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Luck had nothing to do with it, according to the German social philosopher (and pianist, music critic, and radio disk jockey) Theodor Adorno. The problem with radio transmissions was less a problem of challenged or scattered hearing than of commandeered listening. Music-making, recording, distribution, and broadcasting were part of a sonic trap set by capitalism, which espoused easy listening as an adjuvant to easy consuming. Industrial society promoted an ethos of mechanical repetition and facile reproducibility that encouraged symphonic snippets and folksy tunes that relied on the comforts of familiarity for their appeal to the heart, the will, and the wallet. "Light" music was light on meaning, heavy on ideology—an ideology of immediate pleasure and quick spending; serious music, which required work of its audience, and cogitation, rewarded listeners with liberating alternatives of sound and sense. Recording technologies always threatened to turn music into a commodity by making it into a marketable material, and technical demands for a narrow mid-frequency tonal range and placid dynamics made serious music, whether twelve-tone, atonal, dissonant, or rhythmically venturesome, nearly prohibitive to record, so "record players" had become conveyances for compositional inanities and routinized performances, "pre-given and pre-accepted." Avant gardes could experiment with gramophone systems to create "legitimate, functional loudspeaker music" hitherto unfeasible, and audiences could benefit from repeated playings to achieve a keener interrogation of performances or pieces—so the technology was not altogether sinister. In the ordinary run of things, however, listeners were being trained to perceive "the complicated only as a parodistic distortion of the simple," that is, as noise; further, they were being trained to attend less to the musical qualities of a performance than to the celebrity of a well-advertised voice or widely photographed composer, which had more to do with commodity fetishism than music criticism. So popular (and recorded, and repeatedly broadcast) music had become a fixture, wrote Adorno in 1941, in a "system of response mechanisms wholly antagonistic to the ideal of individuality in a free, liberal society."[230]

Reframed in the language of Hartley's information theory as elaborated during and after the Second World War, Jeans's problem of hearing and Adorno's problem of listening were both problems in redundancy, at opposite ends of the spectrum of noise. Jeans the physicist made it seem that there was too much noise in all channels, biological and technological, to allow for trustworthy broadcast from a radio studio over the airwaves to the auditory cortex; Adorno the social philosopher made it seem that there was too little noise in most channels, cultural or political or jazz, to prompt healthy variations that would stimulate the intellectual labor necessary to a critical take on the world and, hence, a wider ambit of personal freedom. In the postwar terms of Bell Labs' Claude Shannon (juggler, unicyclist, and originator of digital circuit design) and MIT's Norbert Wiener ("ex-prodigy," and formulator of cybernetics), the greater the redundancy of symbols conveyed through any channel—with noise, *always* with noise—the greater the certainty of reception but the more impoverished the information. Call entropy, H, the freedom of choice in the symbols to be conveyed: not just the variety of symbols available but the rigidity of the rules for selecting one over another, one after another. The greater the randomness or freedom of choice, the greater the entropy and the greater the uncertainty about what has been conveyed—not, mind you, the meaning of the symbols, but the nature and number of the symbols transmitted. With H approaching 100 percent, what comes through can be no more than "white noise"—a statistical and (to Shannon) uncomfortably figurative term which, externalized in acoustics, sounds like an oceanic wash of random frequencies and amplitudes or (to the MIT psycho-acoustician J. R. Licklider) "like the noise of Brownian motion, like the noise inherent in a resistance . . . like ss-sh-hh-hh-hh." With H approaching zero, when there is scant choice of symbols to be transmitted and high redundancy, the conveyance can be close to certain but the information may be nil. With H around 50 percent, as in English messages (half of whose symbol-choices are determined by rules governing syntax and semantics), and with memory operative (so that what comes before affects what comes next), there can be greater certainty about what has been conveyed, since one can closely calculate the probabilities of sequences of symbols and syllables. Even so, if one considered, as did Wiener in 1949, the percentage of spoken words that reach the auditory cortex intact, then "the crude non-human measurements" of statistical mechanics "fail to give an adequate account of the tremendous losses of information inseparable from nervous reception and the transmission of language into the brain." Case in point: when leading thinkers had met in 1946 to discuss the significance of "Feedback Mechanisms and Circular Causal Systems in Biology and the Social Sciences," the psychologist and field theorist Kurt Lewin had spoken so quickly and deferentially that "from the noisy mechanical recording device

we unfortunately have no record of the substance of any comments he made at the first meeting." A human receiver, self-noisy, must *always* contend with noise as "intersymbol interference" or "spurious" information, a function of all that comes through a channel of a specific bandwidth. The consequence, which Shannon's friend Warren Weaver found most "bizarre," was that "the two words *information* and *uncertainty* find themselves to be partners."[231]

Three hundred years before, the English physician Thomas Willis had written up second-hand accounts of "a certain kind of Deafness, in which those affected, seem wholly to want the Sense of Hearing, yet as soon as a great noise, as of great Guns, Bells, or Drums, is made near to the ears, they distinctly understand the speeches of the by-standers, but this great noise ceasing, they presently grow deaf again." Aurists came to accept such "paracusis" as a common paradox: the hard-of-hearing may hear better in loud environments. The physics of this phenomenon, in which word and noise were acoustically partnered, had been laid out for Knudsen by a genial otologist: "high frequency vibrations which are little ones *creep in* on the low frequencies which are big ones," making speech temporarily audible. This made no sense to someone of Knudsen's background, who found that noise *always* got in the way of accurate hearing. In 1929 he demonstrated to his own deep satisfaction that paracusis was paralogical: noise never directly abetted hearing; rather, in noisy situations people unconsciously and unself-consciously speak more loudly, enabling the hard-of-hearing to make out more of their words. Now, with information theory, paracusis seemed to be rearing its ugly ears again and (how could this be?) as no less than a paradigm of communication: no noise, no message.[232]

Correlative or cause? Did noise make communication possible? Was noise, like the bawling and babbling of infants, the nesting ground of all messages? Or, like the call of the parasitic cuckoo, did it lay eggs in the nests of other message-makers, confusing all species of sound?[233] Information theory was agnostic: it made no assumption about prime movers. Noise was axiomatic and affected all conveyance; this did not mean that noise effected conveyance. Cybernetics and the ensuing biophysics of stochastic (probabilistic) processes would be less reluctant to identify noise as omnipresence and effector—as a sort of creator. The momentum for such an acoustemology, where it did not harken back to Babylonian creation myths or Lucretian physics, stemmed from feedback systems as conceived for automata, steam engines, demographic curves, and thermodynamic processes.[234] More immediately, it stemmed from the experiences of electrical engineers who had suffered through feedback from microphones, radio receivers, and public address systems, and who by 1930 had begun to employ feedback in frequency modulation and noise-damping circuits,

transforming what had been at worst an ear-splitting interference and at best a clue about crossed wires into a means for calming and even strengthening signals. The momentum came most directly from work done during the Second World War on statistically noisy problems—how to program a machine to decipher codes far faster than a cryptographer; how to incorporate binary electrical switches into that program; how to design anti-aircraft guns to achieve deadlier results against faster targets by linking them to radar; how to construct programs that computed new trajectories and re-aimed the guns more swiftly than the best artilleryman. As a mathematician and a theorist of Brownian motion, Wiener had been involved in those efforts at the proving ground in Aberdeen, Maryland, laboring over noisy calculating machines known as "crashers"; postwar, as the son of a world-famous Jewish philologist, he applied the principles of adjuvant feedback to the analysis of speech itself, which could only be acquired when an infant heard its own voice well enough to amend the sounds it was making and align them with the select, inflected sounds of its native tongue(s). Without error-correction and audible feedback all the days of our lives, our organs for speech production were too sloppy to prevent our slipping back into a vocal "deadness" and, as with severe adult-onset deafness, an inarticulate mumbling. In 1949 he and Jerome Wiesner of MIT were collaborating on "a method to replace hearing by tactile stimulation," so that the deaf, receiving patterns of stimulation through electromagnetic vibrations at their fingertips, got the appropriate feedback and could "participate in active speech."[235]

Deaf communities by 1950 were embracing Braille but in no mood to return to the brutal oralism of Alexander Graham Bell. In their Silent Clubs, their League of Elect Sourds, and their National Association of the Deaf, they mocked the oralist teachers who had not bothered, or had actively refused, to learn any form of sign language. They had no respect for educators who praised the dull stumbling grating noisiness of those who still struggled with spoken language as if it were their only recourse. How could it be "humane" to humor the deaf as half-articulate children rather than to honor them for an eloquent and adult fluency that happened to be, for the most part, silent? In their own way, deaf activists with an ever-expanding lexicon and syntax of signing would teach the hearing community that there was much to be learned from, and through, silence.[236]

Whether the quietness of a psychoanalyst who becomes a sounding board amplifying the words of a client while attending to his "own inner voice" (Theodore Reik, *Listening with the Third Ear*, 1948) or the postulate of a spiritual life for the Trappist monk Thomas Merton, whose *The Waters of Siloe* (1949) reintroduced the English-speaking world to Cistercian solitude, the embrace of silence after 1945 had more to it than attentiveness

and insight. It had to be felt as an act of resistance, a form of orison, a tactic of erasure or detachment, for it had indelibly behind it the firestorms and shockwaves of Dresden, Auschwitz, and Hiroshima. "Silence is always close to history," wrote a Swiss physician who had turned to philosophy and then Catholicism for anchorage, or hermitage. "There was an example of this at the end of the last World War, the war that was a rebellion of noise against silence; when silence was powerfully present at least for a few days... [and] more potent than all the horrors of the war. It could have been a healing influence... if it had not been overrun and destroyed by the noise of the whole industrial machine getting down to work again." Cities these days were "enormous reservoirs of noise," and airwaves too, for "God, the eternally continuous, has been deposed, and continuous radio-noise... installed in His place." Thus Max Picard, whose *The World of Silence* (1948) Merton held in high regard. If, wrote Picard, we feel like animals lying in wait upon our own extinction while "sinking ever deeper among the briars and bushes of the world of noise," silence could restore to us a hopeful life, for it was the "natural basis of forgiveness and of love." But silence was becoming rarer: "no longer an autonomous world of its own, it is simply the place into which noise has not yet penetrated... the momentary breakdown of noise."[237]

Momentary as the 4′33″ of silence that became the soundmark of John Milton Cage, Jr., a performance piece he credited to his few minutes (4′33″?) in an anechoic chamber where no noise was supposed to penetrate and he himself was the carrier. Son of that California engineer who, as may be recalled, had patented a submarine diesel-propulsion system dismissed by the Navy as too noisy, and who later improved on hydrophone sound detection, Cage the younger seemed to pride himself on equal degrees of acoustic hypersensibility and musical insensitivity ("The whole pitch aspect of music eludes me. Whether a sound is high or low is a matter of little consequence to me"). In 1935, at twenty-three, while attending Arnold Schoenberg's summer lectures at UCLA and haunting Los Angeles movie theaters, he became intrigued by the animations of Oskar Fischinger, a German artist, engineer, and cinematographer whose special effects had helped put Fritz Lang's woman on the moon (*Frau im Mond*, 1929). Struck by similarities between the abstract designs in expressionist cinema and the graphic patterns visible on film soundtracks, Fischinger had worked on projecting an "optical poetry" whose "absolute" geometries vibrated in sync with the frequencies and rhythms of sound. His films, like the 1935 *Composition in Blue*, got Cage in the habit of "hitting and stretching and scraping and rubbing everything" at hand; a talk with Fischinger, invited to Hollywood in 1937, taught Cage to respect the "Buddhist belief that all things have a sound, even if we don't listen or hear it." By 1938, composing, accompanying, and lecturing in Seattle at Nellie Cornish's School of

Music (and art, and modern dance), Cage had arrived at a credo on the future of music: "Wherever we are, what we hear is mostly noise. When we ignore it, it disturbs us. When we listen to it, we find it fascinating. The sound of a truck at 50 m.p.h. Static between the stations. Rain. We want to capture and control these sounds, to use them, not as sound-effects, but as musical instruments."[238]

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and vapid." What was so original in Cage's press release for a 1942 event: "Through organization, [city sounds] lose their nerve-racking character and become the materials for a highly dramatic and expressive art form"? Hadn't Chicago jazzmen been doing that for decades, notwithstanding Cage's dismissal of jazz licks as too tame? Hadn't Edgar Varèse, reacting to the soundscape of New York, already outpaced Cage in his studio at 188 Sullivan Street, "a cave of sounds, coming from bells, recordings, gongs; and the music seems composed of fragments of music, cut and repasted like a collage"? Thus Anaïs Nin, who heard Varèse's music as aptly deafening, with a power that "suits the scale of the modern world. He alone can play a music heard above the sound of traffic, machinery, factories... a universe of new vibrations, new tones, new effects, new ranges.... In his room one becomes another instrument, a container, a giant ear." Why not attend to Partch's new forty-three-tone octave that explored new intervals and tunings? "People may leave my concerts thinking they have heard 'noise,'" wrote Cage in 1943, "but will then hear unsuspected beauty in their everyday life." Precious. Or laughable: the forte of Spike Jones and his City Slickers, who had been using klaxons, gunshots, and "junk instruments" since the early 1940s, with chart-topping hits in 1942, *Der Fuehrer's Face*, each *heil* punctuated by a "birdaphone" or Bronx cheer, and in 1944, a *Cocktails for Two* interrupted by hiccups, gurgles, and honking. Later would come a *Duet*

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