, Lilly lamented, had segregated the two species into airborne and waterborne communication systems. The Communication Research Institute aimed to repair this ruinous breach. Sound media could potentially play a redemptive role in opening up exchange—just as radio signals might be the best way to seek contact with extraterrestrial intelligences (Cocconi and Morrison 1959).

After the blowhole eruption, Lilly heard some strange noises he hadn't heard before, which seemed like weird imitations of human laughter, and then even weirder sounds that he couldn't decipher until he played them back later. Upon repeated listening, Lilly thought the dolphin, known unceremoniously as "Animal Number 6," was imitating his dictations on one track of the tape recorder, though "in a very terse shorthand and quack-

ing sort of way." Neither Lilly nor his team could make "rhyme or reason" of why the dolphin selected what he did to mimic: "I say on the tape, 'The TRR (train repetition rate),' pronouncing it very distinctly so that my secretary can copy it down, 'is now ten per second.' The animal said, 'T R R,' in a very high-pitched Donald Duck quacking-like way. In the same way he picked out 'three hundred and twenty-three' when I said 'three hundred and twenty-three feet on the tape,' and reproduced it in his peculiar primitive but distinctive fashion" (1961b: 79). In this recursive tape recording about tape recording, we find a primal scene of human-animal contact, in which the border between mechanical mimicry and mischievous mockery is unclear. (Media like themselves best as content.) Unfortunately, after several hours of self-stimulation, Animal Number 6 died in an epileptic seizure, splashing water all over the lab in the course of its *Liebestod*.

A detailed knowledge of comparative bioacoustics informed Lilly's obsession with what he called "vocal communication with another species." Dolphins and humans, he recognized, possess radically different kinds of instruments: dolphins play pizzicati on a small violin whereas human voices are more like organ pipes (180). The dolphin range is supersonic: "Their physical conveyors of meaning may not overlap ours at all" (198). Bottlenose dolphins can hear and produce sounds up to 160 kHz in contrast to 20 kHz, the upper limit for (young, healthy) humans; the lower limit for dolphins is around 400 Hz, in contrast to about 20 Hz for humans. Thus, a dolphin could not hear below the G above middle C, which puts the fundamental pitches of most human male voices out of range. Nonetheless, Lilly wanted dolphins to learn new ways of speaking: "it may be possible to teach these animals to vocalize so that we may establish communication with them" (189). Somehow teaching (or forcing, as he would write elsewhere) their voices was preferable to stretching our ears.

Lilly, a capacious thinker who rarely met a speculative hypothesis he wouldn't entertain, was remarkably unimaginative about communication in other modalities than the voice. His vision of communication as the bridging of minds instead of the mutual and peaceable mingling of differences came with high demands: "It may be impossible for these animals to learn to speak any human language because of the differences in their vocal apparatus. It may be impossible for us to speak their language because of the difficulty with our vocal apparatus. We thus may be forever separated in separate universes of discourse; the pathways to communication may not be solvable at the present time" (208–9). Yet the plasticity of dolphin vocals—which he claimed exceeded all other animals—gave him hope. "All

of them (wild or captive) frequently creak, putt-putt, and whistle under water, with some rare quacks, squawks, and blats under water and in air." Dolphins trained by humans at first emit "loud clicks, creakings, whistles, squawks, quacks, and blats" but can learn to "sing" or "wail" in ways that sound like humans singing or babies crying. They could learn to produce "low-pitched whistles, a sound like a plucked banjo string, a baby crying and two cars passing on a nearby highway" (Lilly 1961a: 68). (As always, part of the joy of sound studies is watching the ekphrastic ingenuity of writers before unusual sounds.) Dolphins could also learn to "suppress the other sounds because to humans they sound raucous, derisive, impolite, even scatological, but at least very alien" (Lilly 1961b: 195). (The dolphins were quite adept at making farting noises.) The more he probed, the more he thought creatures with vocal organs plastic enough to produce laughter, whistles, and Bronx cheers might well produce words as well.

Lilly found himself repeatedly in the position of the cryptographer—or the spiritualist—trying to decode garbled messages. "Their language and its meanings is crypto-vocal as well as cryptographic!" (199). It is curious that he didn't choose this more noninvasive option, also very much alive in postwar militarized communication research. Because of the high frequency range of much of their phonations, Lilly found dolphin voices more audible when played back at slower speeds. When he played the tapes at half, quarter, eighth, or sixteenth speed, he heard new things: "Apparently these animals are quite capable of taking a vocalization by a human and compressing it with respect to time. We found that most of the vocalizations made far more sense and their inherent complexity showed up much more easily when we extended their duration and lowered their pitch by slowing down the tape" (80). (To think that dolphins compress time in vocalizing was somehow a simpler hypothesis than the possibility that his mind was projecting a gestalt.) Dolphins could also learn to respect the relatively limited acoustic range of the human ear and voice. Lilly claimed to have taught Animal Number 8 what he could hear and what he couldn't. "It is experiences like this that give us hope that these animals will attempt to meet us at least halfway in our attempt to communicate with them" (89).

Lilly's wishfully benign project of inter-species communication ran aground on its underlying master-slave dialectic. Here we have a dolphin restrained in an oversized aquarium with an electrode in its brain and in water so cold that (as Lilly later found out) it froze and crippled the animal's back muscles, and Lilly wants it to meet him halfway? Cybernetics, as conceived by Norbert Wiener, was the science of "control and communica-

tion in the animal and the machine" (1948), but it also had bellicose origins based on an "ontology of the enemy," as Peter Galison (1994) puts it. Lilly's effort to communicate with dolphins was a kind of "Manichaean science," as Wiener called it, a war game in which it was impossible to distinguish reciprocity, respect, rote repetition, reflexivity, rivalry, and recalcitrance (1954: 34–35, 190–92).

In one poignant example, Lizzie, a dolphin injured during transport to the institute, apparently imitated, on the eve of her death, a loud statement by one of Lilly's associates about the time of day: "It's six o'clock." Writes Lilly,

> The tape recorded this on the air channel; in a few seconds on the underwater channel Lizzie putt-putted, Baby [another dolphin] answered with a short fast series of whistles, and Lizzie very loudly came out with a "humanoid" sentence, the meaning of which (if any) has puzzled several of us since. It may have been a poor copy of "It's six o'clock." But I was caught first by another "meaning." It sounded to me like "This is a trick!" with a peculiar hissing accent. Other people have since heard the tape and come to the same conclusion. (1961b: 203)

What Lizzie had in mind, if anything, is indeterminate. Was Lizzie's hiss a mundane report on the clock time, a denunciation of the whole enterprise, a deathbed confession of her collusion with Lilly's desire to find submarine mimesis, or a tape-induced auditory hallucination of Lilly's own will to find meaning? The undecidable fate of espionage, madness, religious experience, or dolphin research is to hear a voice that you think is speaking to you, but you have no clinching evidence that it really is. Is that sound the other calling to you or auditory pareidolia? Lilly asked the same kinds of questions posed by others at the time such as Samuel Beckett, Erving Goffman, Roman Jakobson, Stanisław Lem, or Sylvia Plath: "How do we know when someone is speaking to us? How do we know they aren't humming a tune, singing a song, talking to themselves, conversing with someone else, hallucinating a vision, repeating nonsense, doing an echo-ranging job with their voice, speaking in a language foreign to us?" (Lilly 1967: 61).

Communication was the great mystery of postwar intellectual life. Like the "Blue Marble" image of the earth taken in 1972 by the crew of the Apollo 17 spacecraft, Lilly managed to pull a vision of a pure untouched beauty out of the midst of history's largest military-industrial complex. Complicated technical systems often produce compensatory fantasies of apparatus-

free universes. Walter Benjamin nicely called such infrastructure-erasing idylls the "blue flower in the land of technology" (Benjamin, 2008: 35). Lilly's dream of communication was such a blue flower. He was remarkably disdainful of the "gadgetry" that enabled his work (Grebowicz 2017: 23–24).

Varieties of Taped Experience in the Late 1950s

Lilly did his experiments with Animal Number 8 and Lizzie in November 1957 and April 1960. It was a good moment to be using tape as a means to get in touch with the other's voice and many creative minds experimented with tape in diverse ways. What electronic music composer Vladimir Ussachevsky said of "music in the tape medium"—that it depended on "an ear and an imagination whose capacities and sensitivities have been extended by means of scientific instruments"—also holds for much more in that period (1959: 19). (Ussachevsky was only one of many composers to make innovative use of tape in this period, such as John Cage, Pauline Oliveros, Steve Reich, Terry Riley, Pierre Schaeffer, Karlheinz Stockhausen, Edgard Varèse, Iannis Xenakis, and La Monte Young.)

Samuel Beckett's one-act play, *Krapp's Last Tape*, was first performed in London in October 1958. Set in "an evening in the future," the play features Krapp, a rather gastrointestinal old man, listening to the autobiographical tape recordings he has been making for decades. (It is set in the future because tape recording had not been around long enough to produce several decades of memoirs.) He begins by consulting a ledger that indexes his tapes: when he finds box three, spool five, he celebrates its "spool!" with a childlike glee. (Here Beckett, as ever, mixes the existential and the slapstick.) The premise of one voice/two speech sources—the self in stereo—allows Beckett to stage a monologue interrupted by another self from other years, some of whose references are lost or obscure. "Equinox, memorable equinox. (*He raises his head, stares blankly front. Puzzled*.) Memorable equinox? . . . (*Pause. He shrugs* . . .)" (Beckett 1958: 13). The effect of the layered voices of old Krapp and young Krapp is by turns hilarious and poignant, a meditation on repetition and its impossibility over time. Krapp stops, forwards, rewinds, and replays the tapes and makes a new tape for this year as well. (One of the peculiarities of tape recording, as Andrea Bohlman and Peter McMurray [2017] point out, is that erasure and recording are achieved by the same means. You record over to erase a previous recording.) Krapp keeps returning, with a mixture of remembered bliss and bitter contempt, to a recorded memory of a long-lost romantic

encounter. Beckett unfurls a small metaphysics of the tape recorder, with its non–random access, problem of indexing, and playback-recording bipolarity. In this play, the tape recorder puts not only the other but the self into elusive, impossible contact (Connor 2010).

In 1958, Beckett styled Krapp as a DIY home tape recordist. Three years earlier in Heinrich Böll's short story "Murke's Collected Silences," tape recording was for professionals. His protagonist, Dr. Murke, works at a postwar German broadcaster. A prominent blowhard aesthetician, one Bur-Malottke, insists that in an already recorded radio talk the term "God" be replaced by "that higher Being Whom we revere." Murke receives the assignment to fix the recording by cutting, splicing, and editing. But Murke can't just drop in the new snippet because German grammar requires the phrase to bend depending on the case, so all manner of comic complexities ensue. In the course of his work, Murke assembles a precious collection of strips of taped silence, which he splices together for his private pleasure. Murke also gets a lady friend to sit silently in his home before a tape recorder that is recording; he is pleased to enjoy both her "silence in the original and on tape." She, however, finds something immoral in the silent taping. Böll indeed has a morality of tape; Bur-Malottke's excision of "God" is an allegory of the postwar cover-up of the recent Nazi past. Murke, who is apparently too young to have been complicit in any atrocities, relishes the string of taped silences (Böll 1966: 146).

In 1958, the Harvard zoologist Donald Griffin published *Listening in the Dark: The Acoustic Orientation of Bats and Men* (1958), a treatise on bat hearing that is also a masterpiece on the phenomenology of listening. Griffin coined the term *echolocation* and helped demonstrate the uncanny ability of bats to navigate around obstacles such as wires hung in a darkened room, thanks to their ultrasonic vocalizations. To study bats, Griffin abandoned the range of frequencies adapted for human ears and listened to sounds up to 200 kHz using cathode ray oscilloscopes, amplifiers, microphones, and other postwar acoustic media. (Griffin too was listening in the dark!) By playing tapes of bat voices at slower speeds, he was able to hear the constant signaling of the animals, something that was audible to researchers previously only as ticks or clicks. Griffin used sound technologies to pull the human senses into alignment with those of other organisms; the small brains of the bats spared them the high expectations of human-style communication that Lilly brought to dolphins. His research, like Lilly's, was clearly connected to the military-technical context of developing radar and sonar for Cold War dominion of air and sea.

The founding text of the search for extraterrestrial intelligence, often abbreviated as SETI, was "Searching for Interstellar Communications" (1959) by physicists Giuseppe Cocconi and Philip Morrison. Radio astronomy had been around since the 1930s, but this text was new in stipulating the optimum channel for transmission. If there were intelligent species in the cosmos, how would they communicate with us? Cocconi and Morrison called for "a discriminating search for signals," recognizing the problem of distinguishing natural pattern from intelligent intention. A signal tweeting out a sequence of prime numbers, for instance, would be an unmistakable mark of intelligent life. The smallest fragment of a will to communicate would prove that we were not alone in the universe, but it was so easy to misread distant signals. As Wiener had noted, "In the problem of decoding, the most important information which we can possess is the knowledge that the message which we are reading is not gibberish" (Wiener 1954: 124).

Cocconi and Morrison suggested looking for the needle in the haystack on the "interstellar hydrogen line," a cosmic constant they thought discoverable by any intelligent radio astronomer in the universe. As with dolphins, the question was first how to find a shared channel and then discern intent to communicate. Mimicry—i.e., a parallelism between sending and receiving—served Cocconi and Morrison as the gold standard for communication. They used radio rather than tape, but front and center was the question of improbable connection by way of sound. Lilly had strong ties with the SETI community, and several luminaries from it visited his institute. (See for instance, "Prospects in the Search for Extraterrestrial Civilizations," Box 28, John C. Lilly, special collections, Stanford University.) Sagan, the public face of the quest to find the intelligent other in outer space, warmed to the idea of cetaceans as the oceanic extraterrestrials. He even enjoyed trying to imitate whale song, which he boasted had an informational density exceeding that of the *Iliad*. (You can see him almost absurdly frothing about this on YouTube, together with the inevitable rap remix [Sagan, n.d.].) Sea and outer space were the twin "extraterrestrial commons" full of yet uncontacted alien intelligences (Bryld and Lykke 2000: 19–21).

On June 12, 1959, Friedrich Jürgenson (1967), a Stockholm-based opera singer, painter, and film and radio producer, took a new tape recorder to record birdsong in the Swedish countryside. Upon playback, he heard a trumpet fanfare and a man saying in Norwegian "nocturnal bird voices." He thought the tape recorder was malfunctioning but soon discovered it was tapping into paranormal channels. When he coupled his tape recorder to his radio, he discovered a multilingual voice fest within the analog broad-

cast signals. He thought that these "electronic voice phenomena," as they came to be known, were the voices of the dead, some of them ill-used and seeking justice, and seizing upon the available medium like biblical dispossessed demons entering into the bodies of swine. (Somehow the dead chose to communicate exclusively in languages that Jürgenson knew.) Even Jürgenson's electric shaver sang at him, a female voice pleading to stay in contact. The content of the communications was highly reflexive, often commenting on the channel itself. At first he worried he had gone mad, but his capture of the voices on tape allowed him to play them back for others, who assured him of the legitimacy of his efforts at decipherment. (He hosted some entertaining sounding gatherings in his Stockholm living room.) The tapes provided objective documents for others to consider, saving him from the fear of private psychotic projections.

As with Griffin and Lilly, one of Jürgenson's chief practices in what he called "the art of listening" involved altering playback speed. Time-axis manipulation made the word salad intelligible, even if it could not decisively determine whether the message was "it's six o'clock" or "this is a trick." Noting the fragmentary syntax of the electrical voices, he speculated that the rules of grammar and syntax must be relaxed in the worlds beyond. "Federico, Federico in look," said one voice to him. It was as if the spirits of the dead were suffering from aphasia—damage to their neurological speech centers—even as they were speaking in tongues across the ether.

Ruth Hirsch Weir, a Stanford psychologist and founder of the field of applied linguistics, started to tape her toddler son Anthony talking to himself in his bedroom from June to August 1961. As Viktoria Tkaczyk shows, Weir's intrafamilial recordings fit into a long tradition of research in child language acquisition. And as you might expect, Anthony quickly made the apparatus the theme of his discourse. He apparently did not know about the recording but still used the term *microphone* as often as the word *milk* (Tkaczyk 2018). The tape recorder captured speech just as fractured as Krapp muttering to himself or Jürgenson's multilingual spirits. Roman Jakobson, who contributed a preface to Weir's volume, noted that many of the recorded bits bore "a striking resemblance to the grammatical and lexical exercises in textbooks for self-instruction in foreign languages: 'What color—What color blanket—What color mop—What color glass. . . . Not the yellow blanket—the White . . . It's not black—It's yellow . . . Not yellow—Red. Put on a blanket—White blanket—And yellow blanket—Where's yellow blanket . . . Yellow blanket . . . There is the light—Where is the light—Here is the light" (Weir 1962: 19, 27). The recorded bits of speech in the crib also sound a bit like Beckett,

or Eugène Ionesco, who wrote an absurdist play inspired by the fractured dialogue he found in learning English via the so-called Assimil method combining books and tapes. You can imagine the coded import a Lilly or Jürgenson could pull out of the babblings of Weir's son if told they were from dolphins or the dead.

Lilly was only one of many tape-informed psychonauts in the late 1950s. Those who sought communication with enigmatic voices such as the self, aliens, bats, the dead, children, or dolphins faced the problem that the voices would not appear on command, and when they did appear, they were inaudible, fragmentary, syntactically ambiguous, and usually more interested in metacommentary on the medium than any critical message. Lilly, Beckett, Griffin, Cocconi and Morrison, Jürgenson, and Weir all employed the latest tape technologies, and many were embedded in the Cold War military-industrial-science complex. The kinds of language they trafficked in were full of fragmentary signals and metacommands. This is what the wonders of modern communication media had brought us: memorable equinox, Federico in look.

Lilly's Auditory Legacy

Tape was always the "media a priori" (Kittler) of cybernetics. Alan M. Turing's paper that inaugurated the digital era imagined an infinite spool of paper on which programming would be carried out; Wiener's word for software or programming was "taping." In mathematical automata theory, tape still supplies the metaphorical material. Magnetic tape remains a medium of choice for long-term digital backup storage. Lilly's experiments plunged him into the tape medium. A 1962 lecture starts with an epiphany. Sensitized after years of working with dolphins, Lilly contracted "a feeling of weirdness" that helped him "listen to some rather queer noises that the dolphin was producing in the laboratory and to review them very carefully on the tapes." "We were up against the edge of a vast uncharted region in which we were about to embark with a good deal of mistrust concerning the appropriateness of our own equipment" (Lilly 1974: 72ff). This mistrust was not only technical but ontological and would grow into a full-fledged New Age doctrine of dolphins as intelligent extraterrestrial beings who would show humankind the way out of their warlike and uptight ways. As noted, Lilly sat on a major cultural rift: the counterculture was not the antithesis to the military science of the 1950s, as Burnett notes, but its apotheosis (2012: 617). Within a dozen years, he had transitioned from military neurosurgeon vivi-

secting monkeys to a New Age apostle of sexual and pharmaceutical liberation. LSD and sensory isolation tanks may have once been CIA experiments in mind control, but they took on a cosmic profile. Dolphins, like television, microwaves, plastic surgery, aluminum foil, the "Blue Marble" photo of the whole earth, were abuses of military equipment.

Perhaps the most unorthodox of all Lilly's dolphin experiments was the ten-week cohabitation of Margaret Howe, a local college student, and a dolphin named Peter in a specially constructed flooded room at the Communication Research Institute in the summer of 1965. Her job was to teach him to speak English. Apparently, she came up with the idea, which Lilly supported, since it fit with long-held views of his. (Others, such as Gregory Bateson, proposed a much more sensible plan of trying to listen cryptographically into dolphin phonations—to eavesdrop on an extant "language" rather than to enforce bilingualism.) Margaret and Peter lived together in an amphibious environment complete with the 1960s-sounding name of "encounter space" and even shared the same food (butterfish). Sleeping was an uncomfortable hassle for her, and the constantly damp clothes chapped her skin. The original design was that Howe was to be Peter's mother, but they ended up as lovers. As Donna Haraway points out, women pioneered the human-animal boundary in primatology; the same was true for cetaceans (Haraway 1989: chap. 11 and passim). (The higher-resonance frequencies of human female voices, which are typically an octave higher than male voices, also aided dolphin audition.) Howe's housekeeping tasks were those of a 1960s mom or schoolteacher: washing, eating, playing, cleaning, vacuuming, sleeping, teaching, cooking, talking on the phone. Her work was never done: "Listening to all the tapes is endless," she said (Lilly 1967: 264).

As we have seen, there was a certain madness in trying to rig an interface with aliens in which they would, as in *Star Trek*, the television series of the late 1960s, all speak English. (In a brilliant *Far Side* cartoon by Gary Larson, dolphin scientists cluelessly puzzle over a recurring indecipherable phonation: "aw blah es span yol?" [i.e., "habla español?"].) Peter learned to "somewhat imitate the word 'ball' and 'hello'" (Lilly 1967: 269) but never learned to make the bilabial *M*-sound of "Margaret," probably for well-founded anatomical reasons. (Dolphins don't have lips or voluntary control over facial musculature.) Nonetheless, she pressed forward. In a recording of their interaction, you can hear her scolding him for making a farting sound: "Peter, that's noise!" (Lilly 1994: track seven).

Farting sounds, alas, are not the only complication that females who spend extended time with males have to deal with. The cohabitation of

female human and male dolphin would become one of the most notorious parts of Lilly's work. Howe noted, "I find that his desires are hindering our relationship" (Lilly 1967: 274). He was "too rough to handle," her shins were getting bruised from his friskiness, and she could not satisfy him sexually: "once Peter does have an erection, his mood usually changes completely and he gets so rambunctious I have to leave him" (279). She tried moving him to a tank with female dolphins but even that didn't seem to work. Eventually they worked out a mutually satisfactory arrangement of touching and rubbing (282). She later reflected that it was sexual on his part, but "sensual" on hers. Such doings in the encounter space would yield tabloid-friendly salacious headlines for the recent BBC documentary on their relationship, *The Girl Who Talked to Dolphins* (Riley 2014).

Lilly summed up Howe's work with a soupçon of condescension: "Margaret Howe did a magnificent job. She now rates a long earned vacation. Her intraspecies needs are being taken care of: she, like the girl with the chimpanzees in Africa, married her photographer" (1967: 300). Lilly almost seems pleased here to hail the restoration of the human heterosexual order: all comedies end with a marriage! It was also a weirdly media-enhanced love triangle; John Lovatt, Howe's husband, took the pictures of the live-in. As for Peter, things turned out less well. The big reveal of *The Girl Who Talked to Dolphins* is that he committed dolphin suicide by ceasing to breathe, putatively due to a broken heart from Margaret calling it off.

Tape Loopiness

Ever the tape recorder artist, Lilly shifted from cetacean to human consciousness in the later 1960s and 1970s. Cetaceans served him, like many others, as models of vast musical intelligence. "Imagine being able to relive a full playing of Mahler's *Messiah* or any of your favorite symphonies without any apparatus or recordings outside of your own brain!" (Lilly 1967: 116). (I would love to hear what that piece of nonexistent music sounded like! At least Lilly's mash-up reaches for the majestic zone of the repertory.) Insanity was just the name a confined society gave to the full exploration of the mind; playing an antipsychiatric note, he called for "outsanity" instead. He noticed that when people listened to tape loops of a human utterance and dolphin response, they would hear many more words in the human than the dolphin voices. This was not just projection or the human rage for order. It was the generativity of the "human biocomputer." He thought all organisms were biological storehouses of programs (85ff).

The precise definition of mental illness was getting stuck in a tape loop. The tape recorder furnished Lilly with a concrete model of Freud's repetition compulsion. In a recording from one of his workshops, Lilly intones,

> One problem in human existence is the tendency to repeat, repeat feeling, thinking, action again and again and again in the same kind of looping cycle. It is as if one is controlled by a set of loops of tape. On these tapes are recorded what one says on one track, what one feels on another track, and what one does on the third track. And these are endless loops, and one tends to repeat these again and again and again. (Lilly 1994: track two)

But tape loops were not only the disease but also the cure. Lilly would play loops to his hearers in the hopes that they would break up into revelatory glimpses of underlying processes. Studies of the perception of repeated terms were a favorite of military psychologists concerned with the tricks played by strains on attention in repetitive tasks, such as for radar operators. The danger was telling apart a genuine threat from the "eisegesis" (reading in) of a bored screen watcher (Case 2010). The rapid repetition of an identical word on a tape loop would often start to break apart for the auditor into multiple intelligible words.

Lilly's most famous loop repeats the single well-chosen word *cogitate*, which he enunciates with a slight upper Midwest accent. Listeners reported hearing the word morph into "count to ten" and "melt into it," among many other words; Lilly believed that tape loops could induce an experience quite like LSD in "tripping out." (Another sentence he used: "Deeper and deeper, mother and I are fusing" [Lilly 1972: 63–67].) Such loops could generate fragments of psychoanalytic redolence. The looping repetition of the stimulus "kettle," for instance, could yield such perceived words as "petl," "kut-off," "genital," and "killum" (Lilly et al. 1967: 7). (With striking self-restraint or obliviousness, Lilly fails to note the castration theme.) His quest for a higher form of awareness travels sent him straight from militarized sensory psychology to the California and Maui seashores, where he spent the last three decades of his life as a guru helping others liberate themselves from and with tape loops.

Sometimes he seems to have had second thoughts about his new career as a guru. Consider his poem, dated November 15, 1969, called "I am not the tape looping." With some Yoda-like syntax and Rod McKuen-like stabs at confessional honesty, the poem begins by asking, "Why do I give 'seminars-workshops?'" He wonders if he only feels alive in front of an audience: "You, my audience, make real, me." But then the poem goes meta, as

he is disgusted not (sadly) with its lousy quality but with the very fact that he is writing it at all:

> Round and round rotating unhappily
> Looping you looping me into the old dance.
> This old tape is whirling its senseless self in my computer.
> Can it be broken, erased, drowned, removed?
> Watch it play back—Witness.
> Know its contents.
> On its emoting control-track, see-feel the negative-positive swings.
> Re-record on this track, dampening the swing peaks.
> Play back again, dampen further.
> Till finally the Witness is not the tape, the tape not the Witness.
> Groovy trip, re-taping emoting loops.
> I am not the tapes looping.
> (Lilly 1975: 271)

Here we have unhappy psychic processes modeled on the tape recorder. By playing back again, you can dampen further or erase the Witness that keeps you looping, or something like that.

By the mid-1970s, when Lilly was having what look like psychotic episodes, likely from heavy doses of LSD and ketamine ("Vitamin K"), he was convinced, among other things, that he was an agent of an "extraterrestrial solid-state civilization" that controlled his mind, body, and the world. His name for God—E.C.C.O., the Earth Coincidence Control Office—belongs in the long line of influencing machine delusions that have fascinated psychoanalysts and media theorists. Humans had a solid-state civilization, but dolphins had a wet civilization. "We must learn to live wetly," he intoned (Lilly 1967: 167). His computer metaphors for networked brains paralleled the ways that delphinid networked intelligence is sometimes figured as foreshadowing the internet.

E.C.C.O. is also the title of a 1994 electronic music CD Lilly produced with two Japanese electronic composers. It provides a full palette of ambient sounds—shimmering synths, pulsating drums, choirs, bagpipes, and organs, space-age reverberant sounds of rockets and jet engines, with some new touches such as dolphin calls that morph into seagulls or banshees. Spoken words from Lilly voicing Huxleyan-Blakean themes about bursting the doors of perception repeat on several tracks. Lilly's Gnosticism takes a slow-paced delivery that one would not be surprised to hear that Laurence Fishburne had studied to play Morpheus in *The Matrix* (1999):

"I feel that I am merely an agent, giving you some keys which have been given to me to pass on to you. These keys are to unlock doors out of your present prison, doors opening on new vistas, doors beyond where you are now" (Lilly 1994: track 2). (Indeed, E.C.C.O. is a perfect model for the Matrix, with its solid-state civilization.) The CD itself is full of loops, and all this loopiness is meant to "make you more aware of the repetition processes occurring in your body." The cure for a loop is homeopathic: another loop. Lilly's "cogitate," with a genre-appropriate pulse of about 160 beats per minute, appears on three of the CD's tracks, meant to stir us from the stupor of our unaltered consciousness. One track even features an exchange between Margaret Howe and Peter Dolphin, in which she half coquettishly, half schoolmarmishly calls him a bad boy for ignoring his English lessons and he makes some Bronx-cheer-like noises. (For transcripts of their taped interactions, see Lilly 1967: 288–95.)

As a scientist, Lilly flamed out. He lost touch with mainstream science just as he broke into the ozone layer. His writings of the 1970s, which stretch into autobiography, theology, and self-help, deserve a more careful look by someone with more patience than I, as does his resonance through popular culture. Characters based on him showed up in films, novels, and popular songs. (The story of Peter and Margaret even made it into *Hustler* magazine, much to her distress.) He served as a node within a West Coast countercultural network, and a long list of celebrities and intellectuals took a dip in his sensory isolation tank at some point and left a testimonial about the experience, including Gregory and Lois Bateson, John Brockman, Werner Erhard, Richard Feynman, Alejandro Jodorowsky, Burgess Meredith, Jerry Rubin, Francisco Varela, and Andrew Weil (Lilly 1977: chap. 13).

We can conclude by noting his massive influence as an unacknowledged legislator: he was the principal author of the postwar "dolphin script" (Bryld and Lykke 2000: 189). Given the large role that whale and dolphin voices played as a soundtrack in the 1970s and beyond—a recording of whale "song" was sent into space in 1977 on the Voyager Golden Record—Lilly had an ongoing sonic signature (Burnett 2012: 638; Grebowicz 2017). His career "can be concisely traced on a plane defined by two of the era's significant axes: sex and drugs" (Burnett 2012: 611). In this essay, I have tried to show that the other significant axis of the era, rock and roll, or at least taped sounds, also played a role. Tape was the medium that allowed him to extract voices from dolphins and to shift their phonations into human range. Tape was the *Star Trek*–like universal translator that put everything into a language that Lilly could understand.

Coda

In the end, I do not really know how to take Lilly. There is so much about him that boils down to what Burnett calls "period burlesque" (2012: 617), such as the poem quoted above. Lilly was both explorer of alternatives to the human shape and a medical murderer of another species. He injected dolphins with LSD and then would make loud crashing noises when they didn't seem sufficiently moved by the experience. Lilly's archetype is the penitent compassionate killer, rather like the conservationist Aldo Leopold's lamented but nonetheless formative experience of killing a wolf. His sometimes megalomaniac quest for pharmaceutically enhanced cosmic truth does not seem to have been very good for his family, friends, or mental health. (See, for instance, the rather addled, coonskin-cap-clad Lilly in a taped interview [Lilly 1998].) I find the cultishness of his persona and the tilt from the white-male-crewcut culture of mapping the brain's pain and pleasure centers into California consciousness and druggy spirituality hard to digest. Besides that, a lot of what Lilly says is the sheerest bull honky.

And yet not all of it is. Lilly deserves a good and discerning reader. He belongs to a longer transcendentalist tradition in his identification with the inhuman. Thoreau asked if he might not take intelligence with the earth, Emerson had sympathy with scorpions, Dickinson saw a snake as a "fellow," and Melville's white whale was of course an allegory of everything between heaven and earth. Lilly in turn: "May there not be other paths for large brains to take, especially if they live immersed in some other element than air?" (1961b: 68). That is not a stupid question. It asks how our bodily shape in interaction with our habitat makes us who we are. It is a question I pursued in a recent book with regard to dolphins; this essay is in part an uneasy reckoning with an anxiety-inducing forerunner (Peters 2015: chap. 2). To his credit, Lilly genuinely regretted his macho experiments and sounded notes that made him a feminist ally. Among the annals of crazed white men who populate media theory, he at least had the decency to regret the machismo of his earlier work. For Bruce Clarke, perhaps his most sympathetic reader, Lilly was a visionary forerunner of second-order cybernetics (Clarke 2014). I wouldn't go that far, though Clarke makes a compelling case. But as someone who saw tape recorders as wormholes into other forms of being and sat at the heart of the nexus of postwar weirdness, Lilly is not someone I think we can ignore. There are surely other thinkers from the period we might like or admire more, but who else thought to put aliens, dolphins, voices, drugs, sex, computers, and tape into the service of fan-

tastic and toxic dreams of communication? Lilly set out an agenda we are still figuring out how to work through.

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