Unmaking a Medium

Automation and Art in American Radio, 1950–2010

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Abstract

Unmaking a Medium covers sixty years of creative reckonings with automated technology in radio stations. *Radio automation* refers to a system that can play back a programmed sequence of sound recordings without supervision. It emerged through the United States' magnetic tape recording industry in the early 1950s; it was not then, and never has been, fully distinct from the practice of pre-recording sounds for later broadcast. This project approaches radio automation as an industrial, technological effort and also as a phenomenon that facilitated conceptual junctures among sound, music, computation, and control. The actors in this media history include engineers, disc jockeys, station managers, and experimental sound artists. Through archival records, interviews, broadcast industry literature, artworks, and technical materials like software source code, this research has traced the changing cultural meaning of automation—the sonic, technological, and social relations it shaped and symbolized—in American radio.

Four periods segment this history. From 1953 to 1963, under a set of postwar economic and cultural imperatives for a radio industry facing television's rapid rise, engineers introduced the technique that "automation" would come to denote in radio. The business model under which radio automation stabilized—pairing automation equipment with program syndication—flourished in the 1960s and 1970s. Radio consultants and experimental artists, both empowered by automatic technology, elevated the creative control that *programming* denoted in sound media. From 1980 to 1996, the personal computer remediated radio automation and conferred power on programmers of new varieties. Meanwhile, artists and critics made automation (via a *trope of automatedness*) a symbol for increasing homogeneity in radio's overall sound. Between 1996 and 2010, both the commercial radio sector and independent radio practitioners grappled with the effects of major deregulation and a new media regime that internet firms sought to lead. Each group, in the course of articulating their vision for what radio could become in an internet age, tried to adapt radio automation to new contexts; and each group found that automation exceeded their ability to redefine it in full.

Automation cemented logics that had, earlier in the 20th century, helped radio succeed as a medium: commercialism, categorization, and the sonic managerialism of *musical programming*. Yet these logics accelerated to such an extent that, by the 21st century, automation acted as a destablizing force. Automation has helped revert and reveal radio as something prior to a medium, as a set of technologies and protocols from which new combinations can now be made. Artists working at radio's technical and institutional margins have recognized and widened this opening. Cultural producers and researchers today may find analogous responses to plaformization and artificial intelligence, if they attend to how these automating processes unmake their media.

Résumé

Unmaking a Medium (*Défaire un médium*) retrace soixante ans d'expérimentation créative avec les technologies automatisées dans les stations de radio. L'*automatisation radiophonique* désigne un système permettant de rejouer une séquence programmée d'enregistrements sonores, sans supervision. Découlant de l'industrie états-unienne de la bande magnétique du début des années 1950, cette approche ne fut pas totalement distincte, à l'époque comme aujourd'hui, de la pratique de l'enregistrement sonore à des fins de diffusion différée. Ce projet de recherche aborde l'automatisation radiophonique en tant qu'activité industrielle et technologique à part entière, mais aussi comme phénomène ayant facilité les croisements conceptuels entre le son, la musique, l'informatique et le contrôle. Les protagonistes de cette histoire des médias incluent des ingénieur·es, des disc-jockeys, des gestionnaires de stations et des artistes sonores expérimentaux·ales. À travers des documents d'archives, des entrevues, des publications issues de l'industrie de la radiodiffusion, des œuvres et des matériaux techniques comme le code source de logiciels, cette recherche permet de retracer l'évolution de la signification culturelle de l'automatisation – les relations sonores, technologiques et sociales qu'elle représente – dans la radio américaine.

Quatre périodes rythment cette histoire. De 1953 à 1963, sous les impératifs économiques et culturels de l'après-guerre qui touchent une industrie radiophonique confrontée à l'essor fulgurant de la télévision, des ingénieur·es instaurent une technique qui sera bientôt popularisée sous le terme d'« automatisation ». Le modèle d'affaires selon lequel s'établit l'automatisation de la radio – le jumelage de l'équipement d'automatisation à la syndication des programmes – prospère pendant les années 1960 et 1970. Profitant de capacités décuplées par la technologie automatique, les consultant·es radio et les artistes expérimentaux·ales déploient le contrôle créatif que révèle la *programmation* dans les médias sonores. De 1980 à 1996, l'ordinateur personnel remédie l'automatisation radio et confère aux programmateur·trices de nouvelles variétés un pouvoir décuplé. Pendant ce temps, les artistes et les critiques font de l'automatisation (via le *trope de l'automatisme*) un symbole pour l'homogénéité accrue de la sonorité radiophonique. De 1996 à 2010, le secteur de la radio commerciale et les practicien·nes indépendant·es font face aux effets d'une dérégularisation majeure et d'un nouveau régime médiatique mené de front par les compagnies Internet. En articulant leur vision de ce que la radio pourrait devenir dans une ère de l'Internet, chaque groupe tente d'adapter l'automatisation à de nouveaux contextes et parvient au final à la conclusion que l'automatisation dépasse largement leurs habiletés à la redéfinir entièrement.

L'automatisation a renforcé les modes de pensée qui avaient permis à la radio de s'imposer comme médium au début du XXe siècle : le mercantilisme, la catégorisation, et le management sonore de la *programmation musicale*. Malgré tout, ces doctrines se sont accélérées de manière telle que, à partir du XXIe siècle, l'automatisation a agi comme force perturbatrice. Elle a permis de renverser et de révéler la radio comme quelque chose qui précède le médium, un ensemble de technologies et de protocoles duquel il était dorénavant possible de créer de nouvelles combinaisons. Les artistes qui se sont approprié·es les marges techniques et institutionnelles de la radio ont su reconnaître et élargir cette ouverture. Les producteur·trices culturel·les et les chercheur·euses d'aujourd'hui pourront trouver des réponses similaires à la plateformisation et à l'intelligence artificielle, si iels s'attardent à la manière dont ces procédés automatisés défont leur médium.

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Introduction: automation and unmaking

1992: Lee Harris, owner of WIBU Poynette, steps up to an equipment rack in his rural Wisconsin radio studio and explains to the camera crew,[1] "I am pulling the switch that will take us off of local control and throw us onto Dallas." He removes a stereo audio cable's plug from the patch bay. "I have just pulled the plug on polka." In place of the lively accordion melodies that had filled the station's broadcast day, Tony Bennett's "If I Ruled the World" sweeps WIBU's new, satellite-delivered format into effect on its crescendo of strings and twinkling piano. The camera moves to an unstaffed broadcast studio and zooms in on a gray box with the label "Digital DJ" and a blinking audio level meter—a system that, Harris has explained, contains on its hard drive all the audio for WIBU's commercials and station identifications and that automatically inserts them into the satellite service's music stream at the appropriate times. "It's technically possible to set up a month's worth of broadcasting," he has said, "and walk away from it."[2]

1992: Audio artist Christof Migone begins drafting a series of prompts for fellow radio workers; they will make up *Radio Naked*, a "manifesto that naively impels the radio programmer to dispense (or at least question) all of the conventions and expectations of what radio should sound like." Prompt 10 reads, "Keep all faders up for as long as it takes to play the entire record library of the radio station and then get rid of it." Prompt 15, "Dissect the equipment of your radio station into its component parts: transistors, capacitors, integrated

[1] Hyperlinks in the body of this document lead to audio or video resources embedded at https://akstuhl.net/radio_automation/. I have used this approach to make audiovisual materials closer to hand while minimizing link rot.

[2] "The Last Polka," *48 Hours* (CBS, 1992).

circuits, etc. and send one out to each of your listeners."[3]

In the second half of the twentieth century, broadcast automation and sonic art both, through very different techniques and intentions, began prying apart what had made broadcast radio function as a medium. "[T]he success of all media," Lisa Gitelman has written, "depends at some level on inattention or 'blindness' to the media technologies themselves (and all of their supporting protocols) in favor of attention to the phenomena, 'the content,' that they represent."[4] For media, automation has aided this "opacity," as Douglas Eacho calls it—"the displacement of attention noted by Gitelman, in which that which is automatic is that which does not demand (and indeed is not available to) thought."[5] But automation takes on momentum of its own. Given enough time and regulatory allowance, automation erodes opacity; consolidation and labor displacement proceed so far that it becomes unclear who, if anyone, can communicate through a medium so routinized and rationalized as to exclude most new expression. When a medium feels (or sounds) *automated*, it begins to shed its medium-ness. In American broadcast radio, where a contextually specific form of sonic automation took hold in the mid-1950s, this process eventually helped artists turn away from radio as a "conduit for their content" (as artist Anna Friz recently put it)[6] and toward sonic works that celebrated the opportunity to disassemble radio and devise something new from its parts and protocols.[7]

[3] Christof Migone, *Radio Naked*, 2012, 2012.

[4] Lisa Gitelman, *Always Already New: Media, History and the Data of Culture* (Cambridge, MA: MIT Press, 2008), 6. Gitelman quotes "blindness" from Marshall McLuhan to note his earlier iteration of this argument.

[5] Douglas Eacho, "Auto-Play: The Automation of Performance Action, Writing, and Control" (Stanford, CA, Stanford University, 2020), 9.

[6] "Exploring Radio Art and Transmission Art," *Radio Survivor*, April 14, 2021.

[7] Daina Augaitis et al., *Radio Rethink: Art, Sound and Transmission* (Banff, AB: Walter Phillips Gallery, 1994); Galen Joseph-Hunter, Penny Duff, and Maria Papadomanolaki, *Transmission Arts: Artists and Airwaves* (New York, NY: PAJ Publications, 2011).

Automation has been bound up in cyclical pronouncements of death and rebirth for American radio. Automation helped the radio industry "reinvent itself to survive" as TV pulled networks and audiences away in the 1950s,[8] only to aid a computational regime that seemed (to artists and DJs) determined to "kill" radio.[9] "Radio is dead," composer David Moss declared in 1989; what had once seemed the "perfect medium in which to propagate subversive artistic activity" now demonstrated "mainly the power to flatten, smooth-out, disembody, and trivialize the information it conveys."[10] Yet automation would come to the aid of anti-corporate broadcasters who lobbied hard in the 2000s to establish a more autonomous niche in the medium—and who often depended on software to keep their volunteer-run stations on the air. Automation has been at once a vital and life-sapping presence within radio, an infrastructure that corrodes the infrastructures surrounding it.

In radio, "automation" has since 1954 referred to what engineers at the Ampex Corporation initially dubbed "automatic programming:" tools and techniques that send a preplanned sequence of sound recordings to a station's transmitter. In radio automation's original and still predominant use case, the automation system carries out transitions back and forth between *program* material—often music playlists, on specially formatted tape reels before 1980 and as satellite feeds or digital libraries in later years—and *announcement* material, namely advertisements, weather and traffic updates, and station promotions (see Figure 1). As a technology, it was from the very beginning premised on this categorization, which already flattened the variety of radiophonic forms (songs, interviews, plays, reports) into program material (or, in today's media vocabulary, *content*). Automation did not invent, but has accelerated, several companion tendencies within broadcast radio.

[8] Robert L. Hilliard and Michael C. Keith, *The Quieted Voice: The Rise and Demise of Localism in American Radio* (Carbondale, IL: Southern Illinois University Press, 2005), 3.

[9] April Feld, "Machines Are Killing Radio," *Billboard*, November 20, 1982.

[10] David Moss, "The Beat and the Box," *EAR Magazine*, March 1989.

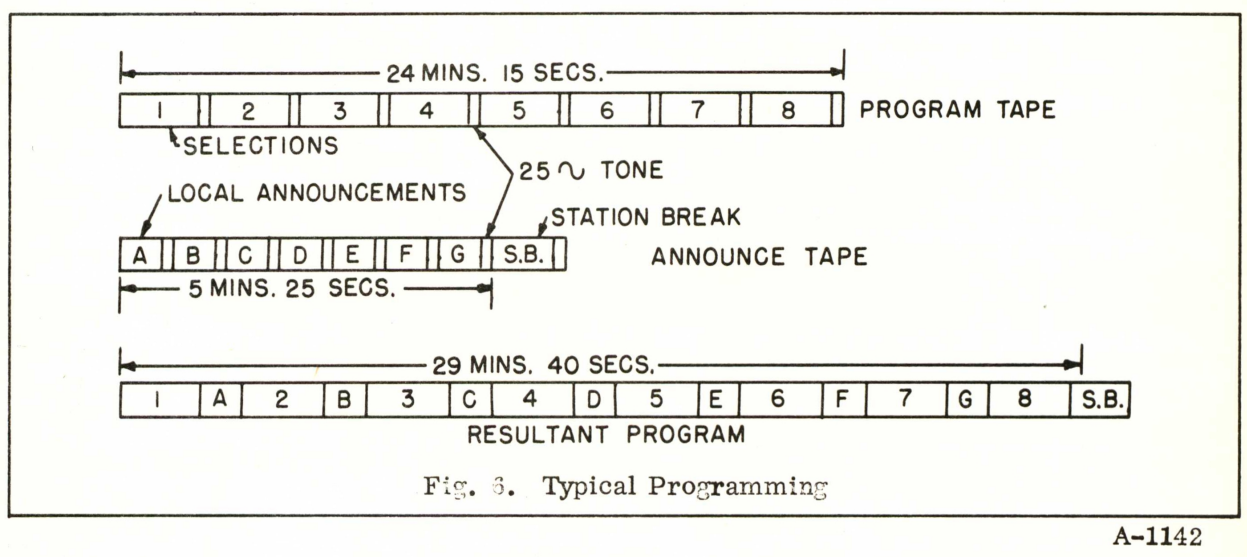

Figure 1: A program sequence diagram from the operation manual for Ampex's S-3380 automatic programming system shows how the controller intersperses recordings from a "program tape" and an "announce tape" to make up the broadcast program.

1. Radio automation is programmatic: it depends on a precisely arranged program log—the plan for what the station will broadcast over the course of a day. Further, it has for most of its existence correlated strongly with musical styles whose precisely calibrated aesthetics privilege an approach to music listening as "self-programming."[11] I refer to this tendency, which very much continues today in music streaming platforms, as *musical programming* in order to hold onto the historical interplay between music's treatment as time-filling content (programming in the broadcast sense) and sound's treatment as software (programming in the computational sense).
2. Radio automation is part and parcel with the use of recordings as broadcast material. To one of the engineers initially working on automatic programming, the choice to implement it was a choice to "extend the degree of automation which we already have."[12] The American Federation of Musicians, in twice banning its members from playing

[11] Tia DeNora, *Music in Everyday Life* (Cambridge, UK: Cambridge University Press, 2000).
[12] Edgar F. Vandivere, "Some Techniques in Automatic Programming," *IRE Transactions on Broadcast Transmission Systems* PGBTS-3, no. 1 (January 1956): 84–86.

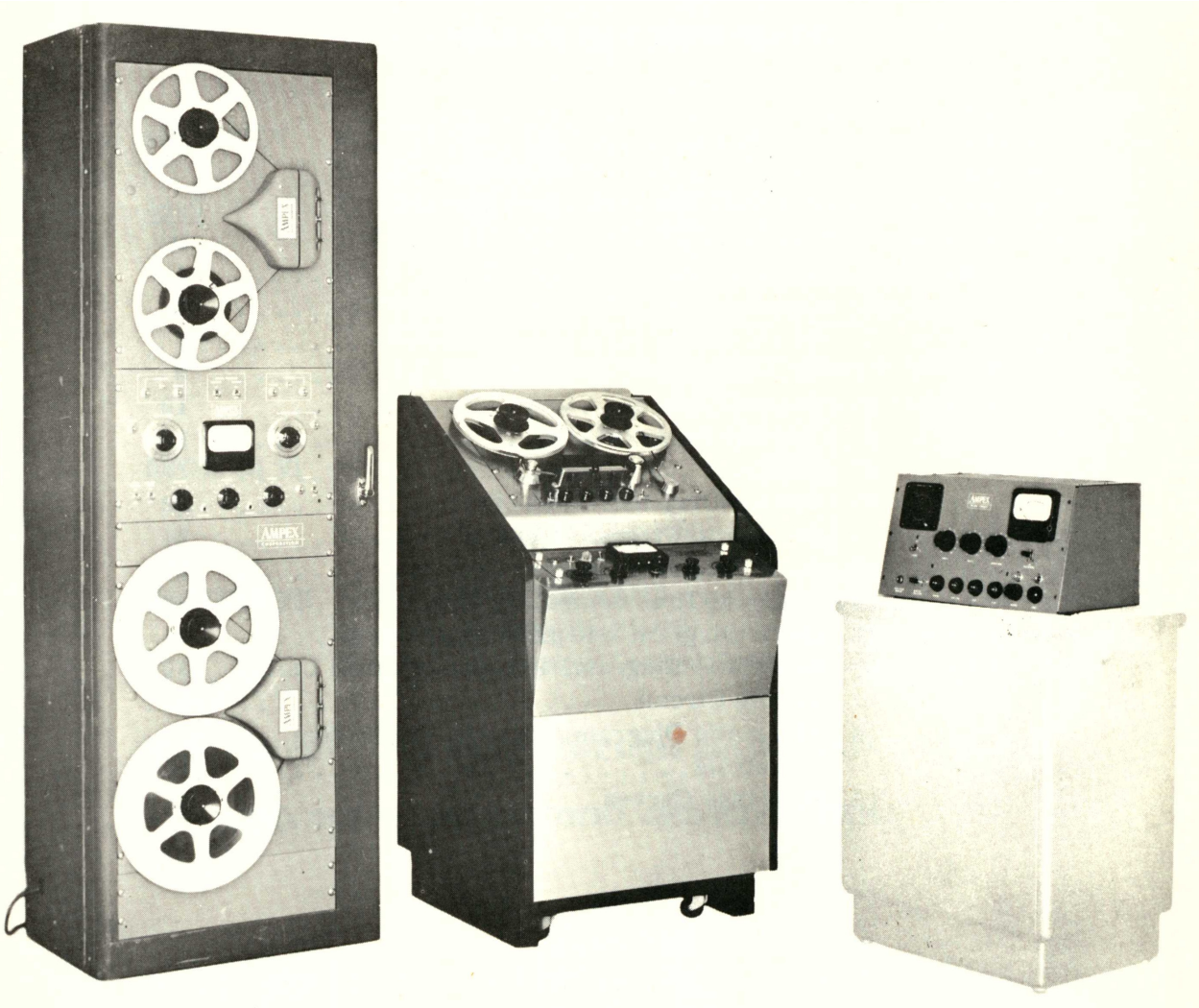

Figure 2: The Ampex S-3380 system. The rack at left contains two playback machines, one for the announce tape and one for the program tape, with a playback control unit in between them. In the middle is a recording machine, and at right the record console that controlled the recording machine and added the cue tones necessary for automatic playback.

in recording sessions during the 1940s, had expressed earlier and more forcefully a similar outlook: that sound recording, in broadcast radio, was itself a labor-displacing technology.[13]

3. Radio automation is linear: it enforces the continuous, one-at-a-time sequence of recorded or scheduled sounds as radio's default sonic operation. This tendency has been noted by artists including Friz who work with a multiplicity of sound sources,[14] and they have also drawn attention to its technical contingency: as Don Joyce demonstrated in the 1980s on his live show *Over the Edge* on KPFA Berkeley, automation's constituent technologies like looping tape cartridges were perfectly suited to dense and out-of-control sound arrangements.
4. Radio automation is managerial: while automation has aided non-commercial broadcasters and even anti-corporate radio movements, it has at points throughout its history helped a disciplinary, managers-over-workers power dynamic take hold even in those contexts where the broadcasters oppose hierarchy or have volunteer labor at the ready.
5. Radio automation is re-centralizing: automation arose in radio just as the large networks were departing the medium for television, and, in theory, it could air locally produced programming at independent stations; yet its commercial viability has always depended on syndication. Syndicated programming is produced centrally and shared to subscribing stations, either piecemeal or as a full package with enough material to fill each broadcast day. The station that takes full advantage of the latter route, preparing as little sound locally as possible, is considered "fully automated."

[13] James P. Kraft, *Stage to Studio: Musicians and the Sound Revolution, 1890-1950* (Baltimore, MD: Johns Hopkins University Press, 1996).

[14] Anna Friz, Interview, September 6, 2023; Jon Leidecker, Interview, August 8, 2023.

It is this last tendency that has, even to the ears of automation's developers and marketers, contributed to the "flattening" that Moss heard in radio—the reduction of variance in broadcast programming at a national scale. "I know all of the formulas of the radio business because obviously the automation system had to support them," says Dave Scott, whose Scott Studios automation systems held a leading market share in the 1990s and 2000s; "and so radio is just so predictable that it isn't fun anymore."[15]

These formulas began taking shape long before automatic programming, in the very process by which broadcast radio succeeded as a medium. Shawn VanCour has termed it "mediamaking:" the routinization, under constraints from policy makers, owners, and production cultures, that overcame radio's initial conspicuousness in the 1920s and allowed stations to cohere as compelling (and commercializable) sources of information and entertainment.[16] When radio automation turned the program log, the key artifact within this process, into a machine-readable *program*, it played a key role as the same forces of mediamaking tilted toward media-unmaking. The "assembly line" mode of broadcast production that "gave way to automation, which became greatly enhanced by computerization"[17] resulted in a new conspicuousness of over-routinization, amplified by widespread syndication and the absencing of station staff. Neoliberal media deregulation and ownership consolidation accelerated this process. That context—with the 1996 Telecommunications Act as its opening—has been the principal one under which automation features in American radio histories.[18] But forty years of technical change and cultural response preceded this period. The radio critique that came to fix on the medium's audible automatedness in fact

[15] Dave Scott, Interview, July 5, 2021.

[16] Shawn VanCour, *Making Radio: Early Radio Production and the Rise of Modern Sound Culture* (New York, NY: Oxford University Press, 2018).

[17] Susan J. Douglas, *Listening in: Radio and the American Imagination* (Minneapolis, MN: University of Minnesota Press, 2004), 280.

[18] See, e.g., Eric Klinenberg, *Fighting for Air: The Battle to Control America's Media* (London, UK: Macmillan, 2007).

prefigured these changes by several years.

This study takes part in the "aesthetic turn" that VanCour has helped inaugurate for radio studies—a focus on the medium's middle level where internal producers and technologies arbitrate the forms, practices, and styles that make up its changing roles in American culture.[19] But, in covering such a wide time period, I have aimed to keep one foot in radio's internal operations and another in the experiential zone where the life and death of the medium (as in Moss's pronouncement, above) seem perceptible to listeners. To grasp automation's cultural meaning for radio requires tuning in to voices who perceived it, or its constituent devices and dispositions toward sound, as more than industrial convenience. Writing on the Experiments in Art and Technology (E.A.T.) collective in the 1960s–70s, Fred Turner has noted,

> to date, scholars have in fact analyzed Happenings and the automation debates within two very separate fields: the history of art and the history of technology, respectively. Yet, in this case, the history of artistic practice and the history of the integration of computing into everyday life need to be seen as entwined.[20]

The becoming-computational of sound in American culture is another case where Turner's prescription holds. Radio automation concretized this process as the main vector for computerization in sonic distribution before digital audio. But sound and radio artists made perceptible—and actively stretched—automation's contextual meaning for sonic media.

Automation in context

The narrow technical meaning that adhered to "automation" in American broadcast radio stands at odds with the term's power, already active by the end of the 1950s and certainly

[19] VanCour, *Making Radio*, 3.

[20] Fred Turner, "Romantic Automatism: Art, Technology, and Collaborative Labor in Cold War America," *Journal of Visual Culture* 7, no. 1 (2008): 6.

ongoing today, to conjure visions where complex robots replace human workers in a universal forward march of technology. In *Automation is a Myth*, Luke Munn has pulled apart and rebutted these premises—efficacy, inevitability, and geographic and social universality—through close attention to contexts where automation predictions clash with much messier labor reconfigurations.[21] Munn joins a wave of recent automation skeptics who, from a broader political economic vantage, likewise contest the assumption that automation has driven major socio-economic change in the United States.[22] Jason Resnikoff, through a deep investigation into the postwar moments where "automation" shot out from executive plans at Ford Motors and into national political debates, has argued that automation is best understood as an ideology: "automation discourse," rather than any significant discontinuity in technological change, was behind the transformations that automation gets credit for bringing about.[23] When Astra Taylor coined "fauxtomation" to refer to management delegating work either to retail customers or to hidden, contingent labor pools, she also referred to automation as an ideology, though one whose implementation in technology (partial and facetious as it might be in a given context) also makes it a reality.[24]

Automation is a slippery historical subject because it acts through multiple categories at once: as an ideology, as a discourse, as a fiction held up for technology's users, and—within a working context like a radio station—a specific machine with material constraints and affordances like any other. More simply, automation is both a process and an object; but when it functions as either one, it is always to some degree functioning as the other. Radio entrepreneurs harnessed the automation discourse to help install automatic equipment in sta-

[21] Luke Munn, *Automation Is a Myth* (Stanford, CA: Stanford University Press, 2022).

[22] Aaron Benanav, *Automation and the Future of Work* (New York, NY: Verso, 2020); Jason Smith, *Smart Machines and Service Work* (Chicago, IL: University of Chicago Press, 2020).

[23] Jason Resnikoff, *Labor's End: How the Promise of Automation Degraded Work* (Champaign, IL: University of Illinois Press, 2022).

[24] Astra Taylor, "The Automation Charade," *Logic(s) Magazine*, August 1, 2018.

tions. That equipment, in turn, helped shape social conditions in those stations along lines that equated managerial control with good broadcasting. But automation's implications for radio are not reducible to the ideology that helped install them. As Raymond Williams cautioned regarding television, "while we have to reject technological determinism, in all its forms, we must be careful not to substitute for it the notion of a determined technology."[25] Broadcast historians have expanded on the causal nuance of Williams's cultural studies approach. Michelle Hilmes argued, in a touchstone work for radio studies, that "media narratives, structures, and audiences are produced in, and themselves help to produce, the same crucible of negotiations of social power that shapes the histories through which we later understand them."[26] Media *technology* also belongs in this recursive historical cast, but with an additional consideration: planners often intend for technical objects to bypass such negotiations entirely.[27] All technologies reflect and play host to ideological efforts. What lets automation appear more ideological than technological is, first, the wide variation in forms and component technologies it takes across different work contexts; and, second, its all-but-explicit naming of the outcome—reduction in labor power—that it intends.

Automation has been a form of sabotage from above, intended to foreclose the possibility of strategic refusal or deviation for workers.[28] But sabotage runs both ways. Automation's top-down sabotage has a universal character: it diminishes labor's capacity to dictate the production process.[29] But sabotage *of* automation is always contextually particular. It de-

[25] Raymond Williams, *Television: Technology and Cultural Form* (London, UK: Routledge, 1974), 133.

[26] Michele Hilmes, *Radio Voices: American Broadcasting, 1922-1952* (Minneapolis, MN: University of Minnesota Press, 1997), 288.

[27] Madeleine Akrich, "The De-Scription of Technical Objects," in *Shaping Technology / Building Society: Studies in Sociotechnical Change*, ed. Wiebe E. Bijker and John Law (Cambridge, MA: MIT Press, 1992), 205–24; Keith Grint and Steve Woolgar, *The Machine at Work: Technology, Work, and Organization* (Cambridge, UK: Polity Press, 1997).

[28] Timothy Mitchell, *Carbon Democracy: Political Power in the Age of Oil* (London, UK: Verso, 2013); Hannah Tollefson and Darin Barney, "More Liquid Than Liquid: Solid-Phase Bitumen and Its Forms," *Grey Room*, 2019, 38–57; Evan Calder Williams, "Manual Override," *The New Inquiry* (blog), March 21, 2016, https://thenewinquiry.com/manual-override/.

[29] David F Noble, *Forces of Production: A Social History of Industrial Automation* (New York, NY: Oxford University Press, 1984).

pends on the material makeup of "the automation," as radio workers often call a specific machine (or software application) at their station. Radio automation has, historically, offered a means for sabotage through its dependence on sound recording; by changing out or erasing audiotapes, station staff have been able to "reprogram" the system, in radio worker Ron January's words—to push back, in select cases, against particularly intolerable decisions from management.[30] Contextualist accounts of automation tend to come away with two insights: that automation is very real, in the sense that it brings about substantial changes in the way work is allocated, controlled, and valued; and that it never completely replaces the workers or the sources of value (whether economic or cultural) it aims to displace.[31] There is no "full" automation, so there is no total elimination of the possibility for deviation—even as that possibility undergoes continual narrowing.

It is in the remaining workers' encounters with automation-as-object, more than in the blunt fact that automation-as-process displaces others, that automation takes on its contextual character. Radio station staff physically interact with their automation system (if no longer as a wall-filling row of tape reel and cartridge players, then typically as a dedicated PC), and it continually joins in and mediates their work even during live broadcasts. Automation systems have acquired nicknames from their manufacturers or users: "Sylvia" for the Schafer 1200 in 1960,[32] or the much more widespread "FRED" (per the reminiscing of engineers from multiple stations, "Fucking Ridiculous Electronic Device"), for instance. These appellations from engineers called attention to automation's "perfect" convenience and the

[30] Ron January and Bob Friedman, Ron January, Oral History (Birmingham Black Radio Museum, February 3, 2017); Gary Richardson and Bob Friedman, Gary Richardson, Oral History (Birmingham Black Radio Museum, August 29, 2015).

[31] Karen E. C. Levy, "The Contexts of Control: Information, Power, and Truck-Driving Work," *The Information Society* 31, no. 2 (March 15, 2015): 160–74; Jonathan Sterne and Elena Razlogova, "Machine Learning in Context, or Learning from LANDR: Artificial Intelligence and the Platformization of Music Mastering," *Social Media + Society* 5, no. 2 (April 1, 2019): 1–18.

[32] *Sylvia: Radio's Perfect Employee*, 1960.

aggravating maintenance tasks needed to keep up that convenience, respectively.

But automation was also bound up with structural changes to radio's expressive work. Automation spread simultaneously with "format radio"—a programming strategy that subsumed individual shows into a unified sound for the station, honed to meet a demographic market niche.[33] Fredrik Stiernstedt notes that radio automation and format radio have taken mutual part in the changes that historians of labor process, following Harry Braverman, have associated with automation—namely, de-skilling workers by standardizing, dividing, and mechanizing their tasks.[34] But as Stiernstedt argues, radio automation has taken part in up-skilling some media workers while de-skilling others; in simultaneously degrading and empowering DJs; and in fundamentally altering notions of *creativity* within the medium.[35] These changes, meanwhile, only made sense in the scope and in service of American radio's corporate stewardship and commercialization.[36] Only through this rationale could radio time became a commodity (with advertisers as its customers) whose production could be demographically honed, streamlined, and automated.

Industrial automation depended on media, especially film and tape (paper and magnetic varieties),[37] as much as media industries depended on automation. Media studies have begun to draw out the implications behind this relationship: "Cinema was early automation," Kyle Stine has argued, surveying plastic film's role as a "protocomputational medium and

[33]Alexander Russo, "Punch Cards and Playlists: Computation, Curation, and the Cybernetic Origins of Radio Formatting," in *The Oxford University Press Handbook of Radio Studies*, ed. Andrew Bottomley and Michele Hilmes (New York, NY: Oxford University Press, 2024); Christopher H. Sterling and Michael C. Keith, *Sounds of Change: A History of FM Broadcasting in America* (Chapel Hill, NC: University of North Carolina Press, 2008).

[34]Harry Braverman, *Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century* (New York, NY: Monthly Review Press, 1974).

[35]Fredrik Stiernstedt, "The Automatic DJ? Control, Automation and Creativity in Commercial Music Radio," in *Radio Audiences and Participation in the Age of Network Society*, ed. Tiziano Bonini and Belén Monclús (London, UK: Routledge, 2014), 151–67.

[36]Susan J. Douglas, *Inventing American Broadcasting, 1899-1922* (Baltimore, MD: Johns Hopkins University Press, 1989); Thomas Streeter, *Selling the Air* (Chicago, IL: University of Chicago Press, 1996).

[37]Noble, *Forces of Production*.

a testing ground for automating twentieth-century data practices."[38] Mal Ahern, likewise noting the importance of factory automation's internal media, has argued that "cinema and other arts of recording offer a means of visualizing the failures and limitations of industrial automation."[39]

But what does automation mean when a medium—both the form and the industry around it—is automation's context? Influential scholarship on "new media" has made the case that automation plays a major role in determining how communication and cultural production proceed amid software interfaces. Lev Manovich has listed automation as one among five key "principles of new media," describing how media creation has become an engagement with various forms of automation—as has media access, by necessity of "technologies that automated media creation" in the nineteenth and throughout the twentieth centuries and the vast quantities of records they enabled.[40] Mark Andrejevic's *Automated Media* treats automation as a singular organizing principle that instills its own set of tendencies or "biases" (in the sense that Harold Innis used the term) in networked communication: toward preemption, where media systems anticipate the user's likely behavior and contour or reduce their experience accordingly; toward operationalism, where systems have bypassed representation in favor of automated responses to user actions; and toward environmentality, where they programmatically modulate users' environments in place of subjectifying individual users.[41] Andrejevic's biases for media automation in the internet platform moment do not align neatly with the tendencies I have named in radio automation; each set reflects distinct conditions in the industries at the time they introduced automation and in the forms and techniques that cohered *as* automation in that context. But the effects on subjectivity

[38] Kyle Stine, "Film as the First Universal Data Medium," in *Interrogating Datafication: Towards a Praxeology of Data*, ed. Marcus Burkhardt et al. (Bielefeld, Germany: transcript Verlag, 2022), 53, 41.
[39] Mal Ahern, "Cinema's Automatisms and Industrial Automation," *Diacritics* 46, no. 4 (2018): 6–33.
[40] Lev Manovich, *The Language of New Media* (Cambridge, MA: MIT Press, 2002), 35.
[41] Mark Andrejevic, *Automated Media* (New York, NY: Routledge, 2019).

that draw Andrejevic's focus are of a kind that radio automation exerted: together with format radio, automation projected specific kinds of listeners and offered itself up to different kinds of hearing on either end of the transmission.

This study combines a zoomed-out interest in what automation means for media with the contextualists' grounded skepticism toward what automation might really mean in the first place. Drawing artists and industrialists together for this kind of aim has been fruitful in Turner's and Ahern's work and also in Douglas Eacho's study of automation and "automaticity" in theatrical performance. Automaticity, for Eacho, combines disintermediation, which marks "a desire to cut past and generally abolish media" that intercede in an action or exchange, and opacity, by which he denotes Gitelman's point about inattention to supporting technologies.[42] Artists in the sonic avant-garde took up a similar disposition to the performance avant-garde that Eacho covers. They treated tape, computers, and other tools of sonic automation as conceptual and material pathways toward new, transformative, immediate relationships with sound. But artists working in the same traditions also began, especially when they looked to radio as a conduit for their work to reach wider audiences, to perceive sonic automation in a flipped configuration: automatic technology did not bypass mediation; it overstabilized it to a point of dismal absurdity. If the same efforts that helped radio succeed as a medium had led to its automation, was this development inevitable?

Do all media automate?

Sonic automation has generally been most identifiable in musical automata, player pianos, the MIDI protocol, and other mechanisms outside of "tympanic" reproduction—the transcription of acoustic vibrations onto a recording medium, such as a phonogram or a reel

[42] Eacho, "Auto-Play: The Automation of Performance Action, Writing, and Control," 8–9.

of magnetized tape or wire.[43] The player piano in particular outshone its contemporary the phonograph as an avatar for automation. "In counterpoint with the phonograph," David Suisman has claimed, "the valence of the player-piano was the rationalization of knowledge, labor, and culture, especially in terms of the growing tendency toward quantification, mechanization, automation, and digitization."[44] But tympanic reproduction accompanied the transduction of cultural desires for sound recording into mass market technologies, Jonathan Sterne has argued;[45] and those cultural desires, as he and Kyle Barnett have both pointed out, included the desire to eliminate workers, as when early phonographs took the place of stenographers.[46] The social desire for automatic recording and transmission—for replacing human bodies with media devices—fell along gendered and racialized lines, imposing automation's distinctly American social priorities on media and on the work and workers that made mass communication possible.[47] To what extent do these characteristics hold for media in general?

Radio automation continued a story that began decades ahead of *automation*'s coinage and nearly simultaneously with broadcast radio—the story of pre-recorded (or "canned") sound, especially musical records, serving as broadcast material. In the mid-1930s, Barnett has shown, the American recording industry re-oriented itself under economic crisis and in close articulation to the radio industry.[48] By the time that most claimants to the much-contested title of America's first disk jockey were playing records on air,[49] radio

[43]Jonathan Sterne, *The Audible Past: Cultural Origins of Sound Reproduction* (Durham, NC: Duke University Press, 2003).

[44]David Suisman, "Sound, Knowledge, and the 'Immanence of Human Failure'," *Social Text* 28, no. 1 (2010): 24.

[45]Sterne, *The Audible Past*.

[46]Kyle Barnett, *Record Cultures: The Transformation of the U.S. Recording Industry* (Ann Arbor, MI: University of Michigan Press, 2020).

[47]Venus Green, "Race and Technology: African American Women in the Bell System, 1945-1980," *Technology and Culture* 36, no. 2 (1995): S101–44.

[48]Barnett, *Record Cultures*.

[49]Charles F. Ganzert, "Platter Chatter and the Doughnut Disker: Developments in Radio Disk Jockey Programming in the United States, 1946–1960," *Journal of Radio Studies* 2, no. 1 (January 1993): 151–71.

and recording had resolved their initial competition—radio sets had threatened to displace phonographs as the technology that would bring music to American homes—and fleshed out a productive symbiosis wherein records filled broadcast time on DJ shows and DJs helped drive consumer record sales.

The DJ show remained a controversial and non-dominant practice within radio through the 1940s, with program schedules continuing to center variety shows delivered by national networks or syndicated more horizontally on electrical transcription disks. Alex Russo, working against the retrospective dominance the networks hold over "Golden Age" radio history, has uncovered the importance that transcription disks and techniques like spot broadcasting held for radio's changing technological and aesthetic configuration leading into the 1950s.[50] These changes, in advancing what Russo calls a "logic of elemental combination"[51] in station-level programming, laid direct groundwork for radio automation. As early as 1930, transcription threatened to make radio automatic in a way that would erode its reason for being: Russo quotes NBC President Merlin Aylesworth's declaration that "[i]f radio is to become a self-winding phonograph, it would be better to disregard radio entirely."[52] Network executives' public opposition to recording failed to stop transcriptions from quietly becoming infrastructural in radio—by 1946 they mediated as much as "43 percent of station programming," as Russo points out;[53] but it did set the stage for the now famous conflict that ushered into American radio the medium that was to be the key component of radio automation—magnetic tape.

Three main characters feature in tape's big breakthrough: American Army Signal Corps

[50]Alexander Russo, *Points on the Dial: Golden Age Radio Beyond the Networks* (Durham, NC: Duke University Press, 2010).
[51]Ibid., 130.
[52]"Aylesworth Assails Recorded Programming in Chicago Speech," *Broadcast Advertising*, December 1930, 7; quoted by Russo, *Points on the Dial*, 87.
[53]Russo, *Points on the Dial*, 78.

member John T. Mullin, Russian-American engineer and businessman Alexander M. Poniatoff (and Ampex, the company he had named from his initials), and the phenomenally popular singer-entertainer Bing Crosby. In 1945, Mullin retrieved two AEG Magnetophon tape recorders from a German broadcast studio and shipped them back to the United States, where he arranged demonstrations of the machine's AC-bias method that had allowed it to surpass phonograph recording in both audio quality and duration.[54] Ampex, though at that point uninvolved in magnetic recording, seized on the opportunity to adopt and reverse-engineer the technology. But it was Crosby's standoff with the ABC radio network about pre-recording his new variety show that would enable Ampex, financially, to see the effort through. Amid a shaky truce with ABC as to whether he could continue pre-recording on transcription disks, Crosby learned about Mullin and the Magnetophons. After first hiring Mullin to tape his recordings with the original German models, Crosby in 1947 entered into a distribution partnership with Ampex and financially secured their leading edge in the United States tape recording industry.[55] Pre-recording for radio broadcast was the pivotal use case for magnetic tape at the outset of the era that would see it replace phonographs, transcription disks, and various data storage media in all manner of contexts both sonic and computational.

In 1953, Ampex introduced "automatic programming" by adding to its existing broadcast-ready tape machine models a 25 Hz cue tone recorder and a sensor that, on detecting those tones, would stop and start tape players (discussed in Chapter 1). Cue tones merely extended the degree to which pre-recording already functioned as a labor-consolidating technique in radio. Nowhere had this function been clearer than in the position the American Federation of Musicians (AFM) had taken when, ten years prior

[54] Mark Henry Clark, "The Magnetic Recording Industry, 1878-1960: An International Study in Business and Technological History" (Ph.D., Newark, DE, University of Delaware, 1992).
[55] Ibid.

and in response to a dramatic decline in stations employing musicians, it banned its members from playing in recording sessions. James Kraft has laid out the convergence of strategic advantages—organizational, legal, and discursive—that AFM president James Petrillo deployed when he called the ban. Among them was radio's very status as a medium: "the public perception of radio as an entertainment medium obscured the fact that it was also an industrial enterprise with its own economic imperatives, among them the desire to control its workforce."[56] The National Association of Broadcasters (NAB)—American commercial radio's industry group, at whose annual conference engineers and managers would help one another propel radio automation forward (see Chapters 1 and 2)—of course also recognized this status, and it coordinated a vicious counter-campaign against Petrillo and the union with help from newspapers and politicians across the nation; amid already waning political support for organized labor in between a New Deal high and postwar low, industry advocates branded Petrillo a tyrannical Luddite.[57]

Yet solidarity among record labels broke before the union's did, and the strike succeeded—not in returning house bands to local stations, but in securing a compensation structure for musicians when stations aired their recorded work. The mass coordinated pause in recording, and its revelation that music had become an industrial pipeline that musicians could strategically block, rippled out in what Marina Peterson has deemed new "configurations of sonic value."[58] Musicians' incorporation into the workforce for the solidified radio-recording industry placed the social, aesthetic, and commercial values attending musicianship under the influence of a newly complex media-technological apparatus.

[56] Kraft, *Stage to Studio*, 140.
[57] Kraft, *Stage to Studio*.
[58] Marina Peterson, "Sound Work: Music as Labor and the 1940s Recording Bans of the American Federation of Musicians," *Anthropological Quarterly* 86, no. 3 (2013): 791.

In between the years of the AFM strikes and of Ampex's automatic programming system, "automation" entered the American lexicon. In 1947, Ford Motors Company executive Delmar Harder coined automation as the label for a new department at the company—one that set about designing devices that could, by reducing the number of workers needed to move parts between production stages, address Ford's considerable challenges in profitability and in labor control.[59] In 1952, management consultant John Diebold pushed the term into national discourse with a book, *Automation: the Advent of the Automatic Factory*.[60] By 1960, automation was the object of national public anxiety and of mediation from the federal government,[61] as the AFM/NAB standoff had been.

Would Petrillo and the strikers have called records-on-radio "automation" if the term had been on hand? Would the term have applied to even earlier musical media? Suisman has offered compelling reasons to think so. His player-piano study revisited the device through the perspective of writers, notably William Gaddis, who had seen it as a kind of fulcrum in a push toward (what was not yet called, in the instrument's nineteenth-century heyday) automation. "As Gaddis maintained, the player-piano symbolized and materialized the growing cultural importance of mechanization and automation, and it did so in particularly subtle and telling ways, expanding the practices and values of mechanization into the realm of consumption and into the aesthetic domain of the arts."[62] Though most of Gaddis's writing took place in the latter half of the twentieth century after the term automation had entered broad circulation, it is not necessarily clear whether he understood this "growing cultural importance" to have progressed continuously between the invention of the player-piano

[59] David A. Hounshell, "Planning and Executing 'Automation' at Ford Motor Company, 1945-65: The Cleveland Engine Plant and Its Consequences," in *Fordism Transformed: The Development of Production Methods in the Automobile Industry*, ed. Haruhito Shiomi and Kazuo Wada (New York, NY: Oxford University Press, 1995), 49–86.

[60] John Diebold, *Automation: The Advent of the Automatic Factory* (New York, NY: Van Nostrand, 1952).

[61] Hounshell, "Planning and Executing 'Automation' at Ford Motor Company, 1945-65: The Cleveland Engine Plant and Its Consequences."

[62] Suisman, "Sound, Knowledge, and the 'Immanence of Human Failure'," 30.

and the present; or whether the player-piano sounded out to him from the past as the avatar for a more recent upheaval. Either way, the fact of automation's 1947 coinage throws the problem of anachronism into focus.

"Historians of technology have taken great pains," Jason Resnikoff notes, "to define automation narrowly with reference to... the postwar auto industry."[63] Should media historians do the same, or at least hold ourselves to using "automation" (and its subsequent cognates "automated" and "automate") only where it would not be anachronistic? There is certainly value in pushing through the ambiguity that has surrounded the term since its emergent years. The automatedness of an automated radio station in 1958 meant something different than the automatism of an automatic musical instrument in 1858. But any real technological specificity soon cleaved from automation, Resnikoff also argues, once it escaped the narrow context of transfer machines in automotive plants; the term held much more function as a claim to novelty and inevitable technological progress.[64] In this light, a comparison with the present-day uses of "artificial intelligence" is useful, for several reasons: 1) that marketing hype has always outweighed definitional specificity for both; 2) that both terms conjure considerable promise and threat, becoming the subjects of fervent popular debate and investigations from government bodies; and 3) that both sustain their novelty with constantly shifting bounds for technical complexity—automation and AI have always just arrived and are always right on the cusp of effecting a massive social transformation, according to the industrial voices who have been their chief promoters since the 1940s and 50s. It is hard to imagine many cases in which media historians today would apply "AI" to a pre-1900 object, given the present levels of transparent industry misdirection and scholarly skepticism surrounding the term. "Automation" deserves similar caution.

[63] Resnikoff, *Labor's End*, 17.
[64] Resnikoff, *Labor's End*.

But there is also value in emphasizing continuities by carrying the term past its own time period, as Suisman did in elaborating a relationship among musical automata, the Jacquard loom, and the player-piano: "Musical technology, in other words, helped inspire the automation of industrial manufacturing, which then returned to inspire musical technology."[65] "Automation," in such uses, serves well to convey a basic configuration among labor, capital, and machines—whether or not anyone in that configuration would have used the term at the time. Here, "artificial intelligence," which diverts attention toward the mystical interior of the machine instead of its operating context, does not present analogous use. If automation can be usefully spotted in any historical instance where managers conscripted a new technology to displace or otherwise exert leverage over labor, then once again the question for sound media—or rather for media in general—is how far back a link between reproduction and automation might extend. In other words, do all media automate?

The magnetic tape apparatus in the 1950s radio studio was a recording mechanism (via the record head) and a transmission mechanism (via the playback head, whose signal traveled to the broadcast console). With the simple addition of a 25 Hz oscillator and corresponding detector circuit, it was also an automation mechanism. Analysts have largely been mistaken, John Durham Peters has argued, to understand these first two functions as separate in the first place: "The distinction between transmission and recording, or the overcoming of distance and the overcoming of death, is largely a convenience of organization."[66] What about the overcoming of labor?

The telephone and other "media of multiplication (transmission and recording)"[67] were, in Peters's account, swept up in a patriarchal social process that indeed strove toward au-

[65] Suisman, "Sound, Knowledge, and the 'Immanence of Human Failure'," 19.
[66] John Durham Peters, *Speaking into the Air: A History of the Idea of Communication* (Chicago, IL: University of Chicago Press, 1999), 143.
[67] Ibid., 195.

tomation:

> Before automated switching, the routine medium of routing phone calls was the switchboard operator. We have met this figure before—passive, neutral or feminine gender identity, servicing an apparatus of message delivery—in the spiritualist medium and in Bartleby the scrivener. An Ontario newspaper in the 1890s repored on operators: "The girls then, are automata.... They looked as cold and passionless as icebergs," and an early training manual prescribed that each "operator must now be made as nearly as possible a paragon of perfection, a kind of human machine..."[68]

A familiar trope across media history sees marginalized bodies standing in for—and being told to imitate—the automated systems with which managers intend eventually to replace them. Writing on Amazon Mechanical Turk, Lily Irani has situated the microwork platform in a historical lineage where media architects aim for their products to act as wedges between "innovative" and "menial" forms of labor. The division typically relies on racializing and gendering the laboring subjects as well.

> These male–female encounters were common sites of anxiety in public discourse—anxieties reduced through the automation of female technical labors. Vannevar Bush's famous piece "As We May Think" describes the "disquieting gaze" of a "girl" stenographer and imagines her displacement by AI and an audio recorder.[69]

[68] Ibid., 196.

[69] Lilly Irani, "The Cultural Work of Microwork," *New Media & Society* 17, no. 5 (May 1, 2015): 720–39, p. 733; Irani credits Wendy Chun's (Wendy Hui Kyong Chun, *Programmed Visions: Software and Memory* (Cambridge, MA: MIT Press, 2011), p. 49n32) citation of Vannevar Bush, "As We May Think," *The Atlantic Monthly* 176, no. 1 (1945): 101–8.

Irani's mention of "AI" is another case of useful anachronism: Bush was helping to set AI's agenda in advance of its actual coinage in the 1950s. While waiting for AI, an "audio recorder" appeared to him as the most available salve for the problem of feminine intermediation.

Media that can consolidate time and distance also inevitably consolidate labor. Someone has to do the recording and transmitting, or the internal routing that makes either possible. For the apparatus to feel like a stable, successful medium to the people who communicate through it, that intermediary worker's presence should produce as little friction (social, sexual, or otherwise) as possible. Automation is in most cases better understood as machines *dis-placing* labor—literally putting physical space in between the worker and the work—rather than replacing it.[70] This displacement makes a convincing show of removing the intermediary worker from the medium, satisfying the priorities of racial and patriarchal capitalism under which these media have taken shape. But, crucially, as a medium grows and stabilizes, other types of work soon move from its inlets and outlets into its interior: musicians in the 1930s and 40s experienced this move, realizing (as Kraft and Peterson have emphasized) that the radio-recording industry no longer just circulated their work but 1) depended on it and 2) dictated its parameters, including musicians' geographic location[71] and the genre system into which they had to articulate their creations. In terms of political economic categories, this expansion often looks like the automation of production workers following the automation of distribution workers: first stenographers, then musicians; or more recently, first content moderators, then journalists.

Automating cultural production does not, in this model, mean replacing the creative process with automatic machinery, as today's spate of generative AI applications might incline

[70] Noble, *Forces of Production*.

[71] Kraft notes that "thousands of musicians had moved from small towns to media centers" when recording became the de facto way to earn income (Kraft, *Stage to Studio*, 148)

us to believe. As on factory floors, the automation that media perform is typically a process of consolidating and relocating work so as to reduce the total number of workers and, more importantly, to put distance between those who remain and the controls that could give them leverage against the system's owners.

Today, culture and media workers including musicians find themselves in a bind, aware of how automated distribution under the "platform" model constrains and devalues their work[72] yet lacking many options for redress beyond withholding at an individual level or retreating to older media. That bind has motivated this research: a search through sixty years of automated music distribution for precedents that point a way out, for moments when people working with or within this kind of apparatus have perceived its vulnerable edges. With music streaming platforms and their algorithmic recommendation systems, radio automation has now been eclipsed by automatic technologies that are new and separate from radio's (though not nearly as new or separate as their owners would like listeners to believe—see Chapter 4's discussion of Google Radio Automation). In all this time, music and sonic workers have not mounted a collective response in any way tantamount to the one—the AFM recording ban—that preceded radio automation by ten years. Generative AI's more overt incursion into media production roles has perhaps just recently made collective refusal more thinkable: visual artists coordinated a refusal campaign against AI-generated images on the platform ArtStation,[73] and writers for film and TV made the studios' desire for AI allowances a prominent target in their 2023 strike.[74] Whether such tactics will prove portable into music and sound media will almost certainly depend on greater organizing

[72]David Hesmondhalgh, "Streaming's Effects on Music Culture: Old Anxieties and New Simplifications," *Cultural Sociology*, June 16, 2021, 3–24; Jeremy Wade Morris, "Music Platforms and the Optimization of Culture," *Social Media + Society* 6, no. 3 (July 1, 2020): 1–10.

[73]Benj Edwards, "Artists Stage Mass Protest Against AI-Generated Artwork on ArtStation," *Ars Technica*, December 15, 2022.

[74]Will Bedingfield, "Hollywood Writers Reached an AI Deal That Will Rewrite History," *Wired*, September 27, 2023.

among and between workers in both categories.

The point that all media automate should do two things for two (overlapping) audiences: for media workers, producers, and audiences, it should serve as a warning that these groups will need to counter, together and proactively, the automating tendency that arises and spreads in a new medium; for media researchers, it should push analysis further toward labor. At the broadest scale, in the influential terms that Harold Innis used, we can add *labor* as another quantity, with *distance* and *time*, around which a "civilization" and its communication systems can be "biased."[75] Today, this bias would characterize American media giants better than either of Innis's original two: while not an express end in itself, social media's drive toward personalization at scale makes automation an implicit necessity. Companies like Facebook have abnegated from the start the vast quantities of labor it would take to responsibly operate a global-scale medium, even as they contingently employ a still vast yet insufficient host of moderators whose "ghost work" bridges the gap left at "automation's last mile."[76] When these firms propose more automation—namely, ever more sophisticated AI screening tools—as the antidote to ills that automated media have facilitated (continual traumatization of moderators, coordination of ethnic violence, and illegal advertising tactics, to name a few), there can be little doubt that a bias toward automation shapes the medium and the social context that allows it to keep growing.

But there is greater value in moving from the scope of civilizational biases and into the working interiors of specific media in specific cultural contexts. Here, an intrinsic relationship between media and automation should guide analysis not just toward media labor but also toward the constant definitional flux, within a given medium, for working roles themselves. Dan Schiller has argued that American communication studies have stumbled over

[75] Harold A. Innis, *Empire and Communications* (Oxford, UK: Clarendon Press, 1950).

[76] Mary L. Gray and Siddharth Suri, *Ghost Work: How to Stop Silicon Valley from Building a New Global Underclass* (Boston, MA: Houghton Mifflin Harcourt, 2019).

labor ever since the field emerged in the late 19th century. For Schiller, a mind-body dualism constrained the kind of work that "labor" could denote and, at the same time, opened up a conceptual space where new emphasis on "communication" became necessary: "At the very historical moment that the separation of hand and brain—and more precisely, of conception and execution—was becoming decisive within the social formation, communication study began to expand into the conceptual space bequeathed by the parallel tendency to separate 'intellectual' and 'manual' labor."[77] Communication studies' adherence to questions concerning an intellectual domain isolated from physical toil both legitimized the field in its emergent years and severely limited its ongoing capacity to account for labor issues. Schiller has argued that a contextualist, integrative approach drawing from cultural studies is key to repairing this fault at the core of the field and the conceptual divisions it has reified. The American broadcast radio context is a productive one toward that end.

Radio labor, automatedness, and *(de/re)programming*

American radio has, from its start, featured arbitrary and shifting labor divisions among various kinds of technical and performance work. Station engineers worked off-air, building and maintaining equipment and monitoring transmitter power; though as the figures directly accountable to the FCC under radio's licensing system, they also bear responsibility for what is transmitted. Other technicians aided broadcast programs directly, switching sound sources and adjusting their volume in coordination with the performers. Announcers spoke into the microphones, but inevitably took on technical work in this highly mediated performance setting. Automation would increase the degree to which announcing meant interfacing with technologies, as announcers (including DJs) increasingly prepared programs on tape rather than performing them directly into the transmission chain. But,

[77] Dan Schiller, *Theorizing Communication: A History* (New York, NY: Oxford University Press, 1996), x.

more significantly, automation took shape as a form of leverage over these individual roles, seizing upon the existing instability of their separation.

Historians of broadcast labor have emphasized that continual technical change makes the industry a difficult one for organized representation; but their accounts also evidence that disputes and shakeups in union coverage, sometimes set off by changes in the broader media landscape, helped motivate technical change. The International Brotherhood of Electrical Workers (IBEW) and the National Association of Broadcast Engineers and Technicians (NABET) competed to represent technical staff at different networks;[78] as network attention shifted to TV in the 1940s, this split meant even more piecemeal representation at individual stations. The American Federation of Television and Radio Artists (AFTRA) covered speaking performers and the AFM covered musicians, but questions at the boundary between performance and technical work—should performers be allowed to manipulate microphones, when that equipment was the purview of NABET-covered engineers?—raised multi-directional disputes among these unions and the employers.[79] The rise of the DJ show, even though a technician typically operated the turntables while the DJ announced, compounded these gray areas even further. The radio engineer Paul Schafer, years before he became the "father of radio automation" through his equipment designs and relentless salesmanship, worked at a cash-strapped station in Fort Wayne, Indiana; there, he "put a microphone between the turntables and... became the first *combo* operator (both an announcer and an engineer) in those parts."[80] By 1980, radio automation had helped station owners remove most live-assist technicians and confer their work on DJs. For live programming,

[78] Charles G. Bakaly Jr., "Decisions Affecting the Networks and Unions," in *Broadcasting and Bargaining; Labor Relations in Radio and Television*, ed. Allen E. Koenig (Madison, WI: University of Wisconsin Press, 1970), 99–119; Robert Coulson, "What Has to Be Arbitrated in Broadcasting?" in *Broadcasting and Bargaining; Labor Relations in Radio and Television*, ed. Allen E. Koenig (Madison, WI: University of Wisconsin Press, 1970), 85–98.

[79] Bakaly, "Decisions Affecting the Networks and Unions," 109–10.

[80] Paul C. Schafer, "Memoirs of Paul Charles Joseph Schafer" (1992), 10.

combo operation had become the norm.[81]

As DJs' responsibilities expanded into more technical territory through automation's intervention, so did other roles particular to American radio's governing commercial model. Several parties might interface with the same automation system in the same station: DJs would pre-record their song transitions at a fully automated station or cue sound recordings from the system's (tape or virtual) cartridge machine when broadcasting live; staff in traffic (the department that makes sure a station airs the advertisements it sells) would arrange cartridges for automatic rotation; and program directors would do the same for musical selections, either planning logs directly and entering them as machine-readable instructions or adjusting parameters in an automated music scheduler. This last area, programming, was already a porous category that both included and regulated DJ work by the time automation arrived to stretch it even further.

In 1955, when radio automation was only just moving beyond Ampex's pilot installations, DJs and program directors were already applying algorithmic tools to their task of music selection. A partnership between IBM and BMI, the royalties-tracking organization that the NAB had stood up as a competitor to ASCAP,[82] offered computerized log analysis to stations; as Elena Razlogova has argued, the venture represented one of the first precursors to today's algorithmic music recommendation systems.[83] Even where computers did not physically enter stations, discourses of computing and cybernetics pervaded this work, as Alexander Russo has shown:

> In a 1955 profile... pioneering Cleveland rock and roll DJ Bill Randle described

[81] "McElhatton Returns to Radio," *KPIX News* (San Francisco, 1980).

[82] Barnett, *Record Cultures*.

[83] Elena Razlogova, "The Past and Future of Music Listening: Between Freeform DJs and Recommendation Algorithms," in *Radio's New Wave: Global Sound in the Digital Era*, ed. Jason Loviglio and Michele Hilmes (New York, NY: Routledge, 2013), 62–76.

himself using the language of cybernetics and information processing. "I weed out those songs that are obviously bad and play the rest on my program to get listener reaction. Then I feed the results into a machine. I'm the machine. I'm a Univac."[84]

Randle's boast shows how *automatedness* became a quality that DJs could playfully confer on themselves, long before radio automation began to confer it on the overall medium in their absence. In step with American radio's new fixation with demographic data and with broadcast formats, as Russo argues, radio programming became a computational activity. And just like computer programming, it was simultaneously an art and a science, predicated on a relationship with technology that at once empowered programmers and distanced them from the medium's core operation.[85]

Here, the social stakes of media automation rear up from the most granular level: automatedness is a property that never stays confined to the medium's technology, but tends to invade the person who uses that technology. Jeremy Lansman, a radio engineer who would help build influential freeform community stations starting in the 1960s, moved toward that project partly out of frustration with how working with KPFA Berkeley's automation system made him feel: "Threading tapes into the blinking automation machine... made me feel I was little more than an automaton myself."[86] The phenomenon is older than broadcast radio and automation, as Mal Ahern shows: "In his 1915 novel *Shoot!*, Luigi Pirandello describes the way that cinema's mechanical processes transform even the man behind the camera into a sort of automaton."[87] Automatedness, better understood as the real or perceived presence

[84]Russo, "Punch Cards and Playlists: Computation, Curation, and the Cybernetic Origins of Radio Formatting"; quotation from "Top Jock," *Time*, February 4, 1955.

[85]Chun, *Programmed Visions*; Chun also notes that what is today called computer programming or software development was originally called automatic programming.

[86]Lansman, quoted in Jesse Walker, *Rebels on the Air: An Alternative History of Radio in America* (New York, NY: New York University Press, 2001).

[87]Ahern, "Cinema's Automatisms and Industrial Automation," 7.

of the five companion tendencies listed at the beginning of this introduction, spreads first from machine to medium, then from medium to media worker. The figure of the programmer in radio represents, to champions and critics alike, this osmosis: the cultural producer's becoming-computational in a deal that offers mastery over the now computational medium.

Many DJs and radio engineers have happily taken up the role that programming offered them, with some going on to work for radio automation vendors; as with the software industry, *programming* has typically been the name for the work that automation makes available in exchange for displacement. For those who can attain it, programming is understood to be more lucrative and more creative than the activity it automates. Other radio practitioners, when the elevation to programmer was either unavailable or unappealing, took up practices of *reprogramming*, as Ron January termed it.[88] These acts of minor sabotage did not aim to overthrow a station's working order but to deviate toward (the worker's opinion of) better broadcasting. Composers and artists, too, have taken keen interest in changing the metaprogram for radio (as with Max Neuhaus, discussed in Chapter 2) or for the act of listening itself (Pauline Oliveros, Chapter 3); they have done so by embracing the role of the programmer, harnessing automatic tools or computing's conceptual power in order to redirect flows of sound or attention. A third disposition, which I call *deprogramming*, extends saboteurial thinking past the blocks that automation puts in the way of real sabotage. Exemplified by Christof Migone's 1992 *Radio Naked* and its prompts for disassembling and subverting deep-seated broadcast norms, it teases out the arbitrary structures that programmers uphold and imagines the effects of their refusal. Deprogramming is a largely speculative activity; yet, amid advanced and ubiquitous media automation, it is unique in charting an escape route from, instead of a negotiation with, managerial control.

[88] January and Friedman, Ron January, Oral History.

Methods

I began this research looking for moments of creative struggle surrounding radio automation. Toward that end, I sought to understand the technology and also the ways that people with various relationships to radio (sound artists, DJs, engineers) have encountered or imagined automation. I began by setting up my own automated "station" in the free, open source radio automation software Rivendell (discussed in Chapter 4). Beyond offering up its own interfaces and source code for analysis, Rivendell introduced me to a chain of what I call structuring metaphors in radio automation's standard workings: grids, clocks, carts, and logs. These virtualized inner media pointed to a long, material history that would play an important part in understanding how automation came to function and to mean what it means in radio.

A search for radio automation's earlier forms led me to industry periodicals. Magazines like *Broadcasting* were not only useful in the ads they ran for various automation manufacturers; they were themselves agents in the history, having pinned the term "automation" to Ampex's technology before most engineers thought of (or acquiesced to) using it. These sources revealed that automation predated, by a few years at least, the origin story that had apparently entered radio industry canon by 1970: that engineer Paul Schafer had built the first automation system in 1956 at KGEE Bakersfield.[89] While coverage around Ampex's introduction of "automatic programming" in 1953 became an important point of focus, it was more significant for its traces of continuity than for the credit it gave to a corporation. The relationship between automation and tape recording reoriented the stakes and scope of how I wanted to apprehend radio automation; in this introduction, I have shown how that

[89] Earl B. Abrams, "Automated Radio: It's Alive and Prospering," *Broadcasting*, June 9, 1969; Christopher H Sterling, *Encyclopedia of Radio* (New York, NY: Routledge, 2004).

continuity should extend labor-political concerns into more processes of mediation.

Media archaeology contributed three guiding prompts for this investigation: first, approaching charismatic origin claims (like the KGEE story) with caution yet with interest, as these stories take part in shaping the media trajectories they (mis)represent; second, a charter toward "reevaluation of the connections and gaps between media technologies"[90] as the factors distinguishing radio automation from pre-recorded programming were much more particular than "automation" would imply; and third, an approach that Erkki Huhtamo and Jussi Parikka draw out from Siegfried Zielinski's cinema historiography, a "'technology-culture-subject' triad" in which cultural studies can cooperate with technical media theory.[91] This last orientation led me toward a particular focus on the physical subcomponents that most directly determined radio automation's practical affordances—for instance looping tape cartridges, discussed in Chapter 3—and on how artists took up those components and affordances in works that channeled larger currents in sound culture.

In the interviews I conducted for this project, I spoke with artists whose work had engaged radio automation or its elements in some way. I also interviewed engineers and others with firsthand experience in shaping, selling, and using radio automation. Meanwhile, I made visits to the Wave Farm library, to the University of Maryland's Broadcast History collections, to the John Cage Trust, to the Stanford University Libraries, to Loyola Marymount University's Center for the Study of Los Angeles, to Washington University in St. Louis's Music Library, and to the Toronto Metropolitan University Libraries. Materials at these sites represented viewpoints ranging from artists (*EAR* magazine, for instance) to corporations (Ampex and Muzak) and commercial radio managers (UMD's NAB collection). Where possible, I also examined software source files—documents where rhetorical conventions and

[90] Erkki Huhtamo and Jussi Parikka, eds., *Media Archaeology* (Berkeley, CA: University of California Press, 2011), 13.

[91] Ibid., 11.

cultural priorities in radio automation merged with (and emerged from) radio automation's direct, technical workings.[92]

A challenge in approaching this subject has been considering sounds as historical actors when most of the available evidence is textual or visual. By having granted certain sounds—25 Hz cue tones—a means to control the circuits that carried them, radio automation demands this attention to sonic agency. Cue tones were never meant to be heard by radio listeners under usual circumstances, though, and the *sound of automation* in radio was a change in the aggregate "sound" of American radio in general rather than a sound that could persist in a recording. I gathered any sound and video recordings I could that might relate to radio automation, or to cultural logics that attended or countered it in some way. The Wave Farm Radio Artist Fellowship presented a unique framework for working with these recordings: the radio artwork I produced in the fellowship's final phase, titled *25 Hz*, spliced together samples from this collection and interspersed them with "cue tones"—volunteers contributed these by generating sounds centered on a 25 Hz drone. A sonic relative to what Ritika Kaushik has called "videographic meddling," this compositional approach undid the inaudibility of cue tones in order to let them interact with adjacent sounds in other ways than control.[93] It steered my interpretation of key source material, and the piece is a companion to this document from within the medium and practice I depict here.

Overview by chapter

Chapter 1, "Cue Tones (1953–1963)," focuses on early efforts at Ampex and elsewhere to add automatic controls into tape-based radio programming, as well as the conceptual implications that tape and 25 Hz cue tones yielded for sound media and sonic imaginaries. The chapter tracks the movement of tape recording, radio, and automatic control through works by

[92] Mark C. Marino, *Critical Code Studies* (Cambridge, MA: The MIT Press, 2020).
[93] Ritika Kaushik, "Videographic Meddling as Media Historiography" (Boston, MA, 2024).

John Cage and through the Muzak Corporation, whose subsidiary Programatic Broadcasting Service established the aesthetic and commercial parameters that would give radio automation traction.

Chapter 2, "The Golden Age of Automated Radio (1963–1980)," puts two key themes of automation's spread across the American radio industry—the use of "creativity" as a selling point for automation, and the effort to expand automation into radio formats beyond easy listening—into context with the moment's surge in political theories of automation. Two cases illuminate automation's forward march from its edges. First, just outside the American commercial radio context at the university-owned CJRT in Toronto, radio automation's political valence came on raw display in a struggle between students and station managers. Second, white media producers imagined a conflict between automation and Black authenticity—one that was not born out in automation's use in Black-oriented stations. At WJLD Birmingham, Black air staff and white managers both found ways to recruit the automation system to their side in a struggle over creative control.

Chapter 3, "Programming the Programmers (1980–1996)," follows the parallel processes by which sonic arts and radio automation each became computational. As personal computers became automation's new vehicles, tape cartridges and their affordance of sonic density helped artists and automators define key features of digital sound culture even as digital audio storage still loomed up ahead. Beginning from how the composer Pauline Oliveros reworked the computational metaphor for experimental sound culture, the chapter uses the metaphor's shifting politics to draw automation critics, analysts, and developers into conversation with a growing radio art movement. By the 1990s, that movement had come to treat automation as an avatar of American radio's increasing commercial homogeneity; by the same stroke, its artists began turning to small-scale transmission as an artistic opportu-

nity.

Chapter 4, "Radio Rearticulations (1996–2010)," untangles automation's complex fortunes in the wake of the 1996 Telecommunications Act and in the emergent years of a data-driven new media paradigm. Rivendell (a free and open source radio automation suite whose user-developer community crossed from Christian conservative radio into a progressive low power FM movement) and Google Radio Automation (the object of a failed effort by the internet giant to diversify its ad tech infrastructure into older media) demonstrate radio automation's capacity to cross political and scalar boundaries as a software object yet also the limits of its capacity to forge infrastructural cooperation across cultural contexts. Artworks by Wobbly and by Anna Friz and Emmanuel Madan exemplify how automation and its attendant forces in radio offered up aesthetic frameworks that celebrated the kind of disassembly automation had invited.

A conclusion draws out factors that artists and independent radio operators may wish to consider in their choice of whether and how to use automation. Finally, I apply the medium-unmaking tendencies radio automation has exhibited to the present moment's surge of media automation: generative artificial intelligence. I identify ways that AI already contributes to death knells for its originating media—the web and internet platforms; and I speculate that new creative movements will orient themselves toward parts and protocols that digital media cast off in their continual, intrinsic drive to automate.

Conclusion

In introducing this thesis, I have laid out what could, from a certain angle, be called an accelerationist view of automation in media. With automation, capitalism's various vectors of influence over media condense into technical objects. As these objects help secure a working order in which management dictates the rules, they also make increasingly evident the

inherent contradictions behind their use: in music radio, for instance, the creative work by which DJs and musicians produce value in the medium is treated as a source of liability to be homogenized and restrained as much as possible. Attention to such structural contradictions was fundamental for Theodor Adorno and the Frankfurt School's critique of mass culture[94] and thereby to a wide lineage of artists and critics who have oriented themselves in opposition to mass media. In 1993, Diana Augaitis and Mary Anne Moser, who with Dan Lander had convened sound artists at the Banff Centre for the Arts in a project called *Radio Rethink* (see Chapter 3), reflected that "radio no longer appears as the seductive medium that it once was," leaving behind a "weighty cultural history" whose traces could be taken up in experiments with a micro-FM transmitter. "It is in such niches and cracks of mass media's mortar that many artists locate their work," they wrote.[95] By eroding radio from within, automation opened some of those cracks; it was thus partly responsible for the flourishing in autonomous radio that *Radio Rethink* and subsequent projects in transmission art would help drive.

But the unmaking that automation aids in media is a very particular kind of destruction, experienced first at a subjective, communicative level rather than at the political economic register of Joseph Schumpeter's "creative destruction."[96] It has not brought down media industries (though, together with financialization, it has helped them stagnate), nor has it displaced workers quickly enough to set off a social crisis where "productivity can no longer be the measure of an individual's right to life," as labor organizer and theorist James Boggs felt would be imminent given automation's momentum in the early 1960s.[97] It is, rather, in

[94] Peter E. Gordon and Alexander Rehding, "Editors' Introduction: Adorno, Music, Modernity," *New German Critique* 43, no. 3 (129) (November 1, 2016): 1–4.
[95] Augaitis et al., *Radio Rethink*, 1.
[96] Joseph Alois Schumpeter, *Capitalism, Socialism, and Democracy* (New York, NY: Harper, 1941).
[97] James Boggs, *The American Revolution: Pages from a Negro Worker's Notebook* (New York, NY: Monthly Review, 1963), 109.

bringing about the condition that Augaitis and Moser named in radio—the loss of radio's status as a "seductive medium"—that radio automation has produced creative openings. When the uniformity of radio content becomes more salient than the content itself, radio fails as a medium, and attention can return to its technical and cultural borders.

Radio is a fruitful venue through which to observe this process, not only because the changes have played out over a long period and through an intimately contextual meaning for "automation;" it is also valuable, as an entertainment medium and a creative pursuit, for how close its contradictions lie to the surface. At community radio stations around the country, people work hard, without expectation of compensation, for the chance to air music for their neighbors. This is work that would very clearly continue without capital's support. Indeed, without the commercial model baked so deeply into radio's institutional model in the United States—and without the ideological heft of *musical programming*, which urges people to professionalize their own listening experience—there would be little rationale for buying machines to fill a notch of the frequency spectrum with recorded music for a full day. In drawing attention to its own absurd degree of automation, radio has also made perceptible the irrationality of a wider media ecosystem—and a society those media maintain—biased toward overcoming labor.

Chapter 1: Cue Tones (1953–1963)

"The age of automation—that art of worker-less factories which has industrial management crackling these days—is coming close to broadcasting," announced the industry magazine *Broadcasting · Telecasting* in September 1954. "The dream of programming a radio station for endless hours with machines doing the switching, the cut-ins, the station identifications, or of operating a tv outlet for hours with slides and film and nary an engineer in sight is not so far off."[98] In fact, as the article acknowledged, the Ampex Corporation had already begun on-air tests of an automatic programming system that could switch between program and announcement tapes as the author described. Through its adoption of German wartime tape techniques and its partnership with Bing Crosby, Ampex had laid claim to the future of pre-recording in radio—a future where recorded sound was higher in quality and more flexibly modular as broadcast material than it had been in the transcription disk era.[99] Now, the company had taken what to some radio workers appeared an obvious next step by automating the transitions between tape segments.

At the core of Ampex's approach was a "cue tone"—a 25 Hz (25 oscillations per second) sine wave, recorded in a brief burst over the announcement or program material, that when detected by a program control device would trigger one tape player to stop and another to begin playing. 25 Hz became an informal standard. It formed the backbone of automated radio well into the 1980s and long outlived Ampex's brief direct involvement with automatic programming. The cue tone technique itself, though, appears to have been a case of multiple discovery rather than an Ampex innovation. The *Broadcasting · Telecasting* article focused

[98] "Coming: Machines to Run the Machines," *Broadcasting/Telecasting*, September 27, 1954.
[99] Clark, "The Magnetic Recording Industry, 1878-1960."

not on Ampex but on an independent engineer who reflected more readily on the implications and continuities behind what would, by 1960, simply be called "automation" in the American radio context.

Figure 3: The Vandivere Automatic Sequencer, as shown in *Broadcasting · Telecasting*. A caption reads, "This is the chassis of the Vandivere Automatic Sequencer, which promises to bring automatic station operation one step closer to reality. It permits inaudible cue tones to be placed on a tape recording to activate other program equipment. The small block in the foreground is the sequencer control board which is used to inscribe tone signals on the tape." Scan courtesy of the Media History Digital Library.

The article reported on a device called the Vandivere Automatic Sequencer (Figure 3). Edgar F. Vandivere, Jr. was a physicist who had served as a consultant to the federal government on broadcast spectrum regulation before starting Vandivere Labs to market the sequencer.[100] The device could embed "inaudible cue tones" into an audio recording so that the recording itself, when it played through one sound reproducer, would trigger an auto-

[100] Lorena Leslie Vandivere, "Research and Family Records," 1996, Hightower Family Genealogical Database.

matic switch to the another one. This technique, whose basic premise Vandivere reportedly credited to TV station manager C. Richard Evans,[101] was "very simple and unspectacular,"[102] as Vandivere himself put it in a 1956 conference paper. Alongside a technical explanation for the sequencer, the paper offered a keen—if rather self-deflating—assessment of the emergent phase for what would soon be called radio automation:

> I like to think that automatic programming, or program automation, is a new thing; but actually it is not really new, of course, because all we mean by automatic programming is the automatic performance of some of the switching which is now done manually. Actually, to propose program automation is to propose that it is useful or desirable to extend the degree of automation which we already have. An automatic program which could be set up in January and then left to run without further attention until the next January would at first thought perhaps represent a station manager's utopian dream, but at a quick second thought it would obviously represent an undesirably high degree of automation. I quote this absurd example in order to emphasize my suggestion that we think of automatic programming in degrees and that one of our first problems is to determine what degree of system automation it is useful to provide, either in general or in any particular case.[103]

In looking ahead to an "absurd" (yet, for management, "utopian") future scenario for automated radio at the same time that he helped inaugurate its basic design, Vandivere illustrated a set of continuities and contrasts that shed light on radio automation's emergent trajectories. Most fundamentally, Vandivere recognized the continuity between sim-

[101] "Coming: Machines to Run the Machines."
[102] Vandivere, "Some Techniques in Automatic Programming," 84.
[103] Ibid.

ple pre-recording and "program automation." His design, for which he filed a patent in 1955, described "automatic sequential transmission" as something that would naturally be desirable given "the practice in many broadcasting stations to record items of audible program material, such as spot announcements and commercials, for subsequent broadcasting."[104] This description of automatic programming as an in-house practice, though, failed to anticipate the important role that syndication would play in automation's predominant use cases; as Ampex spokesmen foresaw, automation would typically shift *where* programs originated (i.e. at centralized program services rather than within stations) in addition to *how* programs were produced and sequenced.[105]

Further, Vandivere's design retained degrees of flexibility that would not stick to radio automation's informal standard. Acknowledging that the number of different control tone frequencies to trigger different actions was an arbitrary design choice, Vandivere proposed three frequencies, each to be embedded within a 10 kHz carrier tone (a puzzling choice of frequency, requiring the recorder to "filter a notch out of the program material" right at the linear center-point of the typical human hearing range); this way, a variable length between one playback machine's start and another's stop could accommodate the slower activation time of phonograph records, which Vandivere saw as "especially desirable" for music playback in an automated system.[106] The enduring Ampex design used only the 25 Hz tone and, though their system could interface with a jukebox-style record changer, helped cement tape's status as the de facto medium for automation. It would become a convention for automated stations to copy their music records over to tape reels or cartridges, up until com-

[104] Edgar F. Vandivere, Recording and reproducing systems, United States US2780679A, filed March 29, 1955, and issued February 5, 1957.

[105] Russell J. Tinkham, "Automatic Station Operation," in *Proceedings of the Seventh Annual NARTB Broadcast Engineering Conference* (Los Angeles, CA, 1953), 5–16; Phillip Smaller, "An Automatic Programming System," in *Ninth Annual NARTB Broadcast Engineering Conference* (Washington, DC, 1955), 27–41, 107–8.

[106] Vandivere, "Some Techniques in Automatic Programming," 84.

pact discs arrived. But most obviously and significantly, Vandivere's cautious rationalizing failed to grasp the zeal that managers and engineers—as in other automating and computerizing industries—would have for automation even at lengths when its further extension seemed counter-productive, even destructive.[107]

The view from organized labor was, predictably, more grim. "Deduct One Engineer, Add One Sequencer," read a headline in the *IBEW Technician-Engineer* when the newsletter reported the *Broadcasting · Telecasting* coverage of the Vandivere Sequencer.[108] IBEW (the International Brotherhood of Electrical Workers) was one of two unions representing technical staff at radio studios in the United States; the other, the National Association of Broadcast Employees and Technicians (NABET), sounded a more urgent alarm the following year. NABET head Clifford Rothery commented that automation had reached the radio-television industry and now threatened to "'sterilize by mechanization' the public's major source of entertainment." Even if automation's ambit encompassed all broadcast media, in Rothery's view, one central culprit stood out within the audiovisual ensemble: he "claimed 'push-button control' was rapidly displacing radio-tv engineers and particularly attacked 'audio tape.'"[109]

For Rothery and anyone else invested in media industries' working dynamics, automation's rapid rise across the postwar American economy signaled a looming existential struggle. By the end of the decade, specific capitalists and corporations would occupy the other side of that struggle—including Paul Schafer, the charismatic engineer and businessman who took up the title "father of automation" despite entering the field three years after Ampex; and the Muzak Corporation, whose subsidiary Programatic Broadcasting Service

[107] Noble, *Forces of Production*.
[108] "Deduct One Engineer, Add One Sequencer," *IBEW Technician Engineer*, 1954.
[109] "Radio-Television: 30-Hour Work Week as NABET's Answer to Automation in Radio-TV?" *Variety*, November 9, 1955.

cemented automation, syndication, and proto-"easy listening" aesthetics in a symbiotic trifecta. But in its early years, neither a person or company but a material—audiotape—appeared, to engineers, labor organizers, and artists alike, as automation's driving force in sonic media. This chapter shows how radio automation expanded from a property of magnetic tape to an industrial operation in its own right. On the way, it passes through artistic explorations—particularly those of John Cage—where tape, radio, and even Muzak showed their propensities for automatic control. But it begins from tape and from the company that had made itself synonymous with tape in the American radio industry.

Ampex: tape automates radio

Russell J. Tinkham, after an initial career in acoustics, had joined the United States' magnetic tape recording industry on the cusp of its expansion, working for the Armour Research Institute in Chicago on efforts to move from wire- to tape-based magnetic recording; he had in 1946 left Armour to become the founding president of a tape recorder manufacturer, Magnecord.[110] Having left Magnecord in 1950, Tinkham joined Ampex as a regional sales-engineering director in 1952 and moved to the company's California headquarters within a year.[111] When he introduced the cue tone technique to an audience of engineers and managers at the 1953 NAB[112] conference, he carefully couched the concept first in radio's economic situation and then in magnetic tape's material affordances. He started by laying out the bind that television had placed on radio broadcasters, sapping profits and necessitating (as he saw it) either "some belt tightening" or "increased efficiency." The question facing a typical radio station owner, he claimed, was "how to run [a] sixteen-hour operation with an

[110]"In Memoriam," *Journal of the Audio Engineering Society* 25, no. 3 (March 1977): 167–68; Clark, "The Magnetic Recording Industry, 1878-1960," 296.

[111]"In Memoriam."

[112]The American broadcast industry's largest professional organization and lobbying group was called the National Association of Radio and Television Broadcasters (NARTB) at this time, having added Television to its name in 1951. In 1958 it would simplify to NAB. I have used "NAB" throughout to avoid confusion, as the organization held continuous importance to this history on either side of 1958.

eight-hour crew," and this "personnel reduction problem" warranted a technological solution.[113] With pre-recording, a time-expanding solution was already nearly viable:

> Basically the record is a method of time storage. Therefore, if we can use real time economically by recording all local voice announcements and commercials one after the other, the announcers need not be at the station except for the time required to make such recordings. The remainder of his time, which is now lost in waiting for some of the various bits of the program material to run its course would be gathered together and used by him to secure new business for the station or to play golf.
>
> All of this may seem to imply an insurmountable splicing job which takes time. Well, it is a splicing job, but not an insurmountable one. It is done electrically by pushbutton and what's more, the play-back is automatic.[114]

Explaining 25 Hz cue tones as "electrical splicing"[115] was a strategic abstraction on Tinkham's part: though the S-3380 executed transitions at the time of playback, he invited the audience to understand automatic programming as a pre-production step. This way, it interceded in an *operational sequence*[116] that comprised problems and opportunities they already grasped at intimate, even bodily, levels. First, there was the "personnel reduction problem" and the thrilling opportunity to store and conserve "real time" that tape recording already offered as its answer. More thrilling yet was the lure of the golf course, which handily combined automation's twin promises to expand leisure time and elevate more (white, male) workers into the managerial class. Standing in the way, though, there was the unthinkably

[113]Tinkham, "Automatic Station Operation," 5.
[114]Ibid., 6–7.
[115]Ibid., 10.
[116]André Leroi-Gourhan, *Gesture and Speech* (Cambridge, MA: MIT Press, 1993); Sterne and Razlogova, "Machine Learning in Context, or Learning from LANDR," 7.

tedious prospect—the "insurmountable splicing job," hours of painstakingly cutting and gluing tape strips together each day—that the audience's hands-on familiarity with tape would have raised. But then, finally, to the rescue came Ampex's cue tone method, elegantly bypassing that single remaining roadblock to automatic efficiency.

Why 25 Hz? Ampex's reasons for choosing this frequency (which they usually denoted as "25 cycles" or "25 cps" [cycles per second]) are not recorded in any surviving materials, at least none that this study has turned up. The frequency is, notably, just slightly within the lower bound of the spectrum for normative human hearing. Some partial clues for that choice center on occasions for operators to play tapes back at high speeds. First, engineers imagined that broadcasters would listen for sped-up tones in a particular hybrid operation with the system. In reporting the results of a 1957 survey on tape and automation's uptake in radio broadcasting, Ampex's R.A. Isberg described an approach to "semi-automatic" broadcasting where a combination operator (a DJ serving also as a technician) would play musical selections from a tape reel that had been prepared for the automation system: "Should the operator not desire to play the tape recorded selections in the order in which they are recorded, he simply runs the machine at fast forward or rewind and counts the beeps caused by the 25-cycle tones at high speed."[117] This narrowly skilled and informatic listening, a new "audile technique"[118] on the part of the combo operator DJ, relied on the machine-legible tones pitching up into a more human-legible range when operators sped through them.

Second, the tones needed to persist through a much higher-speed duplication process that transferred them across tapes. Tinkham, in 1953, correctly foresaw that automatic programming would proliferate hand in hand with centrally produced program material ("conceivably provided by the various program services or by the program service of the net-

[117] R. A. Isberg, "A Survey of Automation and the Applications of Tape Recording in Broadcasting and Telecasting," *IRE Transactions on Broadcast Transmission Systems* PGBTS-9, no. 1 (December 1957): 84.
[118] Sterne, *The Audible Past*.

works")[119] and rapid duplication of that material for subscribing stations. The "new Ampex high-speed duplicator system," Tinkham explained in the same NAB presentation that introduced automatic programming, copied program material at a working ratio of "[t]en hours in two minutes."[120] This dramatic speed increase required a broad frequency response range from the tape and the systems that inscribed signals on it. Non-audio signals had already pushed Ampex to expand that range out to "120,000 cycles" (120 kHz), as Tinkham explained: "It has to do with the records of information on radio backed by the guided missile programs or the operational characteristics of automobile engineering or the ride characteristics of an automobile. The record of oil exploration, for example."[121] The burgeoning set of industrial and military data-processing applications Ampex had begun to explore (which would, along with videotape, soon overtake the broadcast radio applications that had facilitated the company's first tape technology projects) had built the scaffolding for scaling radio automation up. That scaffolding recorded tapes at a speed ratio of "16 to 1,"[122] a rate that would have shifted Vandivere's 10 kHz carrier tone (for instance) up to 160 kHz and potentially outside the range of reliable reproducibility.

Another tape application from outside radio helped spur Ampex's automatic programming design: background music. Where broadcast studios had generally wanted machines that could record and play back sound, a 1953 company overview at Ampex pointed out "a tremendous field generally known as commercial music or background music exists for equipment which reproduces only." Ampex had tailored its new Model 450 playback unit to this sector, equipping the device to play eight hours of audio from a single reel and then to "automatically repeat." Potential users included "[s]kating rinks, bowling alleys, funeral

[119]Tinkham, "Automatic Station Operation," 11.
[120]Ibid., 12.
[121]Ibid., 13.
[122]Ibid., 14.

parlors, railroads, restaurants, hotels, industrial plants, banks, super-markets, and other stores." "Libraries of pre-recorded background music," the document added, "are available through the Tempo Record Company in Hollywood and A-V Tape Libraries in New York and Muzak Corporation."[123] A 1955 competitive file in the corporation's archives included ad clippings for new background music systems with automatic tape playback, including a device from Presto Recording Corporation and a joint venture between RCA Planned Music and Magnecord.[124] A few years later, Muzak would draw the affinity between background music and radio automation out into a full aesthetic and commercial complex (as discussed later in this chapter); but for now, background music had helped supply a key technical component: the Ampex S-3380 Automatic Programming System included, as its first two "major components," a pair of 450-B reproducer machines[125] (Figure 4).

By the end of 1955, the S-3380 was in use at stations including KEEN San Jose, where it "underwent a six-weeks' field test" early in the year,[126] and WJET in Erie, Pennsylvania.[127] Tinkham returned to NAB that year, presenting this time at the management side of the conference while Ampex research engineer Phillip Smaller took his place at the engineering side. And now, they brought a working S-3380 system with them, which a *Broadcasting · Telecasting* convention preview said would be the "main feature" of their vendor booth.[128] A 1955 tape reel, one of the few surviving artifacts of the company's efforts to design and market automatic programming, indicates what demonstrations could have sounded like. Labeled "Music – Demo Copy Auto-Stn," the tape features 30–60 second musical selections—generally

[123] "The History of the Development of Ampex and a General Description of Its Operation and Facilities" (Redwood City, CA: Ampex, 1953), Box 23, Ampex Library.
[124] "Ampex Corporation Competitive File," 1955, Series 2, box 76, MI230, Ampex Corporation records.
[125] "Ampex S-3380 Operation and Maintenance Manual" (Ampex, 1955), 1.
[126] "Exhibitors Will Showcase Latests Wares for NARTB," *Broadcasting/Telecasting*, May 16, 1955, 73.
[127] Isberg, "A Survey of Automation and the Applications of Tape Recording in Broadcasting and Telecasting," 88.
[128] "Exhibitors Will Showcase Latests Wares for NARTB," 73.

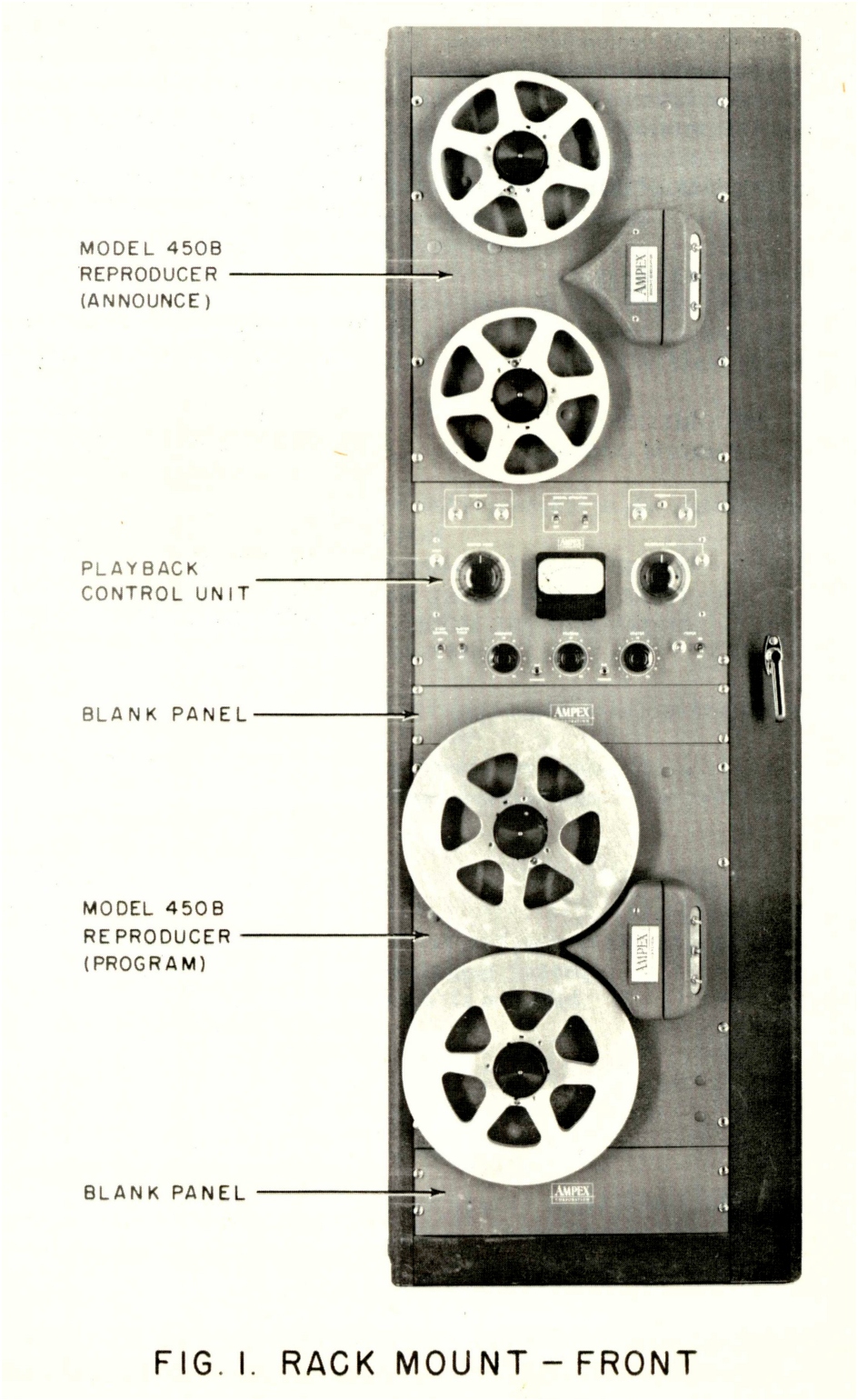

Figure 4: A labeled photo of the Ampex S-3380's playback components in rack-mounted arrangement, from the system's operating manual. Labeled components include "Model 450B Reproducer (Announce)," "Playback Control Unit," "Blank Panel," and "Model 450B Reproducer (Program)."

upbeat, instrumental tunes, ranging from American standards in brass band arrangements to shorter jingles with Orientalist motifs—and 25 Hz cue tones interspersing them.[129] (Part of the Stanford University Libraries' Ampex Corporation Records collection, this reel is the oldest "automation tape," as cue-tone-embedded reels came to be called, that I know to exist.) It is very likely that this or a similar tape featured in Ampex's demonstrations at NAB or at prospective client stations. Its short musical selections would have afforded viewers plenty of chances to watch the system switch automatically between this tape and a companion announcement tape.

Such demonstrations made a big impression at NAB 1955, and not only from Ampex. The longer-established Gates Radio Corporation marketed the Vandivere Sequencer,[130] and General Electric debuted an automatic switcher for TV stations. In the *Broadcasting · Telecasting* issue that followed the convention, reporter Earl B. Abrams cast Ampex as the central member of a quickly expanding cast, paraphrasing extensively from Tinkham as a de facto spokesperson for the emerging broadcast automation field. That article's headline, splashed in huge type across the top quarter of the page, read "Automation Steals the Show."[131] If Ampex managers had any reservations about whether their "automatic programming" constituted "automation" of the kind that was swiftly attracting national debate and predictions of pan-industrial transformation,[132] then the industry press had decided on their behalf.

Automation talk at the 1955 convention was neither purely technical nor purely celebratory. Next to Tinkham in the conference program was Prose Walker, who worked for the NAB as its Manager of Engineering. He called his speech "Operation ERTOM"—"an engi-

[129] *Music Demo Copy – Auto Stations*, Tape reel, 1955, Ampex Corporation records.
[130] "Exhibitors Will Showcase Latests Wares for NARTB."
[131] Earl B. Abrams, "Automation Steals the Show," *Broadcasting/Telecasting*, May 30, 1955.
[132] Amy Sue Bix, *Inventing Ourselves Out of Jobs?: America's Debate over Technological Unemployment, 1929-1981* (Baltimore, MD: Johns Hopkins University Press, 2000).

neer's report to Management."[133] Walker, in characteristic form for NAB's leaders and convention hosts, performed lighthearted deference to station owners even as he pressed the case that they should value their engineers' work. His tone took on more gravity only in closing: "As we move toward automation in broadcasting, let me remind you that you may have the opportunity to 'play God' with the lives and happiness of people who work in your establishment." Hardly arguing against automation, Walker appealed to managers' sense of self-importance even further by invoking the Cold War's ideological struggle: "In this atomic age we are using machines, *as we must*, to maintain the balance of superiority over those who would destroy our way of living." He asked only for automation to keep engineers—at least those engineers who maintained broadcast equipment, if not those who facilitated its use on-air—out of its purview: "*never forget* that the machine has not yet been invented which could mend itself. Neither can a machine *reproduce* itself nor inspire *confidence* and *esteem* in human beings."[134] Delivered in the same year as the first Congressional hearing on automation, Walker's speech sought to temper the too-obvious disparity between a management and press cohort keen on applying automation to radio and a labor force bracing for displacement. His balancing act, invoking both global turmoil and the fine-grained boundaries between machinic and human capacities, was already playing out in very different scenes from NAB.

"Push-button music:" John Cage and automation's elements

Avant-garde artists of the 1950s and 1960s navigated the same turbulent waters of automation anxiety and Cold War ideological strife that the NAB's Prose Walker invoked. Fred Turner has argued that, in collaborations with technology corporations such as

[133] A. Prose Walker, "Operation ERTOM: An Address," in *Proceedings of the 1955 NARTB Management Conference* (Washington, DC, 1955), 1.
[134] Ibid., 5–6 (emphasis original).

Experiments in Art and Technology (and the "Automation House" that hosted the group in 1970), but also by intertwining creative agency with automatic control in their individual practices, artists including John Cage and Robert Rauschenberg modeled a consequentially optimistic disposition toward automation.[135] Radio and tape provided material aid, even prompts, to these articulations. Composers in Western avant-garde circles were among those working busily to elaborate new technical and aesthetic situations around tape recording—including "John Cage, Pauline Oliveros, Steve Reich, Terry Riley, Pierre Schaeffer, Karlheinz Stockhausen, Edgard Varèse, Iannis Xenakis, and La Monte Young" as well as Vladimir Ussachevsky.[136] Many of these artists relied on radio for their technical and institutional needs. In Europe, state broadcasters famously provided Schaeffer, Stockhausen, and others with the various tape machines and test oscillators that they conscripted at pivotal moments in their genre-shaping careers.[137]

Radio also steered the course of less academic artist careers. Working in radio studios in Illinois and later California, radio producer Henry Jacobs set in motion a weird, American-folkloric, radiophonic parallel to Schaeffer's musique-concrête while playing with tape loops and collage techniques for his programs on the non-commercial Pacifica network.[138] Moving in the opposite direction, composer Raymond Scott departed a celebrity career as broadcast bandleader and retreated into an elaborate personal workshop where he developed early sound generators, music sequencers, and other automatic devices; the rumored reason was that his years coordinating ensemble players on the air had left him desiring a level of obedient precision that only automatic instruments could deliver.[139]

[135]Turner, "Romantic Automatism: Art, Technology, and Collaborative Labor in Cold War America."
[136]John Durham Peters, "'Memorable Equinox'," *Boundary 2* 47, no. 4 (November 1, 2020): 11.
[137]Jennifer Iverson, *Electronic Inspirations: Technologies of the Cold War Musical Avant-Garde* (New York, NY: Oxford University Press, 2019); Brian Kane, *Sound Unseen: Acousmatic Sound in Theory and Practice* (New York, NY: Oxford University Press, 2014); Louis Niebur, *Special Sound: The Creation and Legacy of the BBC Radiophonic Workshop* (New York, NY: Oxford University Press, 2010).
[138]Meredith Holmgren, "Henry Jacobs: An Interview," *Smithsonian Folkways Magazine*, 2012.
[139]Irwin Chusid and Jeff Winner, eds., *Raymond Scott: Artifacts from the Archives* (Castricum, NL: Basta Music,

In terms of enduring impact on sound's conceptualization in American art, though—and also in his taking up so many of the specific elements that converged in early radio automation—John Cage warrants special consideration. To Cage, radio, magnetic tape, and computers were all sources of compositional indeterminacy—elements that could be scripted and constrained yet still retain the capacity to exert their own material or random effects through sound. As to radio, Cage encountered the medium as a productive and diffusive context and yet also already heard it congealing into something that escaped its mediumness. His score for 1939's *Imaginary Landscape No. 1* explained that it "was written to be performed in a radio studio," where it could be "recorded and/or broadcast,"[140] and he consistently treated broadcasting as a fruitful "kind of abstract space" for Happenings, dialogues, and performances.[141] Yet with 1951's *Imaginary Landscape No. 4*, which swapped *No. 1*'s variable-speed turntables for radio receivers as its instruments, Cage helped launch a sound art tradition that flattened radio into a source for controlled sonic randomness. As Gregory Whitehead wrote in 1992,

> when radio has appeared under the name of art, it is most often under the degraded guise of industrial artifact, with its commercialized cacophony providing one sound source among others. In this reduced state, radio is no longer an autonomous public space but merely an acoustic readymade to be recontextualized, switched on, and played.[142]

Popular sound media became semi-chaotic audio sources that Cage's performers could switch on and off. They entered a set of "algorithmic strategies and tools," in Turner's

2017).

[140]John Cage, *The 25-Year Retrospective Concert of the Music of John Cage (Brochure Accompanying Record)*, 1958.

[141]John Michael Green, "'Available to Our Ears': John Cage and Broadcast Media" (Rochester, NY, University of Rochester, 2020).

[142]Gregory Whitehead, "Out of the Dark: Notes on the Nobodies of Radio Art," in *Wireless Imagination: Sound, Radio, and the Avant-Garde*, ed. Douglas Kahn and Gregory Whitehead (Cambridge, MA: MIT Press, 1992).

words; through radio and tape, as through the *I Ching* and (later) computer programs, Cage sought to engineer delicate balances of agency amid complex probablistic systems.[143] Turner points out that Cage, in pursuing indeterminacy as a means for ego-abnegation, simultaneously disavowed prior artistic legacies of *automatism* (as a way to draw out and celebrate the artist's psyche) and embraced a number of techniques for *automating* his own art. Further, Cage did so in proximity to collaborations between avant-garde artists and engineers at Bell Telephone Laboratories. Through these partnerships, Turner has argued, Cage and other artists in his circle helped tilt the public automation debates away from fears of technological replacement and toward an empowering vision of machine-aided agency.[144]

But if Cage helped steer a relationship between sonic art and automated futures at the levels of subjectivity and discourse, he also took up automation's core materials in ways that repeatedly converged with the actual designs of sonic (radio) automation. In 1952, the fifth and final *Imaginary Landscape* composition turned again to recordings as source material but this time also to tape as the destination medium. Over the course of the 1950s, magnetic tape became the core medium for industrial automation, replacing punchcards as data storage in computers and transporting machine tool instructions from planners' desks to shop floors.[145] Broadened to include paper rather than just magnetic tape, the material's significance for automation reached even greater conceptual depth, as John Durham Peters has pointed out:

> 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

[143] Turner, "Romantic Automatism: Art, Technology, and Collaborative Labor in Cold War America," 14.
[144] Turner, "Romantic Automatism: Art, Technology, and Collaborative Labor in Cold War America."
[145] Noble, *Forces of Production*.

> programming would be carried out; [Norbert] Wiener's word for software or programming was "taping." In mathematical automata theory, tape still supplies the metaphorical material.[146]

Cage's experiences working with magnetic tape attuned him to this level of enduring impact. "As I see it," he wrote for a 1958 concert program, "tape has brought about in a very tangible way a profound alteration of musical action, the consequences of which are not limited alone to tape but will affect all music."[147] In *Imaginary Landscape No. 5*, which Volker Straebel calls "probably the first piece of American tape music," [148] tape's materiality bubbled up into Cage's composition more than that of the series's previous constituent media. His score (Figure 5) discarded standard musical notation for literal representations of tape: he marked rectangular strips on graph paper to show the relative timing of their beginnings and ends.

A few years later, Ampex would use a similar graphical approach (Figure 6) to show radio producers how best to prepare material for playback on the S-3380 automatic programming system. The visual coincidence between the two—in a form that, speaking to tape's infrastructural place in sound editing even after its displacement by hard drive audio, today mainly evokes the multitrack editor view of a digital audio workstation—belies their very different sonic aims. In Cage's piece, silent gaps and noisy overlaps among the various tape players were the goal; for Ampex, "good timing" meant the precise synchronization of beginnings and ends (excepting a brief fade-out in the music tape while an announcement began) in a continual, one-at-a-time sequence. Yet Cage and Ampex had both arrived at tape

[146] Peters, "'Memorable Equinox'," 15.

[147] Cage, *The 25-Year Retrospective Concert of the Music of John Cage (Brochure Accompanying Record)*.

[148] Julia H. Schröder and Volker Straebel, eds., *Cage & Consequences* (Hofheim, DE: Wolke, 2012), 101; Cage, as Straebel describes, executed his version of *Imaginary Landscape No. 5* with Bebe and Louis Barron in their tape recording studio, using records as source material but relying on tape's affordances to superimpose eight separate layers together.

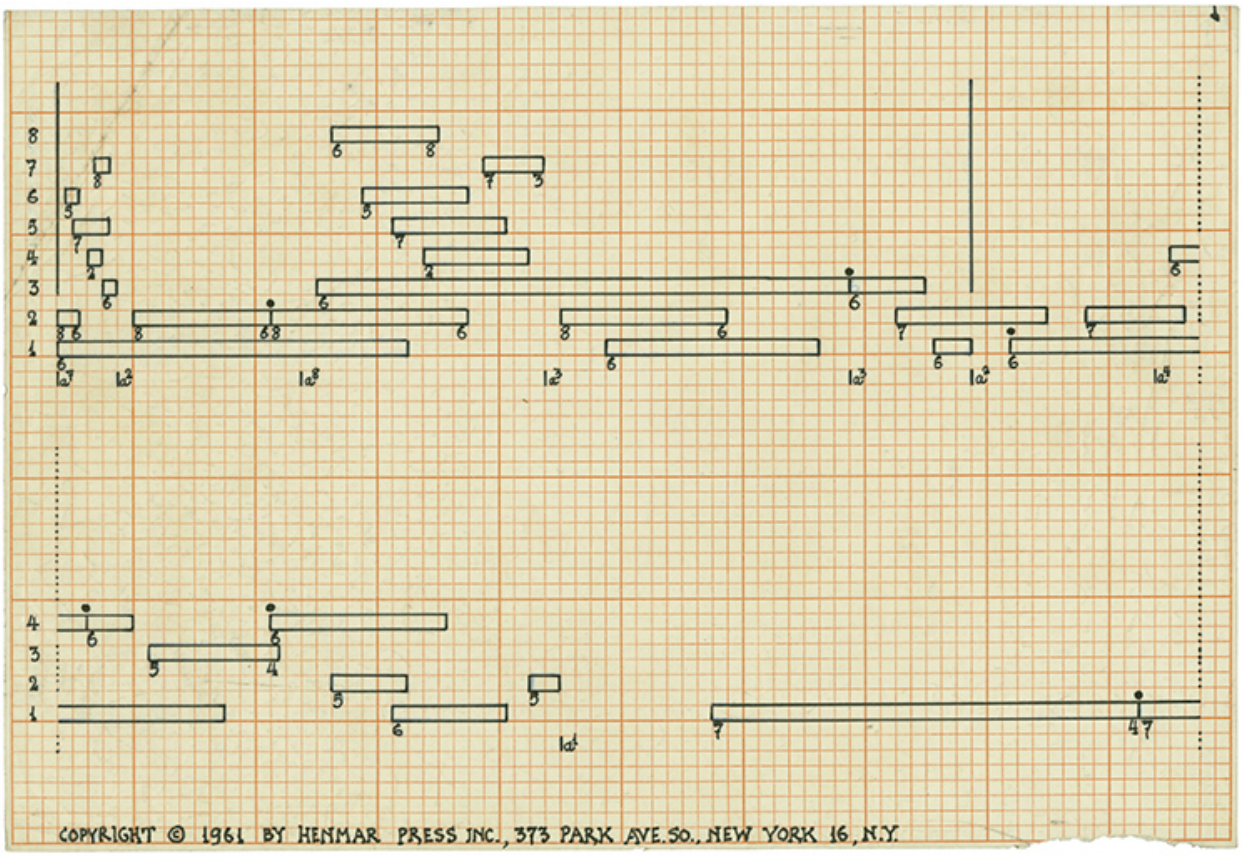

Figure 5: Excerpt from John Cage's score for *Imaginary Landscape No. 5*, composed in 1952. Edition Peters 6719 © 1961 by Henmar Press Inc., New York. Reproduced by permission.

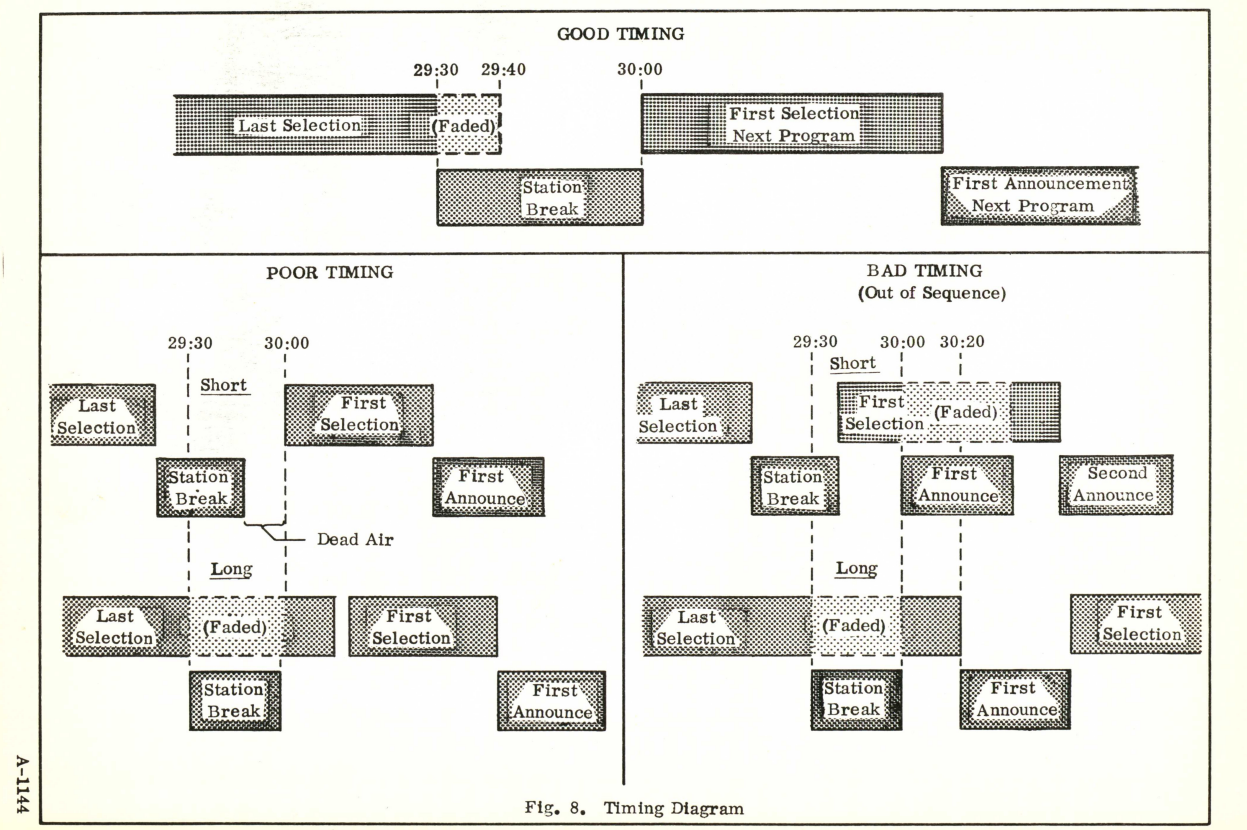

Figure 6: Timing diagram for tape preparation, in the operation manual for the Ampex S-3380 automatic programming system (1955).

through its virtue as a precision-controllable medium. These control diagrams swapped direct graphical representations of tape segments in for prior conventions—music notation and the broadcast program log, respectively—because magnetic tape afforded such convenient and indexical manipulation that *the material itself* could now take the place of *instructions for activating the material*. That is to say, tape provided such a useful service in *investing sound with plasticity* (in a literal, material sense) that it became an appealing visual proxy for sound itself.

Cage's relationship to control was certainly more ambivalent than radio automation designers'. He famously disdained sound recordings as media for musical encounter and especially as end-states for his own work. But in turning toward tape as an internal medium within that work, he pursued an interest in consolidating labor. His composition's instantiation as sound was to take place, if not under his own control, then under a complex set of controls he had arranged on his terms. The work of that instantiation, especially that work which trained musicians would perform, was a dangerous opening for unwanted determinacy to re-enter the process. Cage's pacific public demeanor has helped mask, as Benjamin Piekut suggests in re-examining an infamous collaboration between Cage and the New York Philharmonic orchestra, the inevitable trade-off that Cage's investment in sounds' agency meant for the agency and professional judgment of the musicians who helped realize his compositions.[149]

As a commentator, too, Cage took an ambivalent tack to the question of labor and technology. He would borrow Marshall McLuhan's optimistic (and ahistoric) outlook on automation; McLuhan closed his landmark 1964 *Understanding Media* by arguing that "the social and educational patterns latent in automation are those of self-employment and artistic auton-

[149]Benjamin Piekut, *Experimentalism Otherwise: The New York Avant-Garde and Its Limits* (Berkeley: University of California Press, 2011).

omy. Panic about automation as a threat of uniformity on a world scale is the projection into the future of mechanical standardization and specialism, which are now past."[150] In direct contrast to voices for the labor that made media work (NABET's warning that automation would " 'sterilize by mechanization' the public's major source of entertainment"),[151] the McLuhanist attitude anticipated creative augmentation and flourishing. For Cage, that augmentation would ideally expand labor: "What we need," he wrote in 1966, "is a computer that isn't labor-saving but which increases the work for us to do, that puns (this is McLuhan's idea)."[152] The "us," in this context, was an audience ("Are we an audience for computer art?," the essay began) who might, through computer-guided serendipitous linkage, occupy the role of artists. To occupy this role would be to take on new labor; but that labor would only be possible through disintermediation, when automatic tools bypassed the skilled performers who stood between idea and sound.

Cage's changing process did not only, or even most importantly, negotiate technological agency; the move to indeterminacy more fundamentally aimed to restore to *sounds themselves* the agency that Cage felt they held. For Charles Eppley, this legacy of "[s]onic materialism was a core aspect of Cage's experimental music project."[153] That aspect has fallen out of focus, they argue, due to the discursive emphasis of the post-Cagean conceptual art tradition, as developed through George Brecht's event scores, that uses sound as a "metaphor for dematerialization."[154] The event score would play a crucial role in artistic developments around sound and programming, especially as Pauline Oliveros developed the *sonic meditation* form in the 1970s and so paralleled industrial efforts to reconceive the categories of

[150] Marshall McLuhan, *Understanding Media: The Extensions of Man* (New York, NY: McGraw-Hill, 1964).
[151] "Radio-Television," November 9, 1955.
[152] John Cage, *A New Year from Monday: New Lectures and Writings* (Middletown, CT: Wesleyan University Press, 1969), 50.
[153] Charles Eppley, "Beyond Cage: On Sonic Art History & Historiography," *Parallax* 23, no. 3 (July 3, 2017): 351.
[154] Ibid., 342.

sound and software in relation to one another (see Chapter 3). Yet, as also affirmed by Oliveros's earlier contributions to some of the first American artistic experiments with tape at the San Francisco Tape Music Center (which benefited from occasional Ampex gear donations via employee Eldon Corl),[155] materialities of sound and sound media always anchored these conceptual explorations into the programmatic and the virtual.

The materialist and conceptualist trajectories are both audible within a comment that Cage made while talking with Morton Feldman on New York Pacifica station WBAI in 1966:

> It's become clear that we can be, not just with our minds but with our whole being, responsive to sound. That sound doesn't have to be the communication of some deep thought. It can be just a sound. Now, that sound could go in one ear and out the other. Or it could go in one ear, permeate the being, transform the being, and then, perhaps, go out, letting the next one in.[156]

Besides blending the materialist and discursive tendencies that historians of Fluxus would later wedge apart—here, a sound itself is the agent of potential transformation in the listener, rather than the sound-producing scenario—Cage's comment was also remarkably apt as an unintended description of radio automation's technical basis in cue tones. In an Ampex S-3380 or similar playback system, certain sounds (25 Hz tones) would effect a state change in the electronics, precisely in order to usher a subsequent sound in. Sonic materialism and sonic automation both meant investing sound itself with the capacity to organize and control other sounds.

Cage's sonic materialism pointed him also toward another sound infrastructure that would play a pivotal role in radio automation: Muzak. In separate, unrealized project

[155] David W. Bernstein, *The San Francisco Tape Music Center: 1960s Counterculture and the Avant-Garde* (Berkeley, CA: University of California Press, 2008), 71–72.

[156] "John Cage and Morton Feldman In Conversation, Radio Happening I of V," *Radio Happenings* (New York, NY: WBAI, July 9, 1966).

proposals, Cage twice planned to intervene in Muzak's "Wired Radio" system that piped continuous, instrumental, inoffensive musical recordings into commercial spaces.[157] In the first scheme, which he described in 1948, Cage would "compose a piece of uninterrupted silence and sell it to Muzak Co. It will be 3 or 4 1/2 minutes long—those being the standard lengths of 'canned' music—and its title will be *Silent Prayer*."[158] The second idea, which Cage sketched in a 1962 essay and developed further the same year when he proposed a sound piece to accompany Richard Lippold's sculpture in the Pan American World Airways headquarters, was "Muzak-plus:" an indeterminate replacement for the actual Muzak that (to Lippold's objection) would surround his sculpture in the corporate lobby.[159] Muzak, by this time, epitomized sonic managerial control, not only as a sound infrastructure with installations across and beyond the United States, but also as a scientific effort to extend managerial techniques *through sonic programming*.[160] Underpinning that effort was the "prospect of using inaudible sounds to manipulate human emotions," which psychologist Harold Burris-Meyer had explored in theater experiments prior to joining Muzak in its early years.[161] Radio automation's inaudible cue tones also emerged out of this sonic control logic. It was perhaps inevitable, then, that Cage's fraught quest to turn technologies of sonic control toward anti-programmatic ends would cross paths with Muzak.

The ambivalence in this type of maneuver comes fully to light when Cage himself is subject to a materialist reading. Hannah Pivo applies this approach to great effect in her study

[157] Seth Kim-Cohen, *In the Blink of an Ear: Toward a Non-Cochlear Sonic Art* (New York, NY: Bloomsbury Academic & Professional, 2009); Douglas Kahn, *Noise, Water, Meat a History of Sound in the Arts* (Cambridge, MA: MIT Press, 1999).

[158] John Cage, "A Composer's Confessions (1948)," in *John Cage, Writer: Previously Uncollected Pieces*, ed. Richard Kostelanetz (New York, NY: Limelight Editions, 1993), 27–44.

[159] Herve Vanel, "John Cage's Muzak-Plus: The Fu(rni)ture of Music," *Representations* 102, no. 1 (May 1, 2008): 94–128.

[160] Alexandra Hui, "Muzak-While-You-Work: Programming Music for Industry, 1919–1948," *Historische Anthropologie* 22, no. 3 (January 8, 2019).

[161] Gascia Ouzounian, *Stereophonica: Sound and Space in Science, Technology, and the Arts* (Cambridge, MA: The MIT Press, 2020), 97.

of Cage's proposed Muzak interventions, understanding "twentieth-century business, industry and information design"[162] as key influences on Cage's ideas and compositions. "[E]ven as Cage imagined aggression or even violence toward Muzak through his unrealized proposals for Silent Prayer and Muzak-plus," Pivo writes, "continuities existed between the company and the composer:"

> First, both Muzak and Cage instrumentalized silence, with the former incorporating it into a scheme of sensory control, and the latter using it as a means of expanding sonic and social awareness. Additionally, both parties were profoundly shaped by tendencies of mid-century scientific management, particularly its conception of time as something to be measured, structured and rationalized.[163]

Cage's approach to sound media took automatic technologies as opportunities to unseat a musical hierarchy of composer, performer, and audience. But by declining to connect this hierarchy to that of management and labor—and by refusing rather than interrogating his own desire for control in a technologized sonic environment—Cage reinscribed some of the managerial interests that had pervaded American sound culture at the same time that he tried to reverse their symptoms. The problem of labor was one that composers could rarely bracket from their material and conceptual explorations without listeners reintroducing it.

By the early 1960s, controversies around tape-based and electronic composition had reached mainstream venues. A 1962 *Newsweek* article found composer Vladimir Ussachevsky defending himself against the phrase "push-button music."[164] While the article attached the phrase more to the Electronic Music Center that Ussachevsky had helped establish at Columbia—and to the center's RCA synthesizer—rather than to his expansive

[162] Hannah Pivo, "Selling Silence, Controlling Chaos: John Cage's Interventions into Muzak," *Public Art Dialogue* 9, no. 1 (2019): 96.
[163] Ibid., 111.
[164] "The Sound of Hell," *Newsweek* (New York, United States: Newsweek Publishing LLC, December 10, 1962).

work with tape, Andrea Bohlman and Peter McMurray have cited Ussachevsky's defense against such "assertions that his music was automated" as a meaningful nexus of interfaces and tendencies in the composer's interaction with tape: "by drawing attention to buttons, his critics had identified one of the most important features of tape. The push-button interface—even called a 'piano-key style' in the context of certain cassette decks—also powerfully positions tape as contingent (erasable) and music as re-routable (rewindable), two centrepieces of tape's media logics devalued in the presence of the [phonographic] regime."[165] By "phonographic regime," Bohlman and McMurray mean a complex of assumptions about sonic media that treat phonography as the singular reference for what analog recording is and does. Their effort to recover and re-theorize magnetic tape's unique operative logics, in addition to doing the important work of loosening that regime, helps explain why tape could become the material substrate for sonic automation when the phonograph record had not.

Cage, too, was pondering buttons. 1961's "Where are we going? And what are we doing?," an experimental lecture for four simultaneous speakers, included this fragment on tape recorder interfaces:

> It's very curious. I remember recording machines with dials and clutches. Then later there were push buttons. Now one has the feeling we're going to have dials again. We need desperately when it comes to a machine to be able to go at any speed.[166]

The "push button," as Rachel Plotnick has shown, pervaded imaginaries of technology, work, and control in the nineteenth and twentieth centuries; as the juncture between an

[165]Andrea F. Bohlman and Peter McMurray, "Tape: Or, Rewinding the Phonographic Regime," *Twentieth-Century Music* 14, no. 1 (February 2017): 14.

[166]John Cage, *Silence: Lectures and Writings, 50th Anniversary Edition* (Middletown, CT: Wesleyan University Press, 2012), 205–6.

automatic mechanism and a human body, it channeled the promise of placing incredible machine power under human control and at the same time the fear of what would happen should the wrong bodies be given too much control (or too little labor).[167] Cage's and Ussachevsky's remarks likewise show two different desires clashing against the industrial object of the tape recorder. Ussachevsky confronted the possibility that the music he and his students composed with tape and synthesizers would be dismissed as automated because of the machinery involved in its crafting. He experienced an early version of a problem that continually recurs for electronic musicians: the need to overcome audiences' impressions that electronic instruments obviate real performance.[168]

Cage, on the other hand, feared that manufacturers would (again) pull a particular form of control over tape away from his grasp. The desperate need "to be able to go at any speed" correlated closely to a central point for Bohlman and McMurray, and one that Ussachevsky also voiced: that the faster-than-playback rewind and fast-forward operations of a tape player afforded a "non-linear access to recorded sound."[169] Non-linear access was the enabling condition both for these artists' experiments and for the automatic cuing that let radio announcers execute future audio transitions in a pre-recording session. The push-button design of cue tone injecting devices like the Vandivere sequencer constrained those announcers to a pre-determined vocabulary of temporal changes: start, stop, amplify, silence. As Cage evidently knew, the difference between dials and buttons could mean the difference between agency and automation.

[167] Rachel Plotnick, *Power Button: A History of Pleasure, Panic, and the Politics of Pushing* (Cambridge, MA: The MIT Press, 2018).
[168] Mark J. Butler, *Playing with Something That Runs: Technology, Improvisation, and Composition in DJ and Laptop Performance* (New York, NY: Oxford University Press, 2014).
[169] Bohlman and McMurray, "Tape," 18.

Automation's dad: Paul Schafer

Despite the fanfare around Ampex's automatic programming systems between 1953 and 1956, few traces remain past that point of the company's S-3380 system, or of its direct participation in radio automation at all. With lucrative new tape recorder applications in instrumentation and computation, as well as video tape, Ampex's focus split away from audio recording in the last years of the 1950s.[170] In other words, Ampex by all indications abandoned radio automation in order to supply automation's internal media in more profitable sectors.[171] By 1957, other manufacturers who specialized more narrowly in radio had introduced automation systems. Gates debuted its own "Autostation" system in 1956;[172] while the product was short-lived, the company continued with the "Nite-Watch" automation system the following year and would remain active in the radio automation field for several decades. Automation found a more stable footing with these vendors than it had with Ampex, but in joining their lengthy product lineups it risked slipping too quickly into the mundane. To move beyond its emergent phase, radio automation needed an industry insider who could become its dedicated spokesperson, renew its novelty, and extol its benefit to station owners.

Paul Schafer, a radio engineer and entrepreneur, would already by the end of the 1960s be canonized as the "father of radio-station automation."[174] Such was Schafer's charisma in the radio automation arena that *Broadcasting* magazine's Earl Abrams conferred this title despite having himself, in 1955, dubbed Ampex et al.'s NAB offerings as "automation"[175] (and

[170] Clark, "The Magnetic Recording Industry, 1878-1960," 319.
[171] The remaining archives from the company, now at the Stanford University Libraries, are largely comprised of photos from its internal photography division, and the product ranges represented indicate a decisive shift in focus toward data-industry applications.
[172] "New Gates Tape-Disc System Promises Entirely Automatic Radio Operation," *Broadcasting/Telecasting*, July 23, 1956.
[173] Randy J. Stine, "NAB Honors 'Father of Automation'," *Radio World*, June 1, 2016.
[174] Abrams, "Automated Radio: It's Alive and Prospering."
[175] Abrams, "Automation Steals the Show."

Figure 7: Paul Schafer, in 1967, stands in front of a motor home outfitted with Schafer radio automation equipment. Schafer toured North America with this and other mobile installations, demonstrating them for prospective customer stations.[173] Photo courtesy of Rob Schafer.

Figure 8: Schafer's family members and automation system in the motor home.

having thus contributed earlier to establishing automation's meaning in radio than Schafer did). Schafer often related the story of the bespoke automatic programming system that he built at KGEE in Bakersfield, California, in 1956. This system used Ampex tape players for commercials and station announcements and jukebox-style Seeburg record changers for music, and it alternated between these sources by detecting silence[176] instead of the cue tone technique that other manufacturers had by then implemented (and that Schafer would soon adopt as well). The revision to the radio industry's internal histories crediting Schafer as the progenitor of this technology likely has much to do with the status he had already by this point accrued in the industry through manufacturing equipment for remote control of radio transmitters. Besides designing and marketing these devices, he had also helped the NAB conduct field tests that successfully lobbied the FCC to relax restrictions against unattended transmitter operation.[177] These developments created an opening, which automation would soon enter and widen, for a considerable reduction in the number of personnel that (legally or practically) needed to be at a station for it to broadcast.

But another reason for Schafer's canonization may have to do with his eagerness, at the turn of the 1960s, to acknowledge that he intended his products to reduce reliance on labor. While certainly not the first engineer to deploy an automatic programming system, nor the first person to refer to it as automation, Schafer appears to have been the first radio engineer to deliberately use the term "automation" in the name of a NAB engineering conference presentation. In 1960, he presented a paper titled "Aural Program Automation Techniques."[178] This presentation (quite luckily for research purposes, since NAB record keepers did not usually include copies of the prepared papers in each year's archive around

[176] Stine, "NAB Honors 'Father of Automation'."
[177] Rob Schafer, Interview, March 23, 2022.
[178] Paul C. Schafer, "Aural Program Automation Techniques," in *Proceedings of the 14th Broadcast Engineering Conference* (Chicago, IL, 1960), 136–43.

this time) bucked the conference's usual format where a technical paper would be followed by a very brief question and answer session. Schafer appears to have abandoned his prepared text early into his time and engaged the audience conversationally: "Maybe we can get a little more information across to you in a shorter period of time if we ask for questions at this point."[179] In contrast to technical papers from Ampex's Tinkham and Smaller, the transcribed back-and-forth depicts Schafer building a rapport with an audience of fellow station owners (Schafer had purchased KDOT in Reno, NV the year prior and described examples of his equipment's use on-air at the station). Though quick to jump into technical detail about his product's inner workings, he was also forthcoming with realities around pricing (twelve thousand dollars for the system he described) and even the possibility of technical error, which he relayed through humorous examples. Asked how the silence-detection worked with music, he volunteered, "If the pause is long enough it will drop out. Cha-chas are especially interesting." Asked about "failures in proper sequence," he admitted that his Reno station "had a tape of time signals go by in sequence, and in another case we had a tape of commercials go by."[180] Crucially, he accompanied the presentation with a live demonstration of an actual automation system. He showed managers a machine, imperfect but real and purchasable, that had reduced (according to Schafer's example of an existing customer) 24 hours of programming to 3 hours of work by just one "program man."[181] Schafer's attitude toward labor displacement was defensive only so far as offering reassurances to his fellow engineers: "Only program, not engineering operations are affected by the automatic program package," *Broadcasting* had explained of his system;[182] per the magazine's coverage of his 1960 NAB paper, he pointed out that "[e]ven disc jockeys have been 'automated'."[183]

[179] Ibid., 136.
[180] Ibid., 139.
[181] Ibid., 137.
[182] "Schafer Offers Stations Device for Automatic Radio Programming," *Broadcasting*, March 17, 1958.
[183] "NAB Hears Technical Papers," *Broadcasting*, April 11, 1960.

Schafer displayed his knack for showmanship and his managerial zeal even more sharply in a video advertisement for the Schafer 1200 system, produced in or close to 1960 (while undated, the ad lists Schafer Custom Engineering as a division of Textron Electronics; Schafer sold his company to Textron in 1959[184] and purchased it back in 1961).[185] Here, recycling a heavily familiar trope from masculinized media and technology discourse,[186] Schafer posed the problem of women as a stand-in for the problem of labor. The film opens on a radio announcer reciting an advertisement at the broadcast desk. He stops mid sentence upon realizing that a young woman in a tight-fitting dress has entered the studio to bring him a news bulletin. Ignoring the bulletin, the announcer flirts with this colleague and then, too fired up for professionalism, stumbles over his words when he finally returns to the microphone. A tuxedoed Schafer then appears on screen to explicate this "little fantasy." The point: "All humans make mistakes. And all radio station employees are human. That is, they were until Sylvia came along." He reveals "Sylvia," otherwise known as the Schafer 1200 system, to be a row of three five-foot-high equipment racks sporting eight tape reels as well as a couple dozen knobs and dials. This, he announces, is "radio's perfect employee."[187]

Schafer sets an upbeat frame for radio automation in general before diving into its specifics: "In this electronic age, radio broadcasting, like everything else, is changing for the better." The video proceeds to show the same distraction-prone DJ, now safely distanced from the on-air signal chain by a Schafer Electronics tape preparation device, efficiently pre-recording all his song announcements for the day in one sitting. A close-up from the DJ's perspective shows his finger pressing two buttons in alternation on the device's simple desktop interface as he goes. Schafer points them out: the record button and the "25 cycle

[184] Robert Sobel, *The Rise and Fall of the Conglomerate Kings* (New York, NY: Stein and Day, 1984).
[185] Schafer, "Memoirs of Paul Charles Joseph Schafer."
[186] Irani, "The Cultural Work of Microwork."
[187] *Sylvia: Radio's Perfect Employee*.

pre-start" button that would inject cue tones into the tape. After an in-depth tour of the 1200 system and its capabilities, he sums up in more direct language why "Sylvia" is so ideal:

> Automated broadcasting promises to bring a new way of life to the radio industry, with benefits all across the board: improvement in stations' manpower efficiency; upgrading of programs; perfect programming control; more free time to be used in promotion, sales development, public relations; lower costs of operation, to name only a few. A new way of life thanks to Sylvia, radio's perfect employee, who never makes a mistake, works 24 hours a day without complaining, never misses a day, never asks for a raise. Oh she's a doll, Sylvia is.[188]

Schafer's choice to describe the 1200 system this way is remarkable for a few reasons. For one thing, by personifying the automation system as an "employee"—and especially by describing it in contrast to a litany of frustrations that human employees presented to managers—he directly promised and celebrated job displacement with an enthusiasm that was unprecedented even in arenas as management-friendly as the NAB. For another, taken together with the video's opening "fantasy," the choice reflects a managerial and misogynist outlook that blamed working women for the fallibility of their masculine colleagues while simultaneously using femininity as a metaphor for perfect subservience.

But "Sylvia," in a more surprising turn, gets to reap the benefits of personification for just a moment and offer a retort to Schafer's objectifying appraisal. With stop motion animating the horizontal tape lifter bar up and down in a close-cropped shot where two tape reels appear like eyes, a woman's voice says, "Don't get carried away, cuddly. Keep your hands off

[188] Ibid.

my trim. I just work for you. You don't own me body and soul."[189] Apart from later anecdotes in which an electrical surge would cause a system's tape cartridge unit to air all of its recordings simultaneously (see Chapter 3), this moment is one of the only cases where an automation system spoke for itself. To complete the scene, Schafer pulls his hand off the machine and jumps back in shock before delivering the punchline: "Well, that's the woman for you." The gag's message is clear, leaving the video's heterosexual, male, managerial addressee with one last taste of the unpleasantness automation can alleviate—in this case, the inconvenient fact that women in their employ might bristle at their sexual advances. Yet, especially viewed at sixty years' distance, the sheer oddity of a talking reel-to-reel deck pries open a wider interpretive space—one in which the speaking machinery calls attention to the contradictions of its capitalist setting. Why, after all, would an advertisement for a purchasable product allow that product to reject the possibility of its ownership? And beyond "own," there was "body and soul." Did radio automation possess both these things?

The feminized voice of automation is, today, most audible in "virtual assistants" like Apple's Siri, Microsoft's Cortana, or Amazon's Alexa. Jessa Lingel and Kate Crawford place these assistants within a long history of *secretaries*, pointing out that "secretary" referred first to a writing desk, and only later to a working role that was "deeply gendered—with heteronormative femininity at its center."[190] Secretaries, they explain, have been narrowly empowered in their access to information and office control infrastructures and at the same time heavily confined in their career mobility; the archetypal secretary of the twentieth century worked in intimate relation to managers and with considerable informatic resources (including, often the first computers to enter the office) at her disposal.[191] "Sylvia," in Schafer's treat-

[189] Ibid.

[190] Jessa Lingel and Kate Crawford, "Alexa, Tell Me about Your Mother": The History of the Secretary and the End of Secrecy," *Catalyst: Feminism, Theory, Technoscience* 6, no. 1 (May 15, 2020): 7.

[191] Lingel and Crawford, "Alexa, Tell Me about Your Mother"."

ment, represents a significant improvement upon the young script assistant from his ad's opening "fantasy." As an automation system, she possesses not only an impressive proto-computational capacity but also a form that cannot distract the announcers whose work she coordinates; a wall-filling bank of equipment racks, she has turned *back* into furniture. Much as Schafer was happy to admit his machine's technical fallibility for the sake of building a rapport with his NAB audience, the jarring retort from the device in the ad's closing was well worth the reassurance it gave his target audience—in this case, that the consolidation of power within machinery would not spell the end of erotic power differentials in the workplace. Indeed, at a station that used Schafer's system to its fully automated capacity, the remaining "program man" would have as his counterpart a "traffic girl [who] would sit down in the morning and dial into a memory cartridge the sequence of spots for the entire day."[192] Feminized roles remained at the automated station, but automation's core division between program and announcement material ("traffic" denoted scheduling and tracking announcements, especially ads) walled these women off from the broadcast studio; their work was deskilled and turned into a process of data entry. In playing up this aspect of radio automation, Schafer did more than fantasize about a "perfect employee." He anticipated that a much stronger aesthetic and social pleasure attended sonic managerial control than radio automation's first designers had realized.

"Adult Music · Automated Equipment": Muzak's Programatic Broadcasting Service

From radio automation's beginning, it owed debts to functional music services: the Ampex model 450 tape playback unit that formed a key part of its S-3380 system had been developed with long-playing background music in mind.[193] But if this affinity was only technical

[192] Schafer, "Aural Program Automation Techniques," 142.
[193] "The History of the Development of Ampex and a General Description of Its Operation and Facilities."

at its outset, it became an enduring aesthetic attachment after Muzak—a company as synonymous with background music as Ampex hoped to be with tape—entered the radio automation business. By 1950, Muzak had become a major presence in America's industrial and commercial spaces. Along the way, the Muzak Corporation had explored technological and sonic features that could set their "piped-in" music service apart from other sound media and enhance their claims to be able to stimulate workers and shoppers through sound. Muzak advertised, for instance, a wider frequency range (50 Hz to 11 kHz) than commercial phonographs of the era could reproduce.[194]

Muzak's interest in audio quality, and in scaling up its distribution systems, guided it toward tape. Tape, as it did in radio, then presented its capacities for automatic switching. In 1953, the same year Ampex debuted its broadcast automation equipment at NAB, Muzak "switched from turntable operation to automatic transmission of its music on a 24-hour-a-day basis via magnetic tapes."[195] Outside of its flagship background music service, meanwhile, Muzak's owners had also been eyeing radio. Through a subsidiary called Subscription Radio, Inc., Muzak twice—in 1945 and in 1950, neither time successfully—petitioned the FCC to let it launch a "narrowcasting" radio service. In an inverted counterpart to the cue tone's logic, a constant, high-pitched tone (as critics called it, a "pig squeal") would mask radio signals from such a station unless a subscribing listener had installed a special device that would demodulate the musical program from out of the squeal.[196] Also in 1950, Muzak sought FCC permission to move forward with the largely unregulated practice of renting bandwidth within a multiplexed FM transmission. In this plan, regular broadcast FM stations would serve double duty as local conduits from Muzak to its subscribers (and thus help

[194] Hui, "Muzak-While-You-Work."
[195] "Music: Inside Stuff-Music," *Variety*, July 12, 1961.
[196] "Pig-Squeal Radio," *TIME Magazine* 44, no. 21 (November 20, 1944): 84–86; "Narrowcasting: Muzak Revives Former Plan," *Broadcasting*, September 11, 1950.

Muzak move past the costlier telephone lines that otherwise distributed its music).[197]

In what would become more direct groundwork for their venture into radio automation, Muzak in fact aired their background music over broadcast radio for a time in the early 1950s. Muzak president Charles Cowley, speaking before a US Senate subcommittee in 1958 as part of hearings to revise the 1934 Communications Act, explained this non-pig-squeal subscription system:

> In about 1950 there was developed a new method of furnishing background music to subscribers through the means of FM ra[di]o broadcasts. Under this method, the specially recorded music is broadcast to the general public by a duly licensed FM radio station [as] its regularly scheduled program, and is received by the general public on standard FM radio receiving sets. The subscribers of the background music service are provided with FM radio receivers in which there are installed special tripping devices capable of automatically turning the receivers on or off when activated by a supersonic signal or 'beep' emitted by the radio station.[198]

Muzak's "beep" method was nearly equivalent with Ampex's and Vandivere's cue tones. Instead of performing a broadcast engineer's task of switching between tapes, these tones automated the work of turning the listener's radio set on and off—provided that the listener was a subscriber who paid Muzak for the right not to hear station announcements interrupting the background music. Cowley also recounted how Muzak had purchased a New York FM station, subsequently called WBFM, in order to operate this system on its own terms. At

[197] "Muzak to Ask FCC for Use of FM Stations," *Broadcasting*, January 23, 1950.

[198] United States Congress Senate Committee on Interstate and Foreign Commerce Subcommittee on Communications, "Amendment to Communications Act of 1934 (Prohibiting Radio and Television Stations from Engaging in Music Publishing Or Recording Business): Hearings Before the United States Senate Committee on Interstate and Foreign Commerce, Subcommittee on Communications, Eighty-Fifth Congress, Second Session, on Mar. 11-13, 19, 20, Apr. 15-17, May 6, 7, 20, 21, July 15, 23, 1958" (U.S. Government Printing Office, 1958), 822.

this point, despite airing over the radio, Muzak was still explicitly separate from entertainment media: Cowley explained, "it is not an entertainment service; rather, it is specially arranged, scientifically orchestrated and program[m]ed functional music designed to combat tension and to increase working efficiency."[199] But, while Muzak proper (as I will call the company's background music service here for clarity) would retain this distinction and its belonging to the industrial sphere, WBFM would soon become the "flagship station" for a radio automation venture called Programatic [sic] Broadcasting Service.[200] A subsidiary of Muzak, Programatic crossed over into the entertainment sector and, in doing so, established a business model and a musical aesthetics that would cling to radio automation for decades to come.

The venture that would become Programatic debuted in April of 1958 as the "Muzak Radiomation Programming System." In a press release,[201] Muzak promised a full introduction of the system at the following week's NAB conference from Cowley, along with engineer Emil Hembrooke and sales director Ed Hochhauser. The release emphasized that Muzak's "revolutionary" approach to broadcast radio was "fully integrated"—meaning it "combines year-around fully automatic radio stations operation with distinctive music programming of wide audience appeal." Repeating the point more materially, the author (either Hochhauser or a supervisee) explained the combination as "daily tape recorded music programming plus basic equipment for unattended, completely controlled broadcast."[202] While acknowledging none of the existing entrants to the radio automation market, Muzak touted the novelty of combining equipment (tape players) and content (tapes) within the

[199] Ibid., 823.
[200] Gil Faggen, "Something New Comes to FM Programming," *Billboard*, May 25, 1963.
[201] Muzak evidently hoped magazines would publish the release verbatim, as it refers to "a spokesman for Muzak." The issue of *Broadcasting* published on the same day indeed quoted heavily from it in a short article announcing the system's upcoming NAB debut.
[202] "Muzak Radiomation Programming System [Press Release]" (Muzak Corporation, April 21, 1958), Box 228, Folder 4, William Benton Papers.

same commercial service. They noted that "[r]esearch and development of the System has been under way since 1954"—incidentally, just a year after Ampex's first NAB presentation on automatic programming and two years before Schafer's first installation at KGEE.

It is in fact unclear to what extent a radio automation venture had really been the object of four years' R&D at Muzak, as opposed to a low-hanging fruit that emerged more suddenly on the branches of other efforts. Emil Hembrooke, the lead engineer on Programatic equipment, had applied in 1955 for a patent (assigned to the Muzak Corporation) that described the use of 25 Hz tones to automatically switch between 15-minute segments in "the wired or radio broadcasting of musical programs, as in the system known by the trademark 'Muzak.' "[203] Despite mentioning radio, Hembrooke went on to describe Muzak proper rather than any more general broadcast applications. Shortly after Programatic's commercial debut, a promotional booklet for the Jack Wrather Organization (which had acquired Muzak in 1957) announced it as "a totally new and unique development in the radio industry," continuing: "The first Programatic machine was unveiled September 1, 1958. This is rather startling since it was conceived in March of 1958" (not to mention announced via press release in April 1958). The booklet's two-page spread on "Programatic—Automation in Radio," which elevated the new venture to equal footing with Muzak itself, showed Hembrooke "inspecting the heart of his creation"—an exposed vertical rack of motors, step relays, and other electrical components (Figure 9). The visible parallels in the same booklet's pages for Muzak proper, which showcased tape duplication rooms and "special Muzak playback machines" of notably similar proportions to the Programatic engineering prototype, cast some doubt on the booklet's claim that the latter machine "was brought from design to production in a short six months time."[204] Yet even if it mostly repackaged internal Muzak technology

[203] Emil Frank Hembrooke, Automatic control circuit, United States US2921291A, filed March 9, 1955, and issued January 12, 1960, 1.

[204] "The Jack Wrather Organization" (Beverly Hills, CA: Jack Wrather Organization, 1961), Series 5, box 7, folder

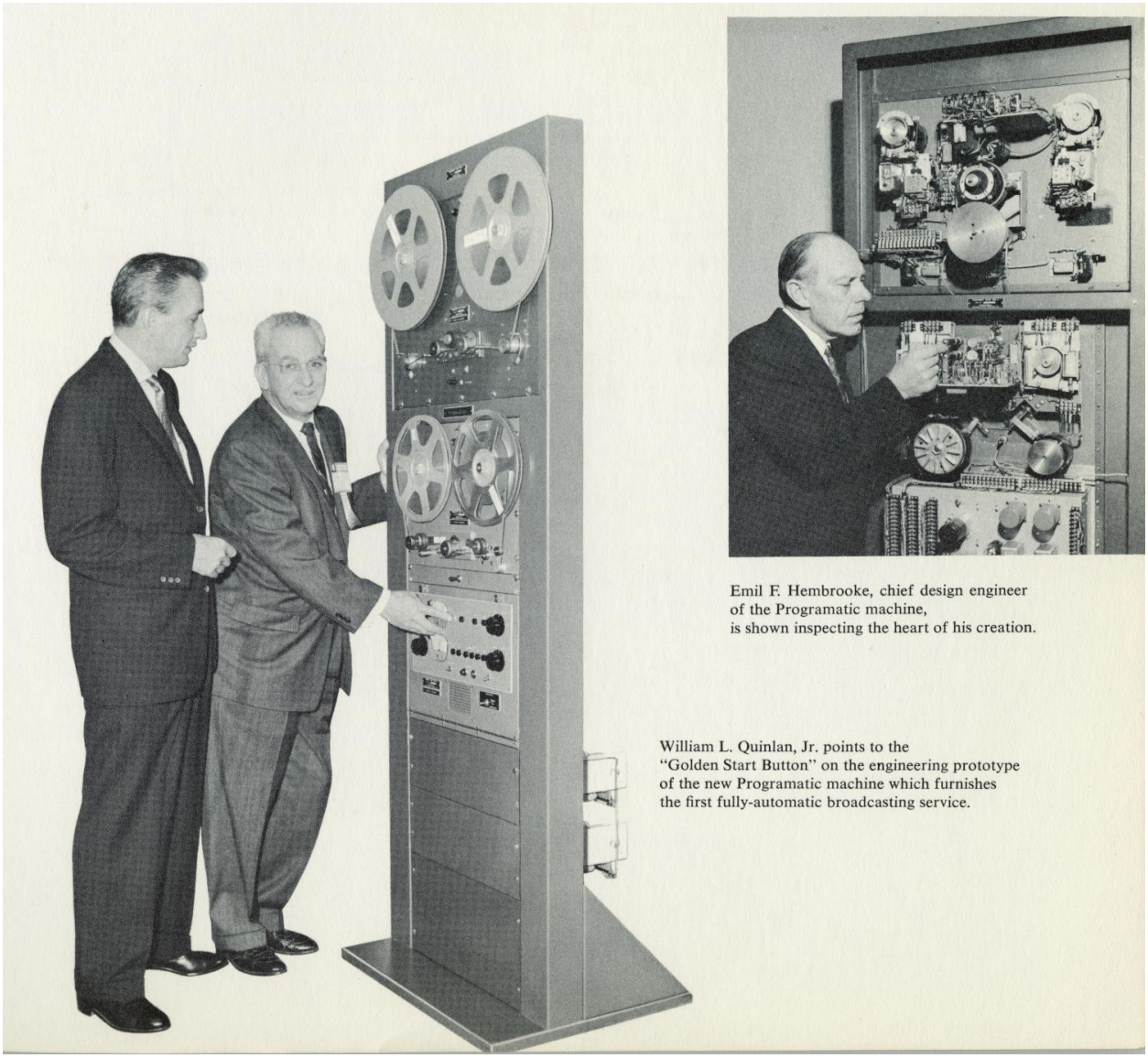

Figure 9: Photos show a Muzak executive and Muzak engineer demonstrating a Programatic Broadcasting Service automation system's front interface and interior workings, respectively; from "The Jack Wrather Organization" promotional booklet circa 1961. Jack and Bonita Granville Wrather Papers. CSLA-23. Department of Archives and Special Collections, William H. Hannon Library, Loyola Marymount University.

as broadcast studio gear, Programatic had gained enough internal traction to be treated as significant by the higher-ups.

Regardless of its actual technical novelty, equipment was only one part of what allowed the Wrather Organization to launch a radio automation service. For one thing, Jack Wrather's ownership meant that the oil industry, even more directly than it did for Ampex, subsidized Muzak's activities during these years. Wrather was born into a powerful Texas oil family. He had moved into television production after returning from US military service in Korea, and he purchased the Muzak Corporation during a turbulent few years for his increasingly complex entertainment industry holdings.[205] When Wrather and his team (evidently) saw enough promise in Programatic to split it off from Muzak as another subsidiary of his organization, it joined various TV and radio stations as well as the production outfits responsible for *Lassie* and *The Lone Ranger*. But Wrather had maintained large and active stakes in oil drilling operations around the country. An organizational chart at the start of the booklet, styled both as a tree and as an eruption of oil from a derrick (Figure 10) emphasized for readers that oil drilling remained fundamental to all other ventures, no matter how disparate.

But beyond financial backing and technical feasibility, Programatic's launch depended on crucial advantages in the radio industry and in Muzak's own labor networks. Programatic promised not only automation equipment but also material for that equipment to play, and that material was carefully formatted—formatted in the technical sense as tape reels where cue tones had been pre-embedded, and formatted in the broadcast sense of maintaining a specific style keyed to a specific target audience. The musical style that Programatic would deliver leveraged three angles: first, Muzak's existing resources for arrang-

1, Jack and Bonita Granville Wrather papers.

[205]Jack Wrather to Robert L. Thornton Jr., September 10, 1958, Series 1, subseries B, box 1, folder 14, Jack and Bonita Granville Wrather papers.

Figure 10: An organizational diagram including Muzak and Programatic Broadcasting Service, from "The Jack Wrather Organization." Jack and Bonita Granville Wrather Papers. CSLA-23. Department of Archives and Special Collections, William H. Hannon Library, Loyola Marymount University.

ing and recording instrumental covers of popular songs; second, automation's special economic utility to station owners during overnight hours, when advertising revenue was too low to justify a full staff presence; and third, a perceived market gap left open by disc jockey shows and their focus on young listeners. These angles converged in a simple shorthand: "adult music." Adult listeners, the executives foresaw, would be up late and eager to hear pleasant music, featuring few or no vocal parts and disrupted by as few station announcements as possible. This imagined listener wanted music that could recede politely into the background but that was still, in contrast to Muzak proper, designed to entertain. *Broadcasting* explained that the sound on Programatic reels would be "melodic, 'entertainment music,' almost wholly instrumental—'the complete antithesis of the average disc jockey program,' according to spokesmen. It also would contrast with the background music that Muzak supplies to stores, offices and restaurants. Rock-and-roll and jazz will be omitted."[206] Adult music was a negative aesthetics, distanced gently from Muzak proper and forcefully from the genres in which young and non-white listeners, DJs, and musicians trafficked.

From its announcement onward, automation and adult music appeared side by side as Programatic's banner features, with personnel reduction's larger appeal to station owners either following or remaining implicit. As the Muzak Radiomation Programming System press release explained:

> Outstanding features of the integrated system are automatic broadcast of superior adult music programs and measurable reduction of station operating costs. Radiomation equipment and taped programs are planned to cost less than one employee, yet make possible reducing overhead by from two to four employees in an average-sized station.[207]

[206] "Muzak to Show System for Full Automation," *Broadcasting*, April 21, 1958.
[207] "Muzak Radiomation Programming System [Press Release]."

While Wrather/Muzak management would quickly drop the portmanteau "radiomation" from their branding, at least one other manufacturer picked it up along with Muzak/Programatic's business model: visitors to the 1961 NAB convention could preview "Magne-Tronics Automatco radio music program service and Magne-Tronics background music service for fm multiplex on magnetic tape with radiomation equipment."[208] Where Magne-Tronics here tried to straddle the line between broadcast radio programming (as Programatic did) and background music delivered to subscribers via FM sidebands (as Muzak had been doing), the Wrather Organization split the two offerings apart with the Programatic branding and with its emphasis on entertainment versus background music. By 1960, the name Muzak no longer appeared in Programatic's advertisements in *Broadcasting*. In its stead, a logo with clapping hands and the text "O-Vation Music" added new branding to the service's signature adult music package. An ad that year (Figure 11) boasted that 78 stations had subscribed to the service, which the company made available as an exclusive franchise to one AM or FM station per local broadcast market. The same ad enumerated the "hazards" that automation promised to eliminate from radio studios. Accompanied by snappy icons of an LP, microphone, fader, and other error-prone physical elements of the standard live broadcast desk, the ad not only promised "practical automation come to radio" but also now heralded automation as a kind of dematerialization for radio production—a development that it offered up as liberation both for station owners and for the board operators employed to manipulated these hazardous elements, even if their jobs were to disappear along with those disks and faders.

[208] "Equipment Exhibitors at NAB," *Sponsor*, May 8, 1961, 95.

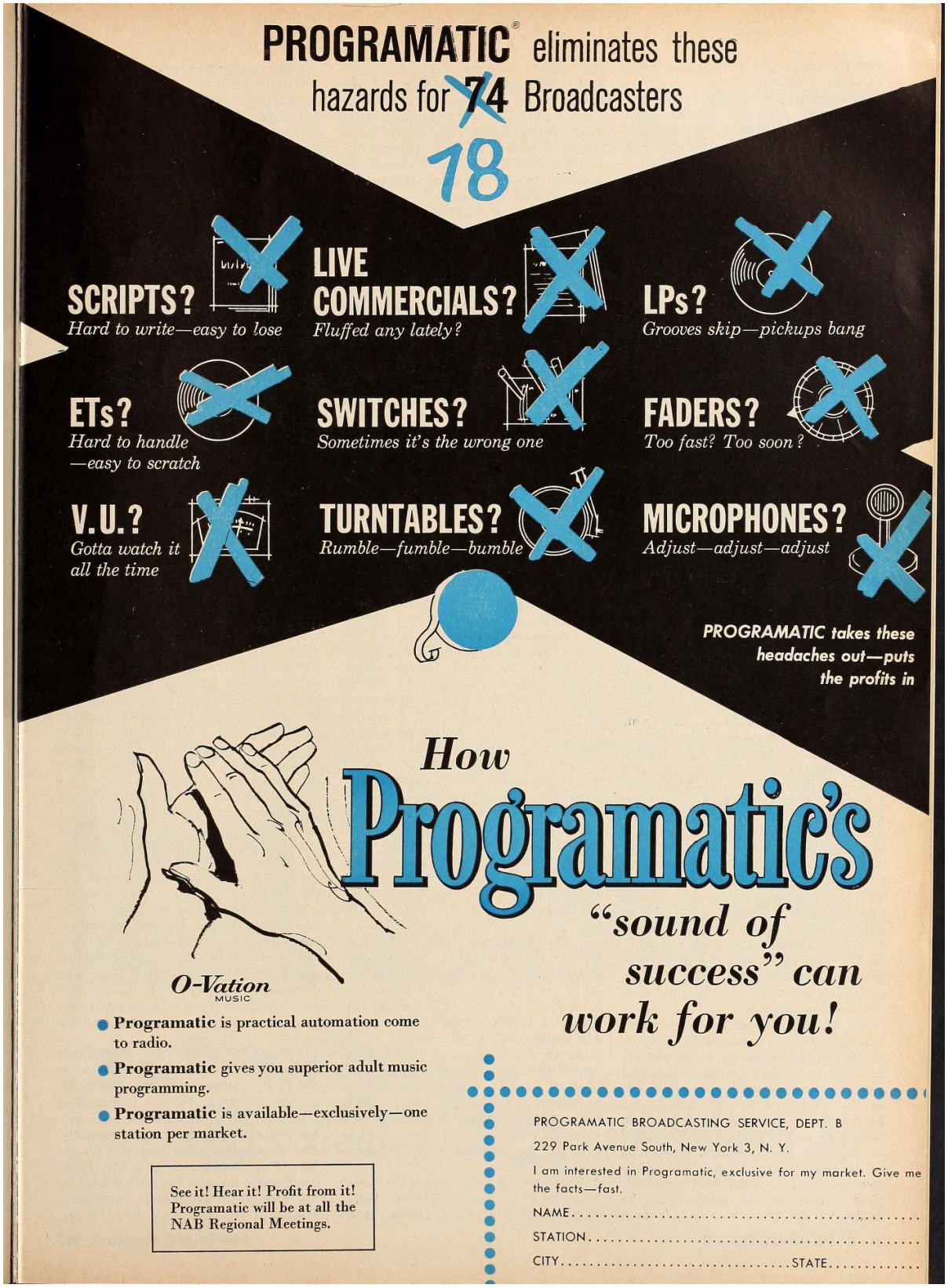

Figure 11: A Programatic Broadcasting Service advertisement as printed in the November 7, 1960 issue of *Broadcasting*. Scan courtesy of the Media History Digital Library.

Radio's labor absence

Programatic's success boosted onto a more public stage the prospect that automation might displace the people listeners heard on the air. Yet voices for labor were muffled by radio's entrenched division between technical and performance roles, as well as by variously complacent or defeatist outlooks. In March 1959, *Newsweek* ran a short article about Programatic under the heading "Radio without Humans." The last of the piece's three paragraphs turned to labor concerns:

> How do the people who will be most drastically affected feel about it? Martin Block, dean of the country's 2,500 disk jockeys, said confidently: "You can't automate personality. I won't start worrying for awhile." An American Federation of Radio and Television Artists [(AFTRA)] spokesman was less sanguine: "You can't fight progress. It will cost some people jobs. [But] we have gotten generous sever[a]nce pay provisions in the latest contracts."[209]

Conversations about automation's effect on labor typically focused either on DJs or on engineers. This was a divide that broadcasting's existing labor representation—AFTRA for performers, NABET or IBEW for technicians—reinforced even as it eroded in practice. Stations' cost-cutting had increasingly required engineers to serve as DJs or vice versa; years before he took the radio automation field by storm, Paul Schafer had worked as a "combo operator (both an announcer and an engineer)" at an upstart station in Indiana, having entered in a purely technical role.[210] On the engineering side, a subsequent entrant to the Programatic-style automation-syndication market felt the need to temper distress about a major labor displacement. An article in the *IBEW Technician Engineer* titled "Re-education

[209] "Radio Without Humans," *Newsweek* (New York, United States: Newsweek Publishing LLC, March 9, 1959).
[210] Schafer, "Memoirs of Paul Charles Joseph Schafer."

Fund Established As Answer to Automation Threat" began,

> International Good Music, Inc. (IGM) of Bellingham, Wash., and the International Brotherhood of Electrical Workers (IBEW) announced the signing of an agreement—the first of its kind within the broadcasting industry—which establishes a reeducation fund for the training and retraining of employees displaced as a result of the installation and operation of automated equipment and program services made and sold by IGM to the industry.[211]

This fund, along with AFTRA's above-quoted concessions to "progress" and emphasis on severance deals, was characteristic of the "ameliorative (or palliative) measures"—"joint consultation with management over automation; displacement only by attrition (and 'red circling,' or guaranteeing existing jobs); retraining for displaced workers;" etc.—that the larger labor unions sought in these years as automation blossomed in manufacturing industries.[212] David Noble's history of automation and labor struggles in the metal machining sector sets these piecemeal efforts against the larger political question—and the possibility of refusal—that union leaders declined to engage.

> [I]f the public debate and press statements by labor leaders were the most visible signs of what one observer caustically labelled the "automation hysteria," most of labor's energies were devoted to the less visible realms of collective bargaining, grievances and arbitration, legislative lobbying, and, finally, shop floor struggle. Unwilling to confront head-on and directly challenge management's prerogative to determine the means and ends of production, or to question the form and direction of technological change itself, the unions sought ways to slow down the pace

[211] "Re-Education Fund Established as Answer to Automation Threat," *IBEW Technician Engineer*, June 1961.
[212] Noble, *Forces of Production*, 251.

> of displacement, ease the burdens of those already or soon to be undone, maintain the strength and integrity of existing bargaining units, defend (or acceptably redefine) endangered job classifications and work rules, protect and enlarge the earnings of the membership, and win for the workers an equitable share in the proceeds of progress[213]

A combination equipment–programming operation like Programatic affected a broader field of sound work than just station engineers and DJs, but the relevant labor advocates like AFTRA appear to have been ill poised to confront it. By the early 1960s, Programatic had begun syndicating recorded DJ and variety shows to subscriber stations alongside its O-Vation adult music reels. *Variety* in 1961 reported that Sammy Davis, Jr. had agreed to begin recording five hour-long shows a week in a deal with Hollywood FM station owner Harry Maizlish. Davis's shows would air through Maizlish's KRHM and syndicate through Programatic.[214] Syndication of this sort, by dodging between established bounds of production and distribution, put up an effective barrier between performers and the union representation to which they were entitled. Leadership in AFTRA's national office took notice of the Davis announcement as well as a similar deal between Maizlish and DJ Steve Allen, who would likewise produce a show for KRHM and Programatic syndication. While AFTRA appears to have convinced Maizlish to sign its codes of fair practice for commercial radio broadcast and for broadcast transcriptions,[215] it met forceful stonewalling upon asking Programatic to do the same. In response to AFTRA executive secretary Kenneth Groot's request for signature of the codes, Programatic VP John Andrus (using Muzak Corporation letterhead) insisted that "we have never employed the services of AFTRA members in the production of Pro-

[213] Ibid.
[214] "Radio-Television: Sammy Davis' FM Strip," *Variety*, July 12, 1961.
[215] Joseph Singer to Irving Lewis, July 18, 1961, Box 17, Folder 23, American Federation of Radio and Television Artists (AFTRA) National Office Records.

gramatic Broadcasting Service and our present plans do not contemplate the use of AFTRA members in the future."[216] Groot asked Andrus to clarify, "Does this mean that there are no performers engaged by Programatic Broadcasting Service for any performance whether or not AFTRA members, or are the services of performers confined to programs produced by independent producers for distribution by Programatic?"[217] Andrus responded, after a ten week delay, by repeating his earlier denial and adding that "your other questions concerning our business seem immaterial to the issue, and, therefore, we are reluctant to answer them."[218] AFTRA, evidently, declined to pursue the matter further.

By all indications, then, the musicians who produced "adult music" for Programatic and O-Vation did not attain AFTRA representation, even though they were performing exclusively for radio broadcast. Union deference to automation's "progress" surely deserves some blame. But Programatic's business model illustrates a more insidious function that automation could be leveraged to exert at the nexus of production and distribution. Musical performance was not what Programatic promised or intended to automate, yet radio automation affected its conditions. Syndication and automation both introduced layers of mediation into an operation where musical performance was distant enough from radio transmission for management to overcome labor protections that depended on a relationship between the two. Muzak was in a unique position to realize this model, given its longstanding need to commission music recordings that adhered to close parameters (adult music adjusted the parameters of Muzak proper but retained a similar degree of parameterization). This pre-existing facility for fending off obligations to labor was likely as significant an advan-

[216] John R. Andrus to Kenneth Groot, July 28, 1961, Box 17, Folder 23, American Federation of Radio and Television Artists (AFTRA) National Office Records.
[217] Kenneth Groot to John R. Andrus, August 4, 1961, Box 17, Folder 23, American Federation of Radio and Television Artists (AFTRA) National Office Records.
[218] John R. Andrus to Kenneth Groot, October 19, 1961, Box 17, Folder 23, American Federation of Radio and Television Artists (AFTRA) National Office Records.

tage for Muzak as any technological infrastructure as it entered and remodeled the radio automation market.

Conclusion: musical programming, programmed music

Three aspects of Programatic Broadcasting Service's operation have had considerably more staying power than the venture itself, which continued to advertise in *Broadcasting* up to 1972 but gradually disaggregated as it changed owners. First, there was Muzak's use of non-organized performance labor to produce a musical recording catalog that could fill its service. Second, there was the contractually-yoked pair of automated audio technology and subscription programming for that equipment. Third, and binding the other elements together, there was the aesthetic orientation of the music: rejecting genre categories, positioned carefully between background and foreground, optimized to flow seamlessly in the automatic sequence and, as it flowed, to optimize the listener's mood and activity. That these properties still characterize automated sound media in the post-2010 period has not been lost on today's critics, who often levy the term "Muzak" (in its generic sense "to refer to all forms of programmed musics")[219] against platforms' dulling effects on music in general.[220]

Bundling these aesthetic and industrial trajectories together was radio automation's first and most lasting influence upon American sound culture. Programatic, in narrower terms, was the vehicle in which Muzak's managerial science of *musical programming* crossed over into entertainment media—a point that is missing from historical comparisons that use Muzak to understand functionalism in present-day music services.[221] Radio automation's

[219] Ronald M. Radano, "Interpreting Muzak: Speculations on Musical Experience in Everyday Life," *American Music*, 1989, 459.

[220] Liz Pelly, "The Problem with Muzak," *The Baffler*, December 4, 2017.

[221] Nedim Karakayali and Baris Alpertan, "Mood Playlists, Biopower, and the 'Functional Turn' in Online Media: What Happens When a Pre-Digital Social Control Technology Is Transferred to the Internet?" *The Information Society* 37, no. 1 (January 1, 2021): 20–34.

growth imposed a trade-off for music: automation helped increase the share of broadcast time devoted to recorded music, as music playlists afforded repetition, interruption, and recombination much more than news and other talk formats generally did. In turn, recorded music heightened its status as the default content that could (or should) fill an auditory channel. This status was not new; one of several competing origin stories for DJs recounts how Martin Block aired records to fill time in between bulletin updates in the Lindbergh baby kidnapping case.[222] But radio automation designers cemented this division between (musical) program and announcement at the most fundamental level. The emergent automation-syndication industry, from Programatic onward, reified musical programming in the literal sense: from the station's perspective, it was no longer an activity but now an object (a tape reel) that arrived in the mail. Moving from musical performance to musical recordings to musical programming, an abstracting chain had placed considerable distance between the work of musicianship and the moment of music's dissemination. The negative aesthetics of "adult music," as with subsequent "beautiful music" or "easy listening" formats,[223] helped ease music into its proper, functional slot in the automatic conduit between a composition and a psychological effect on the radio listener.

Sonic artists, including John Cage, at times fought passionately against this same becoming-programmatic of sound and listening. But the technological elements that Cage conscripted or repurposed in that effort—tape, radio, computation, Muzak—were the same ones that meanwhile joined together to automate American broadcast radio. Cage has multiple, enduring legacies, and his anti-programmatic interventions in music form one. The idea of injecting silence into an automatic distribution system, as Cage proposed to do with Muzak, would recur in 2014 as one of very few instances where musicians have been

[222] Russo, *Points on the Dial*, 162.

[223] Joseph. Lanza, *Elevator Music : A Surreal History of Muzak, Easy-Listening, and Other Moodsong* (Ann Arbor, MI: University of Michigan Press, 2004).

able to exploit a streaming platform.[224] But this legacy clashes with the equally meaningful one in which Cage, along with other members of the American avant-garde, helped assuage public apprehensions around automation and rebrand it as an aid to democratic, creative subjectivity in a vast and hyper-mediated world.[225] Under the cover of such complexity, sonic automation arose as an entirely unspectacular wedge between work and management: what automation meant to radio was, as Ampex's Russell Tinkham emphasized in 1953, "a station manager's control."[226] This control flowed from the simple interaction of 25 Hz tones and tape players. At the outset of the 1960s, automation had not just taken hold in the United States' most listened-to sound medium; it had invested sound itself with managerial control.

[224]Paul Bonanos, "Spotify Silences Vulfpeck's Silent 'Sleepify' Album," *Billboard*, May 6, 2014.
[225]Fred Turner, *The Democratic Surround: Multimedia & American Liberalism from World War II to the Psychedelic Sixties* (Chicago, IL: The University of Chicago Press, 2015).
[226]Tinkham, "Automatic Station Operation," 14.

Chapter 2: The Golden Age of Automated Radio (1963–1980)

In the 1960s, radio automation entered its heyday. Its constituent technologies continued to evolve, starting in the "brains" of automation systems, which began as banks of switches and then acquired punched tape readers and eventually screen-and-keyboard interfaces. Its business model and its manner of installation into stations had generally solidified, and it now reached for new aspirations. For automation's designers in the 1950s, the guiding technical problem had been how to simulate live radio—an effort that required not only technical precision in the automation system components but also careful instruction for the station staff on how to prepare their local recordings for smooth integration into the system (see the Ampex S-3380 timing diagram in Chapter 1, Figure 6). In the 1960s and 1970s, the problem became how to make automated radio *surpass* live radio in quality and consistency. Much as Ruth Schwartz Cowan has shown of industrialization and women's domestic work, automation did more to elevate the standards to which work was held than it did to ease work.[227] For a passionate subset of radio nostalgists, this span between radio automation's maturation and its computerization is remembered as a period of unique excellence in music programming. The program syndication services, among whom Drake-Chenault Enterprises often stands out for an exceptional devotion to smooth transitions, took the lead in addressing a new question: what would define good radio, now that broadcasting was work that could be automated?

[227] Ruth Schwartz Cowan, *More Work for Mother: The Ironies of Household Technology from the Open Hearth to the Microwave* (New York, NY: Basic Books, 1983).

The automation-syndication industry pointed to two principal answers: creativity and flow. Creativity featured prominently, ambiguously, and often cynically in rhetoric from automation boosters. It was both what radio workers could enjoy thanks to automation *and* what automation would demand of those workers if they wanted to successfully differentiate their station among a sea of competitors running the same syndicated programs. *Programming*, an equally amorphous working category, was the name that distinguished creative work amid automated broadcast technology from a DJ's uncreative tedium of minding record players and microphones. Elevated to the quasi-managerial role of programmer, a former DJ could (and had to) work upon the overall character of the station rather than upon the sound it transmitted at any given moment.

This was the period in which Raymond Williams observed in American broadcasting a shift, as he put it in 1974's *Television: Technology and Cultural Form*, from mere *programming* into *flow*. Williams pointed to music radio formats to indicate how programming had rationalized and specialized broadcast media.[228] Formats, the genres or demographic categories that told listeners what they would hear if they tuned in to a given station, also corresponded to menu offerings that syndication services presented to potential subscribing stations. But *flow* represented a further, more intrinsic evolution of programming that played out at the level of sequence and transition. It eliminated "intervals" between the program segments and advertisements or announcements, in service of a continuous experience that began and ended not at the bounds of a particular program but when the listener/viewer switched their radio/TV on and off.[229]

In radio, more than in the TV offerings that drew Williams's main focus, technical craft could help produce flow through cross-faded transitions; sound afforded a *seamlessness* that

[228]Williams, *Television*, 89.
[229]Ibid., 90.

did not have an analog in visual media. DJs made the seamless transition between records a benchmark for their creative talents; the program services pursued it systematically under the logic of automated and formatted flow. Drake-Chenault oriented its whole operation around the pursuit of sonic seamlessness, to the extent that it birthed a particular work of music-collage—Mark Ford's "Chartsweep," produced as part of a rock & roll audio documentary—that still draws reverence from audio sampling artists today. The aspiration that grew within *programming* likewise yielded artistic inspiration as it pointed to a further scaling-up of mediatic control: first from a broadcast to a station, next from a single station to the medium itself. Radio interventions by the composer Max Neuhaus, automatically patching audience phone calls into chaotic live mixes, turned this degree of command toward the goal of inverting broadcast radio's structure; his *Public Supply* and *Radio Net* propelled an infrastructural and anti-programmatic bent to experimental radio art while also embracing the figure of the sonic artist as programmer.

Even when commentators held up artistry or creativity as qualities that automation diminished, these axes helped mask the more straightforward control struggle that always motivated automation's installation. The same was true of authenticity, which white media producers tried to impose as a distinct concern for Black radio workers—one that both automation and affirmative action threatened. At the partially automated station WJLD Birmingham, Black air-staff declined to fix on automation as an authenticity problem. They bypassed it to focus on grievances against the station's white management, and in some cases they took subtle, unauthorized advantage of the automation system's material affordances in order to improve upon the managers' programming. At other stations, automation rode in under the aegis of either professionalism or profitability, overcoming what should have been strong incentives against eliminating workers: for CJRT Toronto, the university-

owned station's charter to provide training to student volunteers; and for WCFL Chicago, the fact that a powerful labor union owned the station. This chapter focuses on these contexts, rather than retracing a long series of similar episodes where commercial stations automated their programming, in order to illuminate radio automation's installation from its more contested edges.

These installations took place within (or, in the case of CJRT, in the shadow of), a national context where the "automation discourse," as Jason Resnikoff chronicles it, had considerably increased its spread since the 1950s.

> The weakness of the welfare state and the outsized importance of work in American political life gave "automation" a peculiar significance in the United States. The term lumped many different kinds of material change into a single neat narrative that held that all technological development meant progress and that the inevitable end of progress was the abolition of human labor.[230]

American broadcast radio's narrower contextual meaning for automation, though now solidified, was not isolated from the way automation captivated industrial, political, and social debates. 1963 marked a decisive moment in automation's entrenchment as a national concern: a group of prominent technocrats formed the Ad Hoc Committee on the Triple Revolution (automation, or "cybernation," presented one "revolution" alongside atomic weaponry and human rights) and were answered four months later by President Kennedy calling for a National Commission on Automation.[231] With James Boggs's publication the same year of *The American Revolution: Pages from a Negro Worker's Notebook*, the American left also began a new reckoning with automation as a meaningfully distinct (though by no means discontin-

[230] Resnikoff, *Labor's End*, 11.

[231] Jeremy Rifkin, *The End of Work: The Decline of the Global Labor Force and the Dawn of the Post-Market Era* (New York, NY: G.P. Putnam's Sons, 1994), 82.

uous) phase in the long clash between industrial machinery and labor power. Boggs maintained a sense of automation as both crisis and opportunity: a dire accelerant to capitalist immiseration that was spurring social transformations, could thereby hasten mass revolutionary action, and would sustain emancipation from need under communism's eventual classless society.[232] Herbert Marcuse, a year later, cast automation in a similarly ambivalent light when he made the topic central to a social critique that helped galvanize the New Left.[233] The radio industry would seize on an ambient optimism toward automation, hammering throughout the 1960s and 1970s on the trope that the successful installation of automation at a broadcast station both required and enabled new levels of *creativity* from a technologically liberated (not replaced) staff.

Radio automation remained a niche industry within the larger American media sector, but one whose rate of growth generated ongoing excitement and predictions of broader transformation—a transformation under which media would become computational. Earl B. Abrams, in a 1969 special report for *Broadcasting*, stated that the "automated radio industry is presently a $10-million-a-year business" and broke that figure down into two thirds spent on equipment and one third "spent on software, the 18-hour-or-more bulk music and other programming that is designed for stations that are clicking away for 18 to 24 hours a day, seven days a week, with few, and at certain times no, personnel."[234] Abrams's casual description of music as software rang true in a context where musical programming, just like computer programming, was increasingly rationalized, masculinized, and separated from the machines that executed it;[235] for radio, this consolidation took cultural power from station music librarians, who were often women, and transferred it to the syndication ser-

[232] Boggs, *The American Revolution*.
[233] Herbert Marcuse, *One-Dimensional Man: Studies in the Ideology of Advanced Industrial Society*, trans. Douglas Kellner (Boston, MA: Beacon Press, 1964).
[234] Abrams, "Automated Radio: It's Alive and Prospering."
[235] Chun, *Programmed Visions*.

vices.[236] By 1975, Drake-Chenault estimated that more than twenty percent of all radio stations in the United States were automated and projected that half would be automated by 1980.[237] In 1980, automation had become a prominent enough aspect of commercial radio that when San Francisco TV station KPIX ran a five-part series on the state of radio in the area, automation served as the focus for the final installment.

> Today, the big elaborate studios have given way to small announce booths. And with each passing year, the technicians are disappearing in favor of combo operations where the disc jockeys or news jockeys operate their own equipment. Even the records have been phased out—now the music is on tape cartridges, and a very busy jock does it all.... The live disc jockey probably won't go the way of the dinosaur, but right now there are many stations in the Bay Area that have nothing but tapes on the air many hours of the day; and one station, KARA in San Jose, is fully automated.[238]

Even among its boosters, radio automation appeared to surge ahead in technological complexity more by its own motive power than by any clear rationale in financial savings or working utility for the "very busy jock." But the destination of its surging was clear to industry insiders: the entrance of computers as radio's governing media. A 1976 print ad for automation vendor Systems Marketing Corporation bore the faux-headline "Automation News: The Dumb Race to Nowhere" and cautioned readers against costly, unnecessary embrace of microprocessor-driven controllers.[239] Yet by 1980 radio automation, still manifesting as wall-size racks of reel-to-reel and cartridge players, was a computer-controlled tech-

[236] Thanks to Alex Russo for noting this dynamic.
[237] Bert Kleinman, "Over 20% of U.S. Stations Now Automated," *Billboard*, February 22, 1975.
[238] "McElhatton Returns to Radio."
[239] "Automation News: The Dumb Race to Nowhere (Systems Marketing Corporation)," *Broadcasting*, March 15, 1976.

nology; as the KPIX report put it via somewhat overextended anatomical analogy, "here's where the computer comes in: this is the brain, the heart of the automated radio station."[240]

Creativity under control

In broadcast industry reportage and in engineering workshops, automation vendors and station owners who had automated their studios stopped describing automation as a means to eliminate workers. Instead, they claimed that automation pushed station staff into more creative roles and (perhaps even more optimistically) expanded the station's gross profits enough that station owners could retain these workers and even increase their pay despite the costs of the automation system. Speaking at a 1966 panel in the NAB engineering conference, Lee Facto of IGM even cautioned that personnel reduction was the wrong thing to seek in moving to automate. Systems required maintenance and programming. As Broadcast Electronics president Ross Beville put it in opening the panel,

> automation should not be undertaken with a view that there should be an immediate reduction in personnel. The monster must be fed. Program material must be prepared well in advance and this takes people. You will find that the requirement for on-air operations may decline, but you will also find an increase in the man hours required for the advanced preparation and scheduling of program material.[241]

Echoing Beville's "monster" figure, Facto emphasized that "[a]utomation systems are the greatest tape gobblers in the world" and that they demanded either a syndication service (like the ones IGM provided) or a robust programming staff. "If you don't have enough people you end up playing the same music over and over again and then you are accused of

[240] "McElhatton Returns to Radio."

[241] Wilson Raney, "Automation Panel," in *Proceedings of the National Assocation of Broadcasters* (Chicago, IL, 1966), 45–87.

having a local Muzak operation." The real improvement to be sought in automation was not, according to Facto, economic in nature; it was about control.

> On the other hand, other people go into it with the idea that they want to get more control, management control. They can't control their disc jockeys. They are always playing the wrong kind of music. Getting this kind of control is a very valuable thing and automation can do this for you.[242]

This priority always rode under the industry's subsequent claims that automation made radio work more creative. Creativity in pre-recording was creativity under control. By turning DJs into programmers, managers were able to claim that their work had become more creative in nature while also eliminating the liability that they would exceed the bounds of the particular creativity the station owners were after.

Station owners and industry reporters pushed the creativity claim through profiles of automated stations. "[A]utomated programming is opening up music personalities to more creative roles," *Billboard* magazine wrote;[243] in a separate 1975 issue, an article bore the title "Automation: The Key to Creativity."

> Automation is going to allow air personalities to be more creative, to do more with their music and to play more music, believes Mark Mathew, manager of totally automated KGRC-FM here [in Hannibal, MO]. "We believe in automation," said Mathew. "There's no reason why a creative air personality must be turned into a monkey and sit at the board for four hours when through automation he can cut an 'alive' show in 40 minutes and spend the rest of his time in the studio creating

[242] Ibid., 64.
[243] Earl Paige, "Music Goes on and on as Automated Equipment Expands Formats," *Billboard*, February 22, 1975, 20.

other radio material.[244]

Elevating the work of personnel at an automated station consistently meant denigrating the work of live radio production. In another NAB workshop in 1968, the general manager of WDXL in Lexington, TN said, "I have always liked to think there is something an intelligent man can be doing around a radio station that will bring in more money and give him more prestige and a better job and a better position in life than turning a turntable."[245] Describing an announcer whom he had promoted to program director, the manager touted that "he is no longer on the control board but has an office and a desk;" further, that his work had become creative: "we want him to use his head a little bit and get out and listen to some of the other stations and come up with some ideas.... even our high school boys are doing wonders with this automation, using their imagination, their creativity." Creativity figured as a proving ground for a "boy" to differentiate himself as an "intelligent man"—something he certainly couldn't be as a "monkey" sitting at a control board. "Creativity" had long invoked a celebratory claim on the reach of human faculty and thereby on humanity as a category;[246] the staff's very humanity, proponents wanted the industry to believe, was at stake in the question of whether to embrace radio automation.

American radio was certainly not unique in pushing this frame. "Historicizing creativity and automation together," literary historian Scott Selisker has argued, is necessary because of the dyad's contribution to a heightening class divide, where "concepts of disruption and creativity constitute the evolving visions of the human, described in the terms of a management class that differentiates itself from the routinized subjects (or nonsubjects)

[244]Anne Duston, "Automation: The Key to Creativity," *Billboard*, June 24, 1972.
[245]Robert J. Sinnett, "Radio Automation Workshop," in *Proceedings of the National Assocation of Broadcasters* (Chicago, IL, 1968), 42.
[246]Raymond Williams, *Keywords: A Vocabulary of Culture and Society* (Oxford: Oxford University Press, 1976), 45–46.

of *post-human* labor."[247] As Programatic Broacasting Service had in print ads (see Chapter 1), these automation boosters used pre-automated machinery to convey live broadcasting's drudgery: sitting at a control board or turning a turntable. Rhetorical distinctions also helped: "disc jockey" included the role's chief reproduction medium in the name, while "programmer" denoted a managerial level of meta-control. Programming, in the sense of preparing tape reels and cartridges for automated broadcast, was of course no less technical or reproductive than the work it consolidated and time-shifted; and for Facto's emphasis on managerial control to make any sense, it necessarily afforded less freedom of choice than playing records live on the air had. The elevation difference between DJ and programmer then depended not on the degree of technicality but on the question of subservience to versus mastery of the technologies involved. The easiest subservience to claim was temporal: live broadcasting required the announcer to wait for a record to finish playing. Prerecording may have *increased* the amount of work needed from producers—KGRC's Mathew "said that even when an air personality feels lousy, he can sound good. 'You keep doing takes until the show is recorded just the way you think it should be' "—[248]but at least it freed them from the technology's pace. If any might have been troubled that management now dictated their pace instead of technology, then an implicitly managerial status in programming helped assuage that concern; programmers had a place in the management hierarchy, even if machines now populated the only tier below them.

What *programming* most significantly offered at an automated station—and the appeal that speakers like the WDXL general manager emphasized by focusing on the program *director* role—was a chance to have a say in the rules whose faithful execution by the automation system would replace live DJing. This distinction closely paralleled an earlier transi-

[247] Scott Selisker, "Automation and Creativity," *ASAP/Journal* 4, no. 2 (2019): 312–13.
[248] Duston, "Automation: The Key to Creativity," 26.

tion into *automatic programming* (programming in its present-day sense) in the American computing industry. Numerous historians have shown how executives and academic leaders restructured computing in various stages following World War II to first masculinize the programming profession, to celebrate its intellectual and creative mastery over technology, and then to rein in programmers' excessive autonomy (which had led to a tendency for software projects to overrun managers' schedules and budgets).[249] Wendy Hui Kyong Chun has argued that this transition, in abstracting computational commands into higher-level software processes, "led to the more thorough (because subtle and internalized) disciplining of programmers, which simultaneously empowers and disempowers programmers."[250] In radio, automation ushered the role of programmer into a status that was at once more elevated and more beholden to management's priorities, more intellectual in its operation upon the station's musical contours and more narrowly technical in the actual work of shaping those contours (i.e. entering data into the automation system). IGM's Facto acknowledged that it was "very true of automation that you cannot separate engineering and program[m]ing as you do in a live operation."[251] As was well underway for computer programming by that point in the 1960s, the radio programming's automated empowerment already hinted at its absorption by the technical domain—that the programmers' mastery over automation would not long protect their roles from being automated in turn.

As automation increased its spread in American radio through the 1970s, creativity shifted from a selling point for automated radio—something it offered workers—to a requirement it imposed on them. In a 1977 article titled "Creative Programming with Automation" for *Broadcast Programming and Production*, IGM employee JoAnn Roe Burkhart

[249] Nathan L. Ensmenger, *The Computer Boys Take Over: Computers, Programmers, and the Politics of Technical Expertise* (Cambridge, MA: MIT Press, 2010).
[250] Chun, *Programmed Visions*, 35.
[251] Raney, "Automation Panel."

opened on station managers' exaltations of automation as a liability reducer; one, somewhat overstating the case, had pointed out that "'live' spelled backwards is 'evil.'" Digging further into automated stations, though, Burkhart located creativity in an essential yet not at all guaranteed position:

> The key word mentioned by top programmers using automation is "creative," the difference between dead and live sound from the machinery. Creativeness runs the gamut from sheer camp to seriously researched programs that can be put on the air only (or at least most conveniently) with automation, and include format, news and public service announcements.[252]

Creativity appeared here in a somewhat unsteady combination as a benefit that automation conferred on staff and at the same time a measure of their performance. It depended upon a kind of symbiosis between automation system and employee:

> Basic to all the latent creativeness in most DJ's and programmers is the ability to utilize the many features provided in an automation system. Programmed without imagination or incorrectly from an electronic aspect, an automated station can sound robot-like or dissonant.[253]

Buttressed by Burkhart's reminders that live radio was overly technical and uncreative—"[i]t's really not all that creative to sit and spin records and press buttons to actuate commercials"—this configuration held that creativity could only be "latent" in radio workers until automation gave them an opportunity to express it. It was vital that employees do so, lest the individual station sound "robot-like" and, at a broader scale, to avert the

[252]JoAnn Roe Burkhart, "Creative Programming with Automation," *Broadcast Programming and Production*, September 1977.
[253]Ibid.

possibility that "in using syndicated formats, computer-controlled automation systems, and other 'fancy machinery,' all the stations in the country would begin to sound alike."[254] This overtly cynical reasoning redefined creativity to fit cleanly into the gap left between full automation and the human effort that allowed a station to stand out in its broadcast market. The creativity that spokespeople like Burkhart celebrated was not a utopian benefit that automation would confer on an abstract, general workforce. It simply meant broadcast labor internalizing management's priorities, through the working routines that automation reconfigured.

CJRT Toronto: "I don't think your computer needs to learn anything"

Radio automation proved a powerful lever for managerial control, even when this control dynamic ran counter to larger priorities in the context where automation was installed. At CJRT, the radio station that belonged to the Ryerson Polytechnical Institute (today Toronto Metropolitan University), an automation system entered into a standoff whose rival parties—students and a new station management team—argued from different starting points than those of DJs and program directors in a commercial music station. CJRT had for most of its existence served as a training laboratory for students of the Radio and Television Arts (RTA) program, but a governance change at the university led to a four-year gap in this relationship. During that gap, CJRT's new manager installed a Schafer automation system. Student involvement, though restored soon after the system arrived, remained contentious and precarious. In the years that followed, station managers moved from first assuring the school's community that they would use automation minimally to then explicitly leveraging the system as a threat against students.

When the *Canadian Broadcaster* magazine ran a piece on automation uptake in 1969—

[254] Ibid., 54.

"Automation frees announcers for productive and creative work"—it noted that "one of Schafer's major installations in Canada is the fully-automated non-commercial station, CJRT-FM, operated by Ryerson Polytechnical Institute as part of its Radio-Television Arts course."[255] The relationship between CJRT and the RTA program was by then far less close than the article suggested. In 1963, the Ontario Government had restructured Ryerson's oversight, installing an independent board of governors separate from the Department of Education. That board included "Stuart Mackay, the president of All Canada Radio (a firm selling radio advertising)," who "immediately involved himself in the operations of CJRT-FM" and soon persuaded the other board members that the station needed an operational overhaul in order to fulfill its complete mandate, which included providing a "responsible broadcast service to the community" in addition to RTA student training opportunities.[256]

Under Mackay's guidance, the board installed a new manager at CJRT named Donald Stone. Ann Pettypiece, in her history of the station, found that "[i]n spite of the fact that RTA's relationship to the station was being radically altered, no one in the RTA program was consulted in either the process leading to the decision to turn CJRT-FM into a professionally operated station, or to hire Stone."[257] Relations between the station and the RTA program quickly deteriorated, according to Pettypiece. It was Stone who, in the summer of 1967, acquired the Schafer system for the station. By the time RTA students and faculty had made headway in restoring a formal structure for training opportunities at the station that fall, the system was in place. When Ryerson newspaper the *Eyeopener* reported on the return of training opportunities, it also flagged the new presence of automation:

[255] "Automation Frees Announcers for Productive and Creative Work," *The Canadian Broadcaster*, March 1969.
[256] Anne Pettypiece, "CJRT-FM 1949-1974: A Critical Evaluation" (Simon Fraser University, 1982), 56.
[257] Ibid., 57.

> Many students feel that CJRT's decision to pioneer in "Automated programming" has pushed the station too far ahead of the times, thus prohibiting it to typify a Canadian Broadcasting situation. But what about this automation? Was it really designed to eliminate staff and isolate CJRT from the RTA course?
>
> ...
>
> Mr. Stone outlined the reasons for last summer's $18,000 investment in automated programming. "First, we invested after one and a half years of hard investigation into an automated programming system, because this is the way the commercial broadcasting industry is going. In the United States now, there have been over five hundred automated programming systems bought. To a great extent, automated radio has revolutionized commercial radio in the U.S.[258]

Stone made clear that CJRT's charter to provide a "responsible broadcast service" meant, in his view, increasing the station's professionalism; further, that professionalism (even for a Canadian, non-commercial station) meant conformity with standards from American commercial radio; and, finally, that automation provided a material guarantee of achieving that conformity. Students saw the value equation differently. In editorials criticizing CJRT's management, they levied the term "computer" rather than "automation," importing the distinct voice of resistance to authoritarian control that UC Berkeley students had articulated against computing a few years prior.[259] When administrators launched a closed-circuit student station, "Radio Quad," in answer to the impasse between students' eagerness to broadcast and CJRT's new insistence on professionalism,[260] RTA student Algis J. Kybartas lashed out in "An open letter to Ryerson's professional radio station CJRT:"

[258] Ted Fairhurst and Leo Hunnako, "CJRT: A Plan to Re-Instate the Student," *The Eyeopener*, November 28, 1967.
[259] Fred Turner, *From Counterculture to Cyberculture: Steward Brand, the Whole Earth Network, and the Rise of Digital Utopianism* (Chicago, IL: The University of Chicago Press, 2008).
[260] Bill Gilbert, "Get the Pros Out ... Let Students Run CJRT," *The Ryersonian*, October 15, 1968.

> "With the use of Radio Quad, students will instantly know the audience reaction to their program." Ya, we have an instant audience reaction all right—what the hell's Radio Quad? This obviously pleases you. You get the students off your back by having them broadcast to themselves and then you sit back on your butt pumping programs through a computer and expect to get paid for it. What a job, what security!

Kybartas emphasized the fundamental difference between closed-circuit radio and the thrilling possibility, through CJRT's equipment ("Equipment that broadcasts over the air waves! It reaches people!"), of transmitting to a real radio audience beyond the campus. Then, he returned to the "computer:"

> I hear, CJRT, that you have a computer that sets up most of your programming automatically. Tell me; why do you need a computer when there are classes of students who need the knowledge and practice in radio set-up? Besides, I don't think your computer needs to learn anything.[261]

Kybartas here touched on an existential friction that rode under all of radio automation: why was automation needed in a context where people were eager to supply the labor for free? In radio automation's home context of American commercial music radio, the advertising model answered this question: advertisements turned a radio signal into a commodity, whose character needed to conform to the interests of ad-time purchasers rather than those of the people modulating the signal. This equation both removed the appeal of DJing as labor that people would want to perform freely and also introduced the incentive to consolidate and control the DJ labor that was hired. The equation was less straightforward at a

[261] Algis J. Kybartas, "An Open Letter to Ryerson's Professional Radio Station CJRT," *The Ryersonian*, October 7, 1968.

non-commercial station like CJRT, especially one with a pool of highly motivated free labor and a mandate to use it.

As discussions about a return to cooperation between RTA students and CJRT continued but failed to progress, the extent and nature of the managers' intentions around automation broke into the open. Heading into the 1967–68 academic year, Stone had assured *Eyeopener* reporters that "RTA students will broadcast live" and interface indirectly with the automation system—that they "will program by conventional means while being acquainted with the equipment and its potential."[262] Two years later, the paper recounted a classroom exchange in which CJRT representatives presented a very different arrangement. Students would access the airwaves only by prerecording tapes, and only if station management deemed them to be "what we consider good tapes," which excluded "political or religious programs." The process by which students should or could make these tapes was unclear even to assistant station manager Ron McKee, who told students "you have the use of our record library" but told a questioner that they would not permit students to record library items onto tape at the station and would only "perhaps" allow students to borrow them for tape production in RTA's own facilities. As this hostile information session wound on, per the *Eyeopener* narration, McKee "laid it on the line:"

> Students currently have the opportunity to submit tapes for approval by the staff and those that make the grade will be aired during a three hour time slot saturday afternoons. Mr. McKee pointed out that students in previous year did sloppy jobs or didn't even bother showing up and to rectify that situation this year, CJRT was prepared to broadcast three hours of computerized music au lieu de student tapes. "... we're the most experienced station in automation in Canada... we've got

[262] Fairhurst and Hunnako, "CJRT: A Plan to Re-Instate the Student."

a computer there that will put out three hours of music."[263]

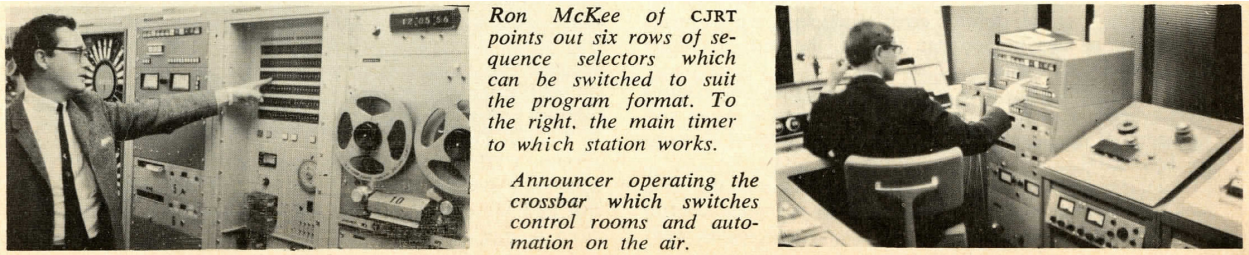

Figure 12: CJRT station manager Ron McKee demonstrates the Schafer automation system, for illustration in engineer Kurt Mayer's article on CJRT's automation use. From *Broadcasting and Communications* (January/February 1969), courtesy of the Toronto Metropolitan University Archives.

Drawing a stark contrast to his supervisor's defensive answers on automation two years prior, McKee invoked the Schafer system as a cudgel. CJRT's use of automation had already precluded the live broadcast experience that Stone had promised and that students like Kybartas had demanded. Now it hung over the meager time allocated for their prerecorded programs, ensuring that students would either internalize the professionalism standards that the management team had imported (along with the automation system) from American commercial radio or forfeit their opportunity to be heard. These students were likely among the first to experience what Erik Yde O'Brien has found of the much more recent use of automation software in college radio: that the system "changes the expectations of what a student radio DJ is" by first reifying the idea that student broadcasters are workers in need of management and then by interposing "the lens of the professional" into the process through which they broadcast.[264] In CJRT's case, the sacrifice of student experience to professional standards was a border- and context-crossing triumph for the American commercial radio model and for automation, its parent-sustaining offspring.

[263] "CJRT Confronts Students," *The Eyeopener*, September 19, 1969.
[264] Erik Yde O'Brien, "College Radio: Managing the Creative Through Software and Policy, a Case Study" (University of Utah, 2015).

WCFL Chicago: the "Voice of Labor" automates

Back in the United States, radio's twin expansion of managerialism and automation claimed a more sharply ironic target: the AM station WCFL, whose owner since 1926 had been the Chicago Federation of Labor. Despite a high-power signal and a competitive lineup of rock & roll DJs, the station had by the mid-1970s come under criticism for a dwindling commitment to its public affairs charter. Though still owned by a large labor organization, WCFL programmed far less in the way of organized labor concerns than it once had.[265] Nathan Godfried, in his comprehensive history of the station, has surmised that "the most likely goal of the shift to the automated music format was to cut station losses while trying to sell WCFL."[266] *Chicago Tribune* columnist Gary Deeb broke the news in February 1976 that station manager Lew Witz had, in the face of sharply declining profits and Arbitron ratings, readied the switch to "a lush, automated format of 'beautiful music.'" The rationale was transparent, to Deeb, as were the expectations for musical quality to come: "the shift to automated Muzak would save WCFL a fortune in its on-the-air payroll. Taped 'wallpaper' being what it is, the station's air staff could be slashed to the bone."[267]

The automated music that began on WCFL was not Muzak proper but, more accurately, a beautiful music format from TM Productions. The Dallas-based TM had begun as a jingle producer and expanded into syndicating music tapes for automated stations in the 1970s—incidentally, Dave Scott, who would by the 1990s own the leading automation software vendor in the United States, had joined TM in 1975 and begun rising up the ranks.[268] Given the continuity among Muzak, Programatic Broadcasting Service (see Chapter 1), and subse-

[265] Elizabeth A. Fones-Wolf, *Waves of Opposition: Labor and the Struggle for Democratic Radio* (Urbana, IL: University of Illinois Press, 2006), 242.
[266] Nathan Godfried, *WCFL, Chicago's Voice of Labor, 1926-78* (Urbana, IL: University of Illinois Press, 1997).
[267] Gary Deeb, "'CFL Rolls in Red, Rocks Toward 'Muzak'," *Chicago Tribune*, February 11, 1976, sec. Section 3.
[268] Scott, Interview.

quent automation-syndication offerings in radio, Deeb's shorthand of "automated Muzak" was only hyperbolic to a small degree. Pointing out that the new format would be an odd match for the station's on-air staff, Deeb noted that the roster-leading rock DJ Larry "Superjock" Lujack held a "no-cut contract" with the station and speculated that its management would pay out the remainder of that contract.[269] In fact, Lujack would stay on for a time after the switch, but with diminished responsibilities and enthusiasm. The final air slot before the format change fell to him, and he capped a series of more emotional farewells from colleagues with a sarcastic entreaty—a litany of reasons that listeners should swear off rock & roll radio instead of switching their allegiance to a rival station (WCFL had accepted ads from those rival stations in the days before the change, lest any ambiguity adhere to Lujack's meaning). After Lujack's show ended at 5:00pm, "the waves came: the sounds of the rushing sea were heard for two hours" before the new format kicked in at 7:00.[270]

Two points emerge from WCFL's switch to automation, which apart from the station's ownership by organized labor was a very typical case of automation-installation for a music station in the 1970s. First was that the actual Chicago Federation of Labor's decision to eliminate jobs in an operation it owned spoke to American labor unions' generally resigned acceptance of automation following the postwar period;[271] even so, it also suggested that the CFL saw the radio station more as a financial asset (or rather liability) than as a working operation, especially as the role of DJs was concerned. Godfried shows that labor-specific programming did increase somewhat alongside the change to easy listening, for the brief time before the CFL sold the station to the Mutual Broadcasting System, so the move simultaneously betrayed and renewed the station's pro-labor character in separate arenas of ex-

[269] Deeb, "'CFL Rolls in Red, Rocks Toward 'Muzak'."
[270] Jack Miller, *A WCFL Retrospective*, 1979.
[271] Noble, *Forces of Production*.

pression and action.[272] The second point is that Lujack's "address to the nation," as he put it, declined to point out the automation element or its irony at "the voice of labor." The subject may well have been off-limits; station management had fired two DJs in the weeks beforehand for discussing the format change ahead of its announcement.[273] But Lujack nevertheless chose to mourn the departure of rock programming rather than the displacement of the people carrying out that programming. It was a choice that grasped only one part of a powerful articulation in radio—easy listening formats and automated equipment—and singled out only that part for scorn, letting the larger managerial complex wash over the station in silence.

Drake-Chenault and the "Chartsweep"

If Paul Schafer secured a status as automation's leading driver from the manufacturing side in the consensus history among radio professionals, a company called Drake-Chenault Enterprises secured it from the side of musical programming. In the late 1960s, Bill Drake and Gene Chenault transitioned from consulting client stations on their programming strategies to syndicating tape reels, and the company remained active until 1988, when competitor Broadcast Programming purchased most of its assets.[274] Drake-Chenault revisited the audiotape affordances that had originated radio automation and refined them in an obsessive investment in sonic seamlessness: a special recording and re-dubbing process moved their cue tones to one second before transitions, eliminating the gaps in the handoff between tape players and allowing for tight cross-fades between audio segments. In this manner, Drake-Chenault played a central role in what Alexander Russo has pointed out as one of the most significant milestones in radio programming of the 1960s and 1970s: automation's es-

[272] Godfried, *WCFL, Chicago's Voice of Labor, 1926-78*.
[273] Ibid.
[274] "Broadcast Programming Acquires Drake-Chenault," *Radio & Records*, March 8, 1991.

cape from the aesthetic confines of beautiful music and its application to more fast-paced formats.[275]

The programming philosophy that led to the company's success was, by contemporary accounts, pre-technological: Bill Drake, as *Time* magazine colorfully depicted in 1968, hitched his career as a programming consultant to a "less talk" format for pop radio that took aim at what industry leaders perceived as excessive DJ banter. "At a time when most U.S. rock jockeys are screaming egomaniacs, Drake advises his stations to end the cult of nonstop talkers," wrote *Time*.[276] A photo showed Drake lounging on a pool float at his home in Los Angeles's Bel Air neighborhood and explained how Drake would monitor his client stations from this luxurious command center. "Should he hear a disk jockey he doesn't dig, Drake gets on the blower (he has 21 phones around the house, including one in each of the five bathrooms)."

As a consultant, a meta-programmer, or "The Executioner" (as *Time* titled its profile), Drake appears now as a very late-1960s, Californian predecessor of figures who sit at the control-and-surveillance center of a medium—the "architect" who resides in a televisual surround at the core of the titular false reality in the *Matrix* films, or the depiction of platform executives like Mark Zuckerberg as having hands on the mysterious levers of "the algorithm," for example. These multiple versions, updated accordingly for their enclosing media regimes yet always cybernetically bound up with companion technologies of monitoring and feedback (phones, cameras, data dashboards), speak to the fear and the fantasy that a medium's operations might flow through a chokepoint narrow enough that a single individual could through it control mediated reality. A pre-echo of this concern attended Drake's hold on music radio—and thereby the reality of popular music—at the very moment

[275] Andy Kelleher Stuhl et al., "Sounds of Accompaniment: Transcript from an SCMS 2022 Panel on Music, Technology, and Labor," *Journal of Popular Music Studies* 34, no. 3 (September 1, 2022): 6–29.
[276] "Programming: The Executioner," *Time*, August 23, 1968.

he and Chenault were becoming an automation tape service:

> Drake-Chenault Enterprises, as the firm is still called, is not universally admired in the music field. When Drake proclaims a hit-bound choice, the prophecy is often self-fulfilling because he controls so many successful stations. But the hits he creates, such as Sonny and Cher's I Got You, Babe and The Monkees' Last Train to Clarksville, can seldom be described as creative new works. A Los Angeles underground paper called Drake "a monument to public tastelessness." For better or worse, Drake is going to have more influence before he has less. Next month 21 new client FM stations will receive by mail, on reels pretaped by Drake's staff, their weekly programming. For the stations, it means getting by for much of their air time with only an engineer on duty. For Drake, it means fewer disk jockeys to monitor, more time in the pool.[277]

Automation, for neither the first nor last time, appeared not merely as a streamlining of labor but as the perfection of a social control apparatus in radio. Yet today, among the career radio engineers who worked for Drake-Chenault or alongside automation systems playing its reels, the image of Bill Drake in the pool does not linger on as the outfit's legacy; rather, the image is of a staff of engineers with high dedication to technical craft in preparing and duplicating music tapes for syndication. Fans and chroniclers emphasize the company's commitment to superior tape-duplication equipment, the high fidelity of its resulting reels, and its solution to the problem of temporal precision that had to that point held automation back from pop formats. As Hank Landsberg, who worked as Drake-Chenault's Director of Engineering between 1974 and 1988, explains:

> Broadcast automation equipment of the '60s and '70s was usually limited to "easy

[277] Ibid.

> listening" music formats, because the hardware of the era wasn't capable of executing a tight, fast-paced pop music format. With easy listening, it was OK if there was some silence between songs; not so with top 40! Top 40 needed tight segues, jingles, spots, time announce, weather and other elements in rapid succession. The problem was how to make an automation system run tight and quick?
>
> The answer was developed by D-C: We put the 25 Hz "cue" tones at the end of each song one second early, so the automation equipment had a "one-second head start." This would compensate for the start-up delay of the reel-to-reel playback decks, and yield tight segues without any "wow-in."[278]

This solution relied on a multi-track recording system, wherein a 1 kHz tone would be placed on its own track, separate from the music. This arrangement kept the producer's task as it had been with all previous automation equipment, that is, pressing a tone-generator button when the program tape reached the point where it should stop. A processing step then played the multi-track tape backward, and a specialized machine detected the 1 kHz tone and placed a 25 Hz cue one second later (thus one second earlier) in the syndication-ready tape reel. It was the first major iteration upon the basic 25 Hz cue tone technique, which had been synonymous with radio automation since 1953. As an automated time-shifting process, it neatly redoubled this technique in on itself. Taking advantage of tape's reversability, it also pointed ahead to the non-linearity of digital audio, which the need for sonic density—and the tape cartridge as the answer to that need—would map out in the 1980s ahead of its technical feasibility (see Chapter 3).

In keeping with Drake's habit of monitoring and admonishing his client stations, Drake-Chenault's techniques for sonic precision extended past their own production studios and

[278] Hank Landsberg, "How D-C Cranked Out All Those Tapes," *Radio World*, November 27, 2019.

into a quality-control apparatus. Client stations would submit periodic aircheck recordings for critique by the central programming staff,[279] and in 1975 the company's program director Lee Bailey circulated an instructional tape for the staff at subscriber stations who would be preparing the local announcement tapes:

> One of the most appealing things you can give your listeners is a smooth, even sound with an unbroken, pleasant pace. It's the kind of sound which doesn't jar the audience with uncertainty; a sound which shows off your professionalism. A smooth, flowing sound is easy to obtain with Drake-Chenault formats and automation. It just takes care and consistency.

In the recording, Bailey proceeds to explain the basic cue tone principle behind radio automation, the Drake-Chenault one-second-delay technique, and the need for subscriber stations to incorporate the same delay in recordings (advertisements and station announcements) they prepared locally. Technical precision was more than a hallmark of Drake-Chenault's in-house productions: through the company's soft revision of radio automation's core protocol, it became as much an export to client stations as the programming itself. A station running Drake-Chenault tapes through automated equipment would achieve *flow* both in the hour-to-hour consistency of its format and at the immediate sonic level, second-to-second.

It was through this devotion to sonic precision that Drake-Chenault spawned an audio artwork that would escape the commercial radio context and live on past the company as an object of great esteem to audio-collage practitioners. Drake-Chenault occasionally added special features amid their regular music block reels, and these included a "50-hour

[279] Hank Landsberg, "Production of Automation Music Programming Tapes at Drake-Chenault," Drake-Chenault: A look back, May 1, 2002, http://www.drakechenault.org/textpg.html.

blockbuster documentary"[280] called "The History of Rock and Roll," produced first in 1969 and afresh in the mid-1970s.[281] The later production ended with a segment, subsequently dubbed the "Chartsweep" or "Timesweep," for which the project's audio engineer Mark Ford spliced together a few seconds of each Billboard number 1 hit since January 1956.

For a later and more countercultural generation of sound and radio artists, Ford's creation stands out as an enigmatic and inspirational precursor to mashup and other forms.[282] On New Jersey freeform station WFMU, sound artist Vicki Bennett a.k.a. People Like Us aired a documentary about "The History of Rock and Roll" spotlighting Ford's montage work.[283] Jon Leidecker a.k.a. Wobbly, the current host of experimental radio show Over the Edge, calls it an "unsung American collage masterpiece" and labels Ford as a "genius" and "artist." These collagists, having accrued a deep appreciation for the difficulty of splicing audio samples together in a fluid manner, point on one hand to the "simple" or "self-evident" concept behind "Chartsweep" and on the other to the artistry of Ford's execution—the musical seamlessness that arose from his painstaking tape editing.[284] That the work came from an automation outfit, from "the company that brought canned radio playlists to nationwide US markets," as Bennett puts it,[285] is for them a point of interest more than irony. Drake-Chenault had developed an internal production culture that prized technical precision in service of broadcast flow. It was a devotion that successfully distinguished the company within the quickly expanding automation-syndication field and helped expand automation's reach beyond easy listening formats. When Ford distilled that

[280] Ibid.
[281] Hank Landsberg and Gary Theroux, "Drake-Chenault Special Features," Drake-Chenault: A look back, 2002, http://www.drakechenault.org/special.html.
[282] Wayne Marshall, "More SoundClowning Around," *Wayne & Wax* (blog), February 24, 2011, https://wayneandwax.com/?p=5155.
[283] Vicki Bennett, "Drake Chenault, Mark Ford, Hugo Keesing: Documentary About The Phenomena Called Chart Sweep/Time Sweep: Radio Boredcast," WFMU, March 30, 2012, https://wfmu.org/playlists/shows/45720.
[284] Leidecker, Interview.
[285] Bennett, "Drake Chenault, Mark Ford, Hugo Keesing."

particular perfectionism to an even more granular level—transitions *within* rather than *between* songs—he inadvertently inspired sampling artists who would find in radio a chance to slice up and counter the medium's formatted flows.

The question of Black radio's automatability

Though efforts like Drake-Chenault's broadened the aesthetic terrain for automation-syndication, a sense remained in the industry that some music radio formats were more amenable to automation than others. Pace and sonic density were not the only factors at work in this differential; so were locality and, more ambiguously, race. A 1975 *Billboard* surveyed the automation-syndication field:

> In the past year, Schafer [Electronics] has seen installations go into more country and rock stations than ever before. A chief reason is the marriage of automation and syndication, says Dwight Herbert, Schafer program sales manager and former deejay.... Classical formats lend themselves well to automation and, of course, beautiful music has always been one of the easiest to automate. The sole exception to automation, if Herbert can be pardoned for a pun, is soul. He believes there is just such a "gut feeling" of intimacy and community involvement, particularly in the deep Chicago innercity [sic] and throughout the south, that few soul stations go automation. In fact, he says he knows of only one in the whole of America.[286]

As a sales representative for a leading radio automation equipment vendor, Herbert's choice to (publicly and emphatically) locate soul music beyond automation's grasp seems counter-intuitive. Perhaps this individual's love for soul radio trumped his professional motives to promote automation: the article noted that Herbert, who appears to have worked

[286] Paige, "Music Goes on and on as Automated Equipment Expands Formats," 20.

as a program director and DJ under the air name Chuck Morgan at KYNA Des Moines in the early 1970s,[287] was "an ex-soul deejay himself."[288] Perhaps it was a more calculated defense, within the automation industry, against poor sales numbers for Schafer among soul stations. In any case, a strange kind of essentialism was at work here: one that, through ambivalent gestures toward race and musical community, pried open the relationship between music radio and communication. Herbert may have grasped some of what Paul Gilroy has called the "pre- and *anti-discursive* elements of black metacommunication,"[289] fixing on the act of communication as the soul DJ's essential function when the article circled back to his belief about soul radio versus other formats:

> Country is one of the easiest to automate. "And it can be done with the same amount of personalities, in fact, better personalities than the average medium market station could hire." The one exception to automation is soul. "Soul is something else, and Los Angeles soul is something else from everything," says Herbert, an ex-soul deejay himself. "It's really a gut feeling of that live jock to really communicate."

This was not, incidentally, the first time that country music (or its predecessor genres) had stood out as a frictionless form of content amid a changing distribution apparatus for music. Kyle Barnett has called hillbilly music of the 1920s "the most industrially viable genre form heading into a period of technological change, media consolidation, and great economic turmoil, in which the shape of the entire [radio and recording] industry would change."[290] Appearing opposite soul, country here suggests a racialized continuum of in-

[287] Ray Dennis, "KYNA Dwight Herbert Luncheon/Reunion," DesMoinesBroadcasting.com, July 8, 2016, https://www.desmoinesbroadcasting.com/xtras/dwight-herbert/dwightherbertluncheon.html.
[288] Paige, "Music Goes on and on as Automated Equipment Expands Formats."
[289] Paul Gilroy, *The Black Atlantic: Modernity and Double-Consciousness* (Cambridge, MA: Harvard University Press, 1993), 75.
[290] Barnett, *Record Cultures*, 146.

dustrial viability—or, in this case, automatability. Soul, in Herbert's formulation, was not necessarily a racially indexical category; but given the geographic zones he listed, which line up with Black population centers in the 1970s, it is tempting to read "soul" here as at least highly correlated to Blackness. The term does appear somewhat interchangeably with "Black" within the automation-syndication industry, which happened to refute Herbert's characterization on the spot: Drake-Chenault announced a new format called "SuperSoul" in the same *Billboard* issue and, in a syndicator directory two years later, labeled it "Category: Black. Description: A modern, more music approach to black radio."[291]

Herbert's fixation with the soul DJ's "gut feeling... to really communicate" evokes what Alexander Weheliye has called the "overdetermined contingency of orality or particular genres of black music;" for Wehilye, this tendency is an ongoing problem in scholarly treatments of Black sound practices, a condition under which theorists "seldom address their technicities."[292] Herbert—and, even more acutely, a pair of TV representations in 1980—imagined that soul DJs must inhabit a kind of primitivistic opposition to mechanization. This notion belied the already highly technologized apparatus that a DJ took up when broadcasting live, let alone the fact multiple Black-oriented and soul stations used automation by 1980. At one of them, WJLD Birmingham, automation figured into a tense dynamic between Black air-staff and white managers. Automation, though, was an ambivalent resource within this struggle and not its origin or focus. As Weheliye argues, the "phonographic technologization of black music and speech" (with radio automation being one particular extension of phonographic technologization) is not "an instance of 'inauthenticity' but [rather] a condition of (im)possibility for modern (black) cultural production."[293] White commenta-

[291]"Directory of Syndicated Radio Programming," *Broadcast Programming and Production*, September 1977, 67.
[292]Alexander G Weheliye, *Phonographies: Grooves in Sonic Afro-Modernity* (Durham, NC: Duke University Press, 2005), 7.
[293]Ibid., 12.

tors' efforts to impose authenticity-versus-automation as a challenge for Black radio workers was an objectifying and disempowering gesture that had little to with how automation actually appeared to the workers who encountered it at WJLD. In those encounters, automation's predilection for enforcing managerial power overlapped with a vulnerability to subtle sabotage.

WJLD Birmingham

At WJLD and its companion FM station in Birmingham, Alabama, automation systems were in use in the late 1970s. Gary Richardson, who today owns WJLD, recounts in an interview for the Birmingham Black Radio Museum's oral history project that his first assignment as a new employee at the station entailed "baby-sitting automation machines" in overnight engineer shifts.[294] Manuel Fitch, who hosted shows on WJLD as "The Mellow Man," recounts not just the automation system but also a syndication arrangement:

> You didn't have to worry about bringing no music.... Everything was programmed. Pre-programmed.... A guy named Tony... worked at JLD. Matter of fact, he worked at the company in Florida where the machine was originated from.... He made some of [the tapes] up before he got here. Cause he was, you know, making old music up... and sent them out to other Black radio stations.[295]

Fitch's recollection strongly suggests that enough Black-oriented stations used automation systems in the 1970s that a Florida-based syndicator—presumably one that had escaped Herbert's notice—catered to them. This is not to say that the working arrangements that automation facilitated were stable or accepted within those stations. Fitch explains that he grew tired of his role appending voice-overs and commercials to pre-recorded tapes, and

[294] Richardson and Friedman, Gary Richardson, Oral History.
[295] Manuel Fitch, Manuel Fitch, Oral History, interview by Bob Friedman (Birmingham Black Radio Museum, February 5, 2011).

Figure 13: Manuel Fitch adjusts a patchbay connection at a WJLD equipment rack, with the automation system's cartridge carousel visible to the right. Courtesy of the Birmingham Black Radio Museum.

his raising the issue with Tony led to Fitch leaving the station.[296] Bob Friedman, BBRM Director, mentions in an interview with fellow WJLD alumnus Ron January that Tony (whom January recalls as being Program Director[297] and as being white) that, "supposedly in Paul's presence [Tony] used the N-word or something like that... Gary [Richardson] remembered Paul [White][298] hitting this guy once and he went out like a light."[299]

While the anecdote is remarkable in posing automated radio programming as, in this case, the project of a racist and an object in proximity to forceful resistance against racism, the engagement with automation by WJLD's Black air-staff was generally less overt. The automation system and its components provided a means of mundane, non-discursive struggle against the plans of the more powerful actors who had set its agenda—a form of what John Fiske, in reference to Black media practitioners including Mbanna Kantako of Black

[296] Ibid.
[297] A 1980 directory in *Cash Box* lists a Tony Saetta as WJLD's Program Director.
[298] White was not only a star announcer at WJLD; as a DJ on WEDR in 1963, he had "used soul hits... to get his signal out to the decentralized army of youthful demonstrators" and earned subsequent praise from Dr. Martin Luther King, Jr.; see (William Barlow, *Voice Over: The Making of Black Radio* (Philadelphia, PA: Temple University Press, 1999), 210).
[299] January and Friedman, Ron January, Oral History.

Liberation Radio, called "technostruggle."[300] DJs, Rayvon Fouché has pointed out, have been among the most adept figures at repurposing and resisting the prescribed use of media technolgies within a practice Fouché calls "Black vernacular technological creativity."[301] January recalls "reprogramming" the automation system without management's permission:

> RJ: Changing out the reels and the carts. And it's amazing, you'd get in—and you know it's pretty similar to what we're doing today. Because—and that's why I got in trouble, I'd go in there and reprogram it as far as I could, which you weren't supposed to do.
>
> BF [Friedman]: What do you mean you got in trouble?
>
> RJ: Well they'd claim some songs were playing a little bit more regular than others.
>
> BF: Now why would you do a thing like that?
>
> RJ: I was just changing it up. 'Cause after a while it gets to be repetitious. You've heard the flow of songs coming in the same way?
>
> BF: Mhm.
>
> RJ: Well after a couple of days later, you'd hear the same flow and you could almost hear what was going to come up next.
>
> BF: So you tried to keep the audience.
>
> RJ: So they'd go in and switch the reels out a little quicker than they were supposed to, and then switch 'em back.[302]

January's habit of minor sabotage countered not the fact of automation, but rather the

[300] John. Fiske, *Media Matters: Everyday Culture and Political Change* (Minneapolis, MN: University of Minnesota Press, 1994).

[301] Rayvon Fouché, "Say It Loud, I'm Black and I'm Proud: African Americans, American Artifactual Culture, and Black Vernacular Technological Creativity," *American Quarterly* 58, no. 3 (2006): 639–61.

[302] January and Friedman, Ron January, Oral History.

tendency for its use to result in an over-programmed "flow" that became too discernable. Changing the rate of change for syndicated or pre-recorded reels was a form of reprogramming, as he calls it, but not of deprogramming—it followed the system's scripts, if not management's schedule, in order to restore a state in which the audience could experience the station as a media channel without the dislodging meta-awareness that excess repetition conferred.

"A human radio station"

Shelley Pope was an announcer who moved from WBUL to WJLD in 1977 and quickly entered into an impassioned rivalry with colleague Paul White. January recounts, via Friedman, that "the line-up was Paul, Ron, Pope, Paul, Pope and finally McKinstry at 8 P and then automation. Pope was a screamer and January remembers Pope breaking VU meters on the board. Competition between Pope and Paul was such that Pope had a studio built in his home so he did not have to be in the station with Paul."[303] This account variously casts Pope as co-working with, vocally exceeding, and moving outside a usual technological configuration in which automation was one component. In an undated recording of Pope on-air at WJLD that (much like Mark Ford's "Chartsweep") has circulated through alternative radio enthusiast networks, Pope elaborates a new configuration among the human, radio's technological apparatus, and the working category "disc jockey" when he refuses his belonging to that category. In the three-minute aircheck, Pope pleads to his listeners: "Don't call me no disc jockey. Because I'm not a disc jockey. I'm a *human radio station*."[304]

Referring to himself instead as a "radio personality," Pope intones that listeners "disfigure" him when they place him in the same category as his rivals. The verb invokes a sense,

[303] Bob Friedman, "Shelley 'Black Pope' Pope," The Birmingham Black Radio Museum, accessed December 10, 2023, http://thebbrm.org/item/441.

[304] Shelley Pope, *I'm a Human Radio Station*, CD, vol. 2, WFMU Radio Archival Oddities, 2004.

as Matthew Fuller would elaborate with regard to pirate radio in London several decades later, that the "medial assemblage" of radio inheres in an expanded vocal body that extends outward from (and transforming by augmentation) the DJ, MC, or announcer.[305] The sense grows as Pope enumerates the component technologies he encompasses:

> Now them people what you call disc jockeys, know what I mean? *I'm a human radio station,* and I don't want to have to repeat this no more. I'm a human radio station. I'm the transmitter, I'm the tower, I'm the turntables, I'm the building, I'm every doggone thing![306]

"Human radio station," lexically, swaps the relative positions of worker and medium as they appear in "disc jockey." More significantly, though, it expands the aspect of the medium that the human worker apprehends and changes the nature of that apprehension from one of *control* to one of *becoming*. "Disc jockey" renders the phonographic recording as radio's motive power and the human announcer's role as one of riding atop, steering, and urging forward that power: "The turntable invents the DJ in order to compute."[307] The other side of the term's allusion to horse-racing is that the DJ steers only in service of that motive power and its owners, and only within the narrow bounds of a linear course. *Becoming* the transmission apparatus rejects the relationship of service or servitude. Discarding the metaphor of steering discards the cybernetic separation of power and control; there is only affect, only transmissible intensity. What Pope achieves (and boasts of achieving) in the recording is a bodily, vocal, performative sublime that expands the sounding subject encompass technology; specifically not a "technological sublime" that would cast technology

[305] Matthew Fuller, *Media Ecologies: Materialist Energies in Art and Technoculture* (Cambridge, MA: MIT Press, 2005).
[306] Pope, *I'm a Human Radio Station*.
[307] Fuller, *Media Ecologies*, 25.

as a landscape-scale conveyor of awe and national triumph.[308] A press photo of Pope (Figure 14) showed him, magisterially posed in a white suit and dark cape, fading in above a section of Birmingham skyline that prominently included phone and radio infrastructure.

Pope's larger-than-medium personality held fast in the tensions that periodically flared between WJLD's Black air-staff and white managers, resulting in what colleagues recall as a dramatic on-air resignation:

> Pope gets on the air. And he said, he said some derogatory things about the management and ownership of the radio station. And basically, these white folks over here are cruel, mean, and whatever he can think of, and said "I quit!" and left the record on the turntable. And all of a sudden, everybody was looking like what? And the record, bloop, bloop, bloop, bloop, bloop on the turntable.[309]

The empty "bloop, bloop, bloop" of Pope's abandoned turntable would echo when Richardson, perhaps empowered by Pope's earlier act of refusal, later undertook his own reprogramming in response to a strict new general manager imposing a format on the station's DJs:

> Now imagine everybody who's always been playing loose, whatcha you wanna do, all of a sudden, this guy puts the format clock up and this is what you're gonna play, man. He tells you the song that you're going to play. It was miserable. I was miserable. And then this guy goes in and he cuts a promo for the radio stations about two and a half minutes long. It was a slow read. It was terrible. And it was like somebody who's playing radio. And I got frustrated one evening. I came in, didn't know that he moved me from midday to the evening, and I don't like it. So

[308] Leo Marx, *The Machine in the Garden: Technology and the Pastoral Ideal in America* (New York, NY: Oxford University Press, 1964).
[309] Richardson and Friedman, Gary Richardson, Oral History.

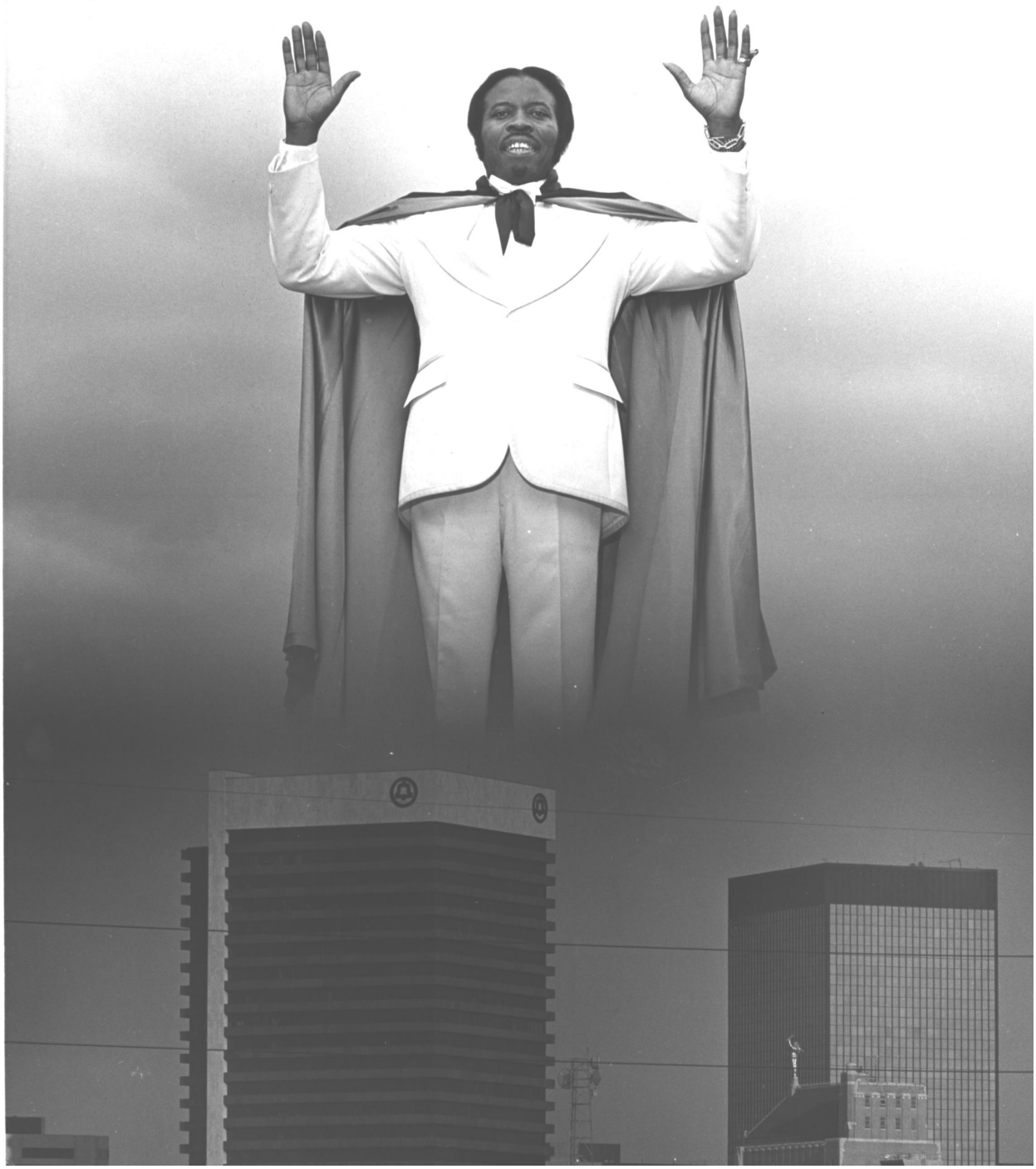

Figure 14: The Black Pope rises above a signal tower, telephone lines, and the South Central Bell Building in Birmingham's skyline. Courtesy of the Birmingham Black Radio Museum.

> I came in one evening, I took the cart outta the rack, put a bulk erase on it, erased the cart, stuck it back into rack. Got tired of it. And the DJ behind me came on and played the cart, bloop, bloop, bloop, nothing.[310]

As it did with January's reel-switching, the tape technology at WJLD and its companion FM station provided a kind of attack surface for subtle counter-tactics against management. Yet the radio workers carrying out these tactics understood them as anti-management so far as they redressed specific harms to the quality of the station. The distinction came to matter when Richardson eventually purchased WJLD around 1985 and automated as much of it as he could:

> I fired everybody. Couldn't afford to pay them. So it wasn't that I didn't want them working or like firing folks. I couldn't afford to pay 'em. So I let everybody go.... I brought in the satellite dish, hooked it up. I put together a little automation system that I home-made out of cassette machines. And I had a cassette machine that actually played commercials, I had a cassette machine that actually played liners, and I had a cassette machine that actually played jingles. And this little switcher, its relays, took the tone from the satellite dish and had the tones output it to relay contact closures. So impressive. But WJLD had their own voice. It was so tight and realistic. People thought the DJs were actually in the studio.[311]

As is audible in Shelley Pope's recorded exclamation, radio practitioners at WJLD prized liveness and vocality in broadcasting; yet these qualities existed in tandem with automation and other tape technologies. It was a coexistence that may well have seen more push and pull than was typical of a partially automated station in the 1970s, given the elements of

[310] Ibid.
[311] Ibid.

racial conflict and remedies of reprogramming that air-staff recall, but it was by no means immune to automation. The fact that the station coming under Black ownership also saw it become fully automated testifies to this relationship—and to the complex technopolitics at work when empowerment also meant accelerating the managerial, anti-labor tendencies that automation encouraged.

TV portrayals: anti-automation as anti-affirmative-action

Despite this evident use of automation and tape syndication among Black stations in the 1970s, the idea of an incompatibility between radio automation and Black radio practice persisted in representations of the medium. In a 1980 episode of the CBS sitcom *WKRP in Cincinnati*, a Black character's encounter with automated radio provided a chance for the show's inter-media commentary to slide subtly from a celebration of working autonomy to a critique of Black empowerment in the workforce. Titled "Venus Rising," the episode followed the DJ character Venus Flytrap (real name Gordon Sims; portrayed by actor Tim Reid) as he entertained a more lucrative job offer from a new rival station, WREQ. On his visit to the WREQ studio, Venus enters a sleek front office with a young Black woman (with whom he flirts) at the reception desk and a white, over-eager station manager who introduces Venus presumptuously as "our new Program Director." When Venus asks, "So when do I meet the other DJs?" the manager begins a two-fold revelation: first that the station is automated, and second that Venus is mainly valued as an affirmative action hire.

> See, Venus, we [dramatic pause] are automated. Just like NASA, first class across the board. Amanda, honey? Why don't you let Venus see MAXX. Just like the Wizard of Oz. [Amanda, the receptionist, dims the lights and causes a set of blinds to open. An R&B song fades up as a wall-size automation system is revealed on

> the other side of the window.] Max is our disc jockey! Twenty-four hours a day, plays all our music. See, with you on the air every night, people will still think we're live.... Venus, there are already fifteen hundred automated stations in this country. Do you realize that, if you buy your news from a national service, you could run an entire station with no people? No people, think of that one! [The manager is momentarily overcome by the ecstasy of this vision.] An ugly thought, but think of it.

Venus asks, "So what do I do around here?"

> Not much! I mean the music is programmed out of New York, so all you have to do is tape a couple of things, interviews and so on, so the people will still think it's all coming out of Cincinnati. And that's about it! It's perfect. [He chuckles, then leads Venus a few steps further away from Amanda.] See, Megalo Communications is a, well, it's a great company to work for. The opportunities are limitless. We're very proud of our *affirmative action program*. [Venus repeats, "Affirmative action?"] Hey hey hey, you know about that, right?[312]

The manager steps out to take a call from New York, making a finger-gun gesture at Venus as he keeps up his peppy entreaties. Venus, backdropped by "MAXX," obligingly returns the gesture; but with the manager out of sight, he turns the finger-gun on himself in an apparent bout of disgust. The double revelation, and Venus's reaction to it, yokes *automation* and *affirmative action* together as corporate projects that would abnegate meaningful work. The episode's skeptical portrayal of automation contributed to *WKRP*'s recurring focus on "the dwindling state of pre-programmed playlists and computer-operated radio stations,"[313]

[312] "Venus Rising," *WKRP in Cincinnati* (CBS, March 10, 1980).

[313] Michael B. Kassel, *America's Favorite Radio Station: WKRP in Cincinnati* (Madison, WI: University of Wisconsin Press, 2013), 99.

but its concluding scenes sharpen into picture of a more specific crisis with race at its core. The prospect of a Black character being paid *not* to work, within the context of a show that celebrates even as it parodies broadcasting's creative labor, poses an immediate moral crisis for that character. Venus eventually declines the job but uses the offer to leverage a new role as Assistant Program Director back at WKRP and a raise for a downtrodden (and white) colleague in the sales department. This refusal to "be some token Black on their corporate roster" and to help "paint MAXX brown," as Venus puts it to the colleague, comes across as a moral victory for his character: he sacrifices a better salary and title for the sake of more authentic work and for that of a collegiality that proactively ignores any question of a racially uneven playing field.

David McElhatton's TV segment on automation in Bay Area radio the same year hailed even more directly a jointly post-racial and anti-automation ethics. McElhatton concluded the segment (and the whole five-part series) with a spotlight on KSOL San Mateo, which had "done away with all of that high technology you've just seen." They had also, McElhatton emphasized, done away with a specific focus on Blackness and Black music and put an end to the practice of pronouncing their call sign "kay-soul." Noting a considerable recent ratings jump for KSOL, he explained that "a new management team has turned the station around by trying to get all the audience, not just the Black audience." Operations Manager J.J. Jeffries (a Black man) further detailed that they no longer "put labels on our music and/or our people." As he closed out the profile, McElhatton tried to draw the station's two aversions—to automation and to racial categorization—into a unified moral, narrating over footage of a racially diverse group of employees posing in the station's front office:

> Jeffries calls [the staff] "rainbow-colored people, happy as can be." And why shouldn't they be? They're the David and Goliath success story of Bay Area radio,

> proving that despite all that high technology, people are still our most important product.[314]

The logic under which white media producers saw automation and Black self-determination as twinned moral hazards was, to fix on McElhatton's concluding words, a logic that treated human workers as commodities. Supposing an opposition between automation and a racialized, pre-technological authenticity was a self-defeating move for automation skeptics; it lent excellent cover to the same blunt managerial rationality that drove automation.

"Venus Rising" suggested that *Black radio automation* would be a double dissimulation. This idea and Herbert's assertion of soul as un-automatable both invoked—and, on the surface, inverted—what Jason Resnikoff has called the "myth of Black obsolescence:" a persistent expectation that jobs performed by Black workers will be the easiest to automate.[315] If Black obsolescence pervaded the postwar "automation discourse" and its ongoing echoes, as Resnikoff shows, then why did these expressions characterize Black *communicative* labor as uniquely un-automatable, as especially dependent on authenticity and liveness—"a gut feeling of that live jock to really communicate," as Herbert put it?[316] The discrepancy depended on the cleavage of *production* from *reproduction* and on those commentators—Herbert or the *WKRP* writers—understanding the DJ as a reproductive figure, with communication and vocal performance constituting reproductive rather than productive work. The "material reproductivity of black performance" as Fred Moten argues, troubles the division between production and reproduction that Leopoldina Fortunati has identified as a gendered function of capitalism.[317] In order for the same larger automation discourse to afford character-

[314] "McElhatton Returns to Radio."
[315] Jason Resnikoff, "The Myth of Black Obsolescence," *International Labor and Working-Class History* 102 (October 2022): 124–45.
[316] Paige, "Music Goes on and on as Automated Equipment Expands Formats."
[317] Fred Moten, *In the Break: The Aesthetics of the Black Radical Tradition* (Minneapolis, MN: University of Minnesota Press, 2003), 18.

izations of Black *productive* labor as especially automation-friendly and Black *reproductive* performance as automation-resistant, that division needed careful maintenance. At stake was what had by this point driven much of the American music radio and recording industry for decades: the capture, mediation, and controlled circulation of Black performers' innovation.

Conclusion: Max Neuhaus and the artist as programmer

In American public discourse of the 1960s and 1970s, automation wriggled out of the management/labor conflict and into a conceptual terrain with more dimensions: pre-automated drudgery versus excess leisure, human authenticity versus robotic power, creativity versus uniformity.[318] Among the many distracting complexities that this discursive expansion produced was the implicit question of *whose* labor could remain authentic and creative amid automated systems. But the explicit questions (how will we create more fulfilling work, with more excellent products, under automated abundance?) proved usefully compelling to automation boosters. Within its original labor/management frame, automation had never appeared as anything other than pro-management. Now, optimists could convincingly claim that, with the proper steering for automated technology and for the society that would necessarily readjust around it, automation would be the path to an ideal middle ground within these various oppositions: work that was meaningful, augmented, and creative.

At a granular enough level, automation's installation repeatedly saw this aspirational rhetoric give way to an older, unglamorous practicality: the installers wanted greater control over the people working under their supervision. In radio, this dynamic was clear to DJs and attuned listeners: Peter Fornatale and Joshua E. Mills wrote, in their 1980 *Radio in the Television Age*,

[318] Bix, *Inventing Ourselves Out of Jobs?*; Resnikoff, *Labor's End*; Turner, "Romantic Automatism: Art, Technology, and Collaborative Labor in Cold War America."

> Proponents say automation is just a logical extension of subjugating disc jockeys to the station's identity. It guarantees a more professional, efficient sound and thus provides the listeners with better service. Opponents say it is dehumanizing—which is hard to dispute. It is one of the most striking developments of the 1970s and in some ways one of the most depressing.[319]

What managers and engineers at NAB meant by "creativity," in regard to automation, fit narrowly in between the bounds of DJs' on-air divergence from station programming and of the excessive uniformity that would result from only airing syndicated program tapes. If automation offered augmentation to radio workers, it simultaneously raised the standards to which managers held their work. At CJRT, the drift was particularly blatant: an automation system that was to serve as a hands-on learning resource for radio students became instead a lever to pry their hands off of the station altogether. Radio automation did not free these students, for whom radio work was intrinsically meaningful, to pursue more creativity; it instead secured a place for a management team to whom good radio meant conforming to an American, commercial model.

But the industrial coupling to which "radio automation" referred—automatic program equipment and syndicated program material—was not the only intersection between automation and radio in this period. Beginning in 1966, the composer Max Neuhaus carried out a series of "live experimental radio broadcasts"[320] that used custom electronics for automatic control over sound-mixing processes. In *Public Supply*, which he first realized at the arts-focused New York station WBAI, Neuhaus devised and advertised a plan to source listener call-ins to the station as sounds that he would mix together on the fly. As Charles

[319] Pete Fornatale and Joshua E. Mills, *Radio in the Television Age* (Woodstock, NY: Overlook Press, 1980), 144.
[320] Charles Eppley, "Soundsites: Max Neuhaus, Site-Specificity, and the Materiality of Sound as Place" (Ph.D., Stony Brook University, 2017), 240.

Eppley puts it in their comprehensive survey of Neuhaus's career, the work putatively upended American broadcast radio's deeply entrenched one-to-many model of transmission:

> The public contributions, directly funneled into the broadcasts by a makeshift automated telephone answering system, created a two-way street—a signal, and a response. In a little over an hour, Neuhaus had unraveled a century of domestic radio use. This co-extensive model of radio broadcasting established new points of contact between radio listeners, radio stations, and a larger listening world. Unlike typical broadcasts of the 1950s and 1960s—often consisting of scripted or otherwise pre-determined programs to which the listener "dialed" or "tuned in"—the model developed by Neuhaus was radically inclusive.[321]

Public Supply and Neuhaus's subsequent (and more ambitious) piece *Radio Net*, per Eppley's interpretation, turned sonic automation toward anti-programmatic ends. Where radio automation had latched onto the pre-recorded tape reel, proliferating both the tapes themselves and pre-recording's programmatic logic, Neuhaus's automatic circuitry instead lent power to the most participatory element of a typical radio studio: the phone line.[322] An automatic call-answering and audio-mixing process, elevating the call-in past its role as a program element, conferred this participatory character on the surrounding broadcast medium.

Neuhaus executed *Public Supply* four more times between 1967 and 1973 at different individual stations—including, incidentally, a production at CJRT in 1969. He then began planning *Radio Net*, which in 1977 occurred live on National Public Radio (NPR) stations across the United States. Phone lines did not only serve as infrastructure for radio audiences, but

[321] Ibid., 241.
[322] Wayne Munson, *All Talk: The Talkshow in Media Culture* (Philadelphia, PA: Temple University Press, 1993).

also for radio networks: NPR had five regional "loops" that relayed its programming throughout the country. Neuhaus, with new custom equipment and considerable help from NPR engineers, turned these lines into sonic feedback loops: using "automatic mixing desks," he "converted the whole system into a closed loop through which the sounds could circulate."[323] Listeners, following instructions that NPR and the local affiliate stations had advertised in advance, called their local stations and whistled into the phone.[324] At a sonic, "textural" level, Eppley points out, *Radio Net* differed markedly from the *Public Supply* productions: "while the former attempted to preserve the input of each contributor (mostly, voice and speech), the latter obfuscated the input signals into an electronic wash, using pitch shifters and filters."[325] If, through an increased degree of automation, *Radio Net* had expanded a field of participation, it also streamlined the participatory audio away from the audience's voices and toward a more tailored, engineered sonics.

As Eppley acknowledges, noting *Radio Net*'s not-insubstantial barriers to participation in the form of call fees, the degree to which Neuhaus's radio interventions were "radically inclusive" hinges on some qualifiers. These artworks invited audiences to take up a newly active role that the artist had defined for them. From his augmented broadcast booth he held open the space for that participation and also carefully steered it toward planned aesthetic contours. The works, particularly *Radio Net*, did not invite those audiences to define roles for themselves. From the head NPR station in Washington, DC, which "did not typically function as a live studio," but "functioned rather as a production facility for conceiving and producing syndicated programs,"[326] Neuhaus sat at the controls of a vast, semi-automatic apparatus. Like John Cage, Neuhaus modeled the sound artist as an individual who could

[323] Margaret Ann Hall, "Radio After Radio: Redefining Radio Art in the Light of New Media Technology Through Expanded Practice" (London, University of the Arts London, 2015), 61.
[324] Eppley, "Soundsites: Max Neuhaus, Site-Specificity, and the Materiality of Sound as Place."
[325] Ibid., 257–58.
[326] Ibid., 256.

"stand poised between the chaotic, probabilistic forces of multiple systems" and "act creatively, with a Romantic degree of agency."[327] As efforts to confront and suspend a programmatic tendency in American sound media, *Public Supply* and *Radio Net* progressed further than Cage's compositions: these works executed a real, structural change in an expansive medium, conscripting both station staff and radio audiences in a reconfiguration that they not only heard but helped enact. But it was still a configuration that placed Neuhaus decisively in control, even as it flung subordinate degrees of chaotic agency out across the mediated city or nation.

The 1960s and 1970s offered up a range of characters who, from very different dispositions and toward very different sonic ends, seemed to grasp the whole radio medium within their control: from Bill Drake, floating in his aquatic command center with radio and cordless phone while his syndication company perfected sonic seamlessness in automated music radio; to Neuhaus, automating call handlers and taking temporary command of an entire national network in order to reverse the flow's direction. Drake was a radio programmer turned meta-programmer, having brought enough of the medium within his grasp to influence its character at a national scale. Neuhaus acted as a *de*programmer, materially inverting the broadcast model and revealing that other structures were possible for the medium. Yet at either side of that opposition, automation consolidated control on behalf of the singular programmer (whatever his opinion of programmatic sound). The question that automation helped address was *whose control*, not *whether control*.

A relationship between practitioner and medium that rejected this question became audible when Shelley Pope declared himself a human radio station. Pope declined to engage in a negotiation of agency with machinery and simply subsumed it into his vocality—a vocal-

[327]Turner, "Romantic Automatism: Art, Technology, and Collaborative Labor in Cold War America," 23.

ity that railed against competitors and against management. Though Pope worked alongside automation, and though he took on a cyborg-like status as he merged with the radio apparatus relaying his voice, what he delivered was not a vision for how automatic control should best serve creative and authentic performance; it was a way *out of control*. This is what his colleagues seem to have heard from Pope, especially in his on-air resignation and the negative, machinic sound of his abandoned turntable. By contrast, the white artists including Neuhaus who would play key roles in establishing categories for *sound art* and subsequently *radio art* were not ready to leave the control question behind. The sound artist as programmer was ascendant, alongside and soon overlapping with another type of programmer, who would also renew automation's momentum in radio: the software programmer.

Chapter 3: Programming the Programmers (1980–1996)

In the 1980s, the personal computer entered radio. Twenty years later, PCs had gone from providing "brains" for tape-based radio automation systems to incorporating those systems wholesale; radio automation became a category of software product, with hard drive audio storage making its work a matter of control routines retrieving and manipulating digital data.

Over the same period, experimental artists took new interest in radio as a medium whose mainstream commercial output, despite all the internal technological change, seemed more solidified than ever. Max Neuhaus's radio interventions in the 1960s and 1970s had shown the potential for sonic artist-programmers to subvert fundamental arrangements among artist, medium, and audience. His culminating *Radio Net* had relied both on technology and on cooperation from a major new entrant in American public radio—NPR and its large network of affiliate stations. In the 1980s and '90s, artists including Helen Thorington and Regine Beyer—whose New American Radio project commissioned experimental works to air on participating stations—drove a more consistent and expansive effort toward artist-led programming. As Thorington's collaborator and fellow radio artist Jacki Apple later reflected,

> Although avant-garde artists have experimented with radio since its inception, it was the advent in the 1970s of non-commercial, listener-sponsored public radio on the FM band, including college and local community stations, that opened up the possibilities of art on the airwaves, not simply as an isolated incident but as a viable alternative to rigidly formatted commercial radio dominated by advertis-

> ing interests.... This new opportunity was augmented by the revolution in both recording and broadcast technology and easy consumer access to sophisticated equipment and processes that rapidly changed the nature of production and distribution.[328]

New conveniences in recording and transporting audio, as well as newly receptive stations, helped these artist-programmers draw more composers and musicians in their avant-garde milieu toward radio work—work that they hoped would reach a mass audience. While automatic technology did not enable their efforts in the direct way it had for Neuhaus's productions, neither did it hinder them. New American Radio acted as a program syndicator, dealing in pre-recorded programming of the type that automation systems handled easily. Audio technology, syndication, and public radio figured into an optimistic idea that novel and challenging sonic artworks might find frictionless, horizontal distribution in a widespread medium. But over a few years, that idea increasingly gave way to pessimistic frustrations with broadcast radio's overall character. A regular "Radio" column in the new music magazine *EAR* published writing from many of artists whom New American Radio commissioned. One of them, David Moss, in a 1989 column disavowed his earlier hope that radio might provide a medium for "subversive artistic activity;" now, he declared radio "dead."[329] Radio automation then stepped into this pessimistic discourse via a *trope of automatedness*; whether any particular station or network used automation or not, the image of computer-guided broadcast programming and robot-run studios stood handily in for the lifeless, homogeneous commercialism that these listeners heard across the AM/FM spectrum.

[328] Jacki Apple, "American Radio Art 1985–1995: New Narrative and Media Strategies," *PAJ: A Journal of Performance and Art* 43, no. 1 (January 2021): 45–65.
[329] Moss, "The Beat and the Box."

The artists writing in *EAR* and producing recordings for New American Radio generally relied on academic and non-profit institutions for their livelihoods; to an extent, the radio critique within which they targeted automation retraced avant-garde critiques of mass culture and a moral economy that elevated art music over commercial music.[330] But their critique converged with what some DJs, who applied artistic craft and judgment to commercial music circulation, had already been saying about computerization in radio. To these radio workers, the computer appeared decisively coupled to a regime of consultancy and over-rationalization in the radio industry. Former DJ April Feld laid out this bleak assessment in *Billboard* in 1982 under the headline "Machines are Killing Radio."[331] By the 1990s, pop culture itself expressed radio pessimism: hip hop artists lambasted the industry as stale and closed-off, and radio automation appeared on *The Simpsons* in a jab at DJs' all-but-automatic function within a degraded medium.

This chapter considers how, amid the changes that computerization was aiding in radio, automation as a trope eventually rose to the fore of popular and artistic radio critiques. Broadcasters, engineers, managers, and artists produced competing visions for how a new computational era in radio programming might redistribute creative control within the medium. That computerization would continue to extend automation seemed self-evident to radio industry workers, but some insiders hoped that it would allow a course correction wherein radio automation could finally become a creative tool for DJs instead of further disciplining and displacing them. On the industrial front, these hopes were largely dashed by the end of the 1990s as early software products like MediaTouch and Digital DJ—both of whose developers welcomed personnel reduction in radio studios—channeled automation's existing tendencies into new media settings.

[330] Georgina Born, *Rationalizing Culture: IRCAM, Boulez, and the Institutionalization of the Musical Avant-Garde* (Berkeley, CA: University of California Press, 1995).
[331] Feld, "Machines Are Killing Radio."

These changes often preceded the actual widespread digitization of recorded audio. They mapped out the affordances and associations that would characterize hard drive audio storage once it became economically viable later in the 1980s. Older internal media formats, especially tape cartridges, gave engineers and artists a head start on designing and critiquing some of the hallmarks of digital audio. The looping cartridge, or "cart" (also knows as a "NAB cart" for the organization's role in standardizing its format; also "Fidelipac"), had by the 1970s become "the essential device in modern automation."[332] Carts had in fact taken hold in parallel with automation across the late 1950s and the 1960s. By storing short recordings as "cuts" that operators could select with help from cue tones marking their starts and ends, carts offered a modular and flexible approach to maintaining banks of announcements, ads, bumpers, sound effects, and sometimes songs. They distributed control and precision in ways that were particularly popular with advertisers and with DJs in the sonically dense Top 40 format.[333] Sonic density was an implicit controversy among artists in the *EAR* orbit: it posed a serious problem in R. Murray Schafer's critique of sonic culture and just as serious an opportunity in the frenetic live radio experimentalism (with carts as its backbone) of Don Joyce and Negativland. Both sides held considerable influence: the avant-garde critique of mainstream radio followed Schafer's fixation with speed and density; while Joyce's radio resampling practice, through his coinage of "culture jamming," steered media art and activism at the outset of a digital multimedia explosion. At the same time, radio automation developers moved carts—which had already featured prominently in automation systems, providing "random access" sound banks alongside the less flexible program reels—into an even more infrastructural position, treating them

[332] David T. MacFarland, "Automation, Radio Programming," in *Historical Dictionary of American Radio*, ed. Frederic Leigh (Santa Barbara, CA: Greenwood Publishing Group, 1998).

[333] Alexander Russo, "Detangling Tape," in Stuhl et al., "Sounds of Accompaniment: Transcript from an SCMS 2022 Panel on Music, Technology, and Labor."

as core building blocks for the first software-based automation systems.

Carts became more, not less, significant as digital audio storage replaced magnetic tape in radio automation systems. Early software products for radio automation used carts as *structuring metaphors*. Much like the directory or file folder in a computer operating system, these virtual carts served as design elements that helped users translate their existing competencies onto a new interface. But, also like folders or directories, they were more than skeuomorphic interface pointers: they determined where and how the software stored audio and made it available to system processes. Further, just as a digital "file" on a PC could be either a document or an executable program (or something in between, like a spreadsheet with formulas), Digital DJ and other radio automation systems used carts as their containers for *instructions* as well as for sounds. A control cart or "macro" cart, in Digital DJ programmer Alan Freeman's terms, could execute a change in the surrounding system, for instance opening a satellite audio feed or rotating the cuts in an adjacent audio cart. In this way, radio automation developers again imbued sound with control—though it was a control that they closely guarded by restricting the ability to add new instructions to the system. The boundary between a "program" in the computational sense and in the broadcasting sense grew considerably blurrier at an infrastructural level, even as user interface design kept the potential implications in check.

Artists also grasped an opportunity to extend sound's power through computation—an extension that they heralded as liberatory. Pauline Oliveros, who had by 1980 earned considerable esteem as a new music composer and sound media thinker, began exploring computation's conceptual potentials through a radical turn in her approach to composition. By using computational terminology ("software for people," "acoustic algorithms") to describe her sonic meditation practice and its poetic text scores, she offered computation

as a metaphor that sound artists could productively integrate and adapt toward the ends of reconfiguring musical agency. Embracing a contradictory coupling of control and freedom, which Wendy Hui Kyong Chun has called a defining condition of networked software,[334] Oliveros's techno-optimism anticipated and influenced a hope that many artists would pin on the internet as an emerging medium. For radio, such optimism clashed with perspectives like Feld's, where the meeting of sound and computation had in practice only meant a medium's decline under ever tighter, creativity-sapping, hierarchical control. But Oliveros helped influence a change for the avant-garde sound network around *EAR*: a turn away from frustrated efforts to inject artistic programming into powerful networks and toward autonomous radio broadcasting as an artistic pursuit. Led by artists and broadcasters in Canada and from outside North America, this wave of interest also aligned with the emergence of "radio artist" as a label, with a first few institutional anchors such as the Banff Center for the Arts, that some American and Canadian artists self-applied in place of "musician" or "composer."

The trope of automatedness also aided this turn from pessimistic investment in conventional broadcast toward optimistic experimentation with ad-hoc, hyperlocal, and live radio. By the mid-1990s, autonomy and automation appeared as opposites in both popular and avant-garde discourse around a medium that was poised for even more dramatic consolidation. Radio automation's transformation into software temporarily threatened but soon redoubled its propensity for managerial control. But at the same time, radio automation gave dimension to the conceptual terrain for a battle between programming and *deprogramming*—between the consolidation of control in sonic mediation and the capacity for sonic art to break listeners out of the programs that media imposed on them.

[334] Wendy Hui Kyong Chun, *Control and Freedom: Power and Paranoia in the Age of Fiber Optics* (Cambridge, MA: MIT Press, 2005).

"Acoustic algorithms"

"By 1990," Pauline Oliveros reflected in a 1999 keynote address to the Improvisation across Borders Conference, "computer hard disc recording and editing is available. A powerful and revolutionary combination—the merging of recording and computing."[335] Ahead of this material merger in hard drive audio storage, sound and software underwent a conceptual and cultural merger. Oliveros, who had long inhabited the conceptual and material nexus among cybernetics, magnetic tape, and experimental music,[336] had herself helped inaugurate this merger through a radical turning point in her approach to composition. By the end of the 1970s, a new practice and a new ouvre had taken shape that Oliveros called "sonic meditations." In exploring and explaining the sonic meditations, Oliveros conceived of music as an informatic phenomenon and the meditations' text scores as programs that would produce music in the course of modulating participants' attention states.

In 1978's "Software for People," Oliveros wrote,

> I believe humanity has been forced to a new frontier by the accelerating rate of change instigated by technology. The frontier is the exploration of consciousness: all forms of consciousness and especially human consciousness. No matter how diverse the lifestyles or music, a common denominator might be found in the study of sensory and attention processes which enable humans to perceive, organize, interpret, and interact with the intelligence that is music.[337]

The textual "algorithms" for sonic meditation provided a path toward this frontier of universal consciousness that existing musical conventions could not; they opened "a freer area of

[335] Pauline Oliveros, "Quantum Improvisation," in *Sound Unbound: Sampling Digital Music and Culture*, ed. Paul D. Miller (Cambridge, MA: MIT Press, 2008), 123.
[336] Theodore Gordon, "'Androgynous Music': Pauline Oliveros's Early Cybernetic Improvisation," *Contemporary Music Review* 40, no. 4 (July 4, 2021): 386–408.
[337] Pauline Oliveros, *Software for People* (Barrytown, NY: Station Hill Press, 1984), 180.

music making that is reliant on ways of listening and responding." This cybernetic and liberatory ideal reflects an optimism about computing that had perhaps grown dated by the end of the Oliveros's life. Certainly "algorithm" carries some baggage today that she did not intend her work to carry, having become a shorthand for the interface layer where platform corporations unaccountably manipulate what users see and hear.

At the same time, it is hard to separate "human programming" of the sort that animated paranoid fantasies throughout the Cold War[338] from the human programming that formed the basis of the sonic meditations. The difference was that Oliveros's process assumed a stable, individual subject while the Cold War fantasies projected a collective, usually racialized, always ideologically brainwashed Other. A sonic meditation was a program that an individual could choose to run on their self-as-system. Ideally, it would alter the subject's consciousness; but when it did, it would do so on friendly terms to which the individual had consented. Further, the alteration would concern no less and no more than the subject's relationship, mediated through their ears and vocal tract, with a sonic environment and with other sounding bodies; it would not erase or subsume the individual as would the mass programming that American discourse imagined enemy states conducting. The friendliness of the human programming at play in the sonic meditations, in other words, relied on an assumed absence of ideology that was inevitably ideological.

Oliveros's reference to "software" and "algorithm" refract a distinct moment in the cultural transit of "the computational metaphor." As Fred Turner has shown, what *Wired* magazine editor Kevin Kelly meant with that phrase in 1998—a wide-ranging rhetorical move toward understanding the world and the human being as computational systems—distilled something very specific to the emergent years of the internet and yet also largely rehashed

[338] Scott Selisker, *Human Programming: Brainwashing, Automatons, and American Unfreedom* (Minneapolis, MN: University of Minnesota Press, 2016).

concepts from the mid-century heyday of cybernetics.[339] Oliveros belongs with the set of counterculture figures Turner identified (many of them in the San Francisco Bay Area, as Oliveros was in the 1960s) who deliberately mined the cold war technocracy for conceptual and material tools. Exploring and extending the computational metaphor's potentials, the sonic meditations were part of a now surprising continuity between the status of computing as an avatar for the military-industrial complex in the 60s and its status as a tool for post-material liberal enlightenment by the end of the century.

But if computing was in a turmoil of material versus metaphor when it entered Oliveros's practice, so was sound itself. When Oliveros put the text score form to work in service of a bodily and environmentally attuned sound practice, she dove headlong into the rift that Charles Eppley has identified in the art historical wake of John Cage: on one side, a sonic materialism where composers sought openings for sounds, noises, and silences to exert their own effects; and on the other, a discursive tradition tied to George Brecht's development of the event score form.[340] The sonic meditations took part in both post-Cagean traditions, reflecting striking similarities between her turn toward sonic meditation and Cage's own turn toward indeterminacy. And yet Oliveros continually identified as a musical *improviser* in contrast to Cage, for whom intederminacy was specifically not an invitation for performers to improvise—hence, Tara Rodgers's suggestion that such compositional strategies "can be interpreted as a negation of identity."[341] This distinction, as Tracy McMullen argues, led Oliveros to meld and disturb a subject/object divide that Cage's work maintained:

> Like Cage, Oliveros's approach attenuated the primacy of the ego in order to expand awareness; however, whereas Cage imposed an external system that pro-

[339]Turner, *From Counterculture to Cyberculture*.
[340]Eppley, "Beyond Cage."
[341]Tara Rodgers, *Pink Noises: Women on Electronic Music and Sound* (Durham, NC: Duke University Press, 2010).

> scribed reaction to the environment, Oliveros encouraged a type of meditative attention and awareness that would foster creative and nuanced responsiveness in an improvisatory setting.[342]

Oliveros put listeners and their sonic environments in deliberate arrangements, with embodiment always a key mediator. But through embodied listening, sound became a *material* means of accessing a plane where various *dematerialized* quantities—information, attention, intelligence, consciousness—could feed back into one another. Another material phenomenon, the networked personal computer, similarly promised a gateway to a realm of dematerialized and liberated exchange; this was the key promise from cyber-utopians by the end of the 1990s. As Wendy Hui Kyong Chun has argued, it is in fact this very condition that lent computing so much discursive power: the notion of *software* as separate from *hardware* "makes it a powerful metaphor for everything we believe is invisible yet generates visible effects."[343]

"Machines Are Killing Radio"

Oliveros understood well the intimate relationship between the means of production and the means of distribution in music: she cited radio's role in expanding her early sonic curiosity and noted that "[i]mprovisation developed in parallel with radio broadcast and recording technology."[344] Still, academic music composition afforded a secure position and a license to incorporate new technology in creative work. This could easily have led a composer in Oliveros's position to ignore how, in the commercial and distributive work through which radio held up sonic culture, some of the same technology was helping stamp out creativity.

[342]Tracy M. McMullen, "Subject, Object, Improv: John Cage, Pauline Oliveros, and Eastern (Western) Philosophy in Music," *Critical Studies in Improvisation / Études Critiques En Improvisation* 6, no. 2 (December 1, 2010): 7.

[343]Chun, *Programmed Visions*, 17.

[344]Oliveros, "Quantum Improvisation," 120.

In 1982, a freshly displaced DJ and music director named April Feld penned an editorial for *Billboard* magazine titled "Machines Are Killing Radio." Contrary to the headline, Feld's villain was not technology itself but rather a cadre of broadcast programming consultants who had yoked their careers to new forms of software-driven analysis and automation.

> The radio industry, in its infinite wisdom, has chosen the computer age in which to die. It has aligned itself with the machine, with the numbers, with the consultants and their research, and in doing so has created a melee of boring sounds and boorish disk jockeys.[345]

Feld had, in short, not found reason to move past the meaning that computers had originally held for student protestors at Berkeley in 1964—the speakers who, in Turner's account, marked the polarized first side of the computational metaphor's political drift "from counterculture to cyberculture." For Feld, the computer did not offer a pathway to free exchange. It was still the avatar of a dominant "machine" that corrupted people and sapped them of creativity. Where sonic artists including Oliveros had made themselves programmers in order to pursue a liberation-through-sound, the meaning that had already adhered to the programmer role in commercial radio was specifically anti-liberatory. Feld continued,

> It seems that the insightful are long gone—fired or disgusted—and in their places are cloned by-products who cannot distinguish between sound and song. There are the jocks, who merely have been programmed to follow a clock, a rotation, a list of do's and don'ts that sorely lack intelligence, texture and understanding. There are the programmers... who stood meekly by while a handful of consultants took over the country and forced people to listen to music that machines deemed

[345] Feld, "Machines Are Killing Radio."

> "right"—music that some passive listener deemed "white"—music that is not music at all, but rather a collage of electronics formulated to be what someone or something designated as a "hit."[346]

Oliveros would likely have sympathized with Feld. The two shared iconoclastic and at times pranksterish approaches to their different forms of sound work, where both navigated professional and artistic milieus that men dominated. Both were attuned, if somewhat obliquely, to how whiteness (whether in rock radio or avant-garde composition) cyclically appropriated and excluded Black musical innovations.[347] Feld's lambasting the "passive listener" among the consultants and their focus groups draws a clear line of affinity to the Deep Listening practice that would become the central thread of Oliveros's later career.

At the same time, Feld's editorial helps excavate another sinister sense of "programming," this one much closer to the sonic setting where Oliveros deployed instructions like "program yourself to do just the hand clap."[348] Playing on the dual meaning of "program" in its computing and broadcasting contexts, Feld bemoaned that most DJs who remained had been "programmed to follow a clock." Like the cart, and also the program log, the clock was a structuring metaphor that endured across various stages of radio technology as first a production technique and then a software interface. A clock segmented each hour of broadcast time, with each line between segments marking a cue that would trigger the automation system to switch from one source (a music playlist on tape cartridge, a news bulletin retrieved via satellite, or a live microphone in the local studio, for instance) to the next. It depended on and repeated a rigid categorization of sounds and ensured a smooth, regularized rhythm of controlled variation over the course of a broadcast day.

[346] Ibid.
[347] George E. Lewis, "Improvised Music After 1950: Afrological and Eurological Perspectives," *Black Music Research Journal* 22 (2002): 215–46.
[348] Oliveros, *Software for People*, "Meditation, Mandala, Music" (1980).

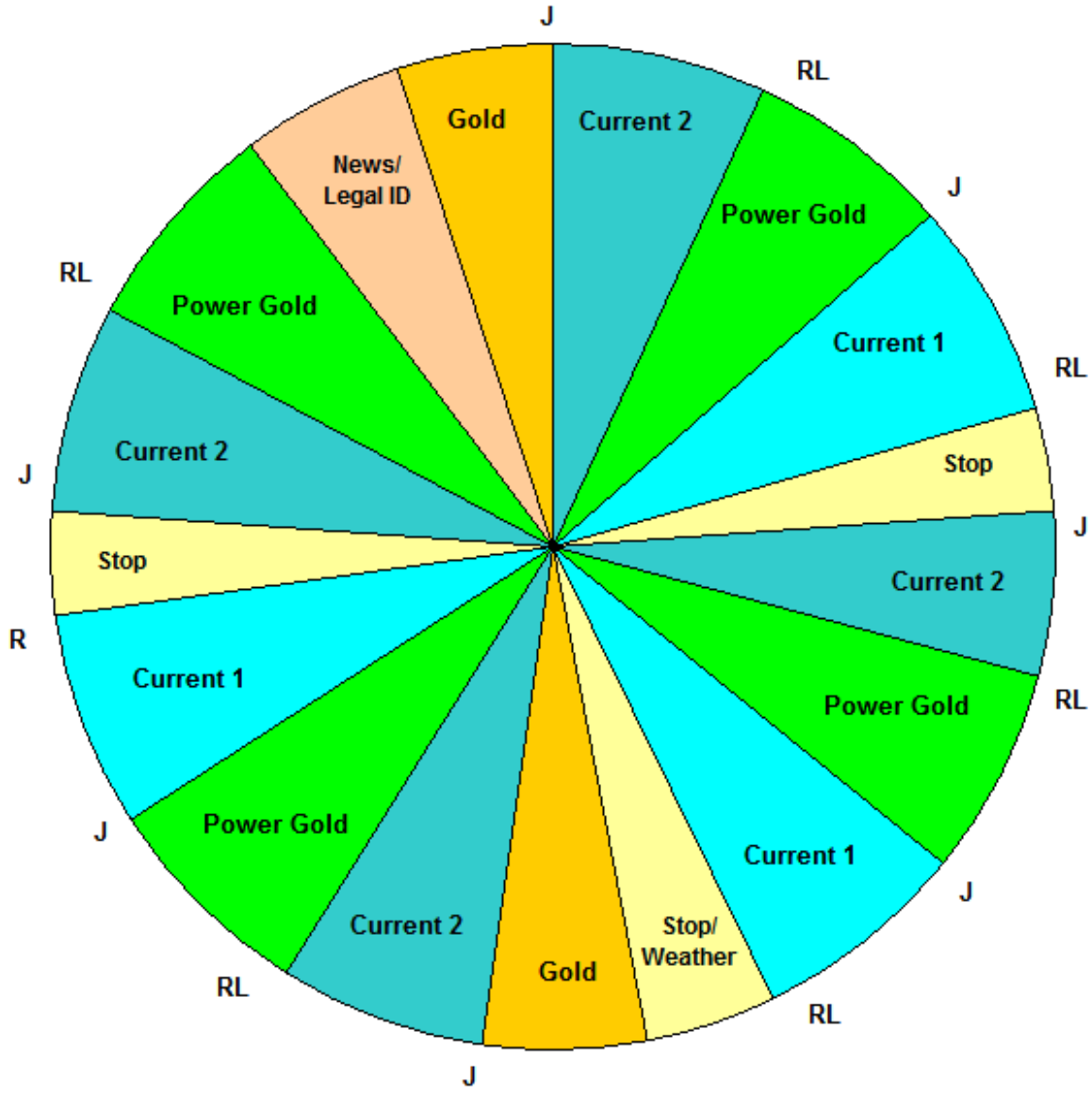

Figure 15: A format clock diagram for a music programming package that Century 21 syndicated to stations for use in their automation systems, circa 1986. Image courtesy of Dave Scott.

Despite the resentment that spurred her to write, Feld was not opposed to computers themselves. She explains, "I actually am a bit of nerd and love computers" (while maintaining that "AI [is] full of shit").[349] But the flexibility and control that computers offered in the radio studio only translated into deprivation of control from her perspective as a DJ. That deprivation was not purely a case of managers using technological change to consolidate their control, as Feld recounts it. Labor organization in radio had failed to stop or slow automation in the industry, but it persisted in maintaining a division between technical and performance roles, which different unions had long represented (for stations that had union representation in the first place). At WCAU Philadelphia, where Feld had risen from a production assistant to a DJ role, "there was a union of technicians" that enforced strict rules about which devices were the exclusive purview of its members. This common practice acted as a stopgap measure, amid the rise of combo operation, against on-air roles absorbing engineers' work; but it also helped keep Feld's engagement with the station's computer narrowly uni-directional:

> I would get a printout, a computer printout of music. And if I really hated the segue that was there, I could go to the tech and ask them if they would change a cartridge for me. I was not allowed to touch the computer.[350]

With software music schedulers dictating playlists under a format clock, Feld saw her role reduced to a "talking head," with only her microphone under her direct control amid a highly technologized and sophisticated studio. The PC's gradual introduction into already automated radio studios like WCAU's helped establish the computer as a tool of rationalization and segmentation in this context—a far cry from the liberatory power that artists more de-

[349] April Feld, Interview, February 21, 2023.
[350] Ibid.

tached from sound media's inner workings hoped it would bring. But this trajectory was still not locked into place for the radio medium in the early 1980s. It was also clear from within the industry that what computers ultimately meant for music and its dissemination would hinge on the decisions of radio station owners.

Random access and sonic density

Feld's critique caught the attention of a University of Minnesota master's student named Lance Leupold. In a thesis on "The microcomputer in radio automation," completed in 1984, Leupold acknowledged a spate of editorials including Feld's that "plead with radio management to put creativity, daring and vitality back into their medium, to expand playlists and reclaim the number of young people who have deserted today's popular music stations for their self-programmed Walkman and Music Television (MTV)"—automation, he wrote, "may be cited as perhaps the worst example of this perceived lack of vitality."[351] Leupold's study proceeded from the fact that automation had become the primary channel through which microcomputers (and personal computers soon after) entered radio studios. Computerization would in turn widen that channel.

> "Automated radio" has traditionally been understood to mean the automation of functions most directly associated with a disk jockey, chiefly playing music and commercials. This perception is swiftly becoming obsolete. The scope of capability of the latest technology makes it possible for the automation of the functions of all radio staff duties with the exceptions of chief engineer and sales.[352]

In the Minnesota broadcast markets where Leupold worked and conducted his research, microcomputers had started cropping up in most aspects of station operation, from record

[351] Lance Edward Leupold, "The Microcomputer in Radio Automation: Accessing Broadcasting's State of the Art" (Minneapolis, MN, University of Minnesota, 1984), 85.
[352] Ibid., 5.

keeping to the coordination of satellite program delivery. One local station he visited had been using a custom program to manage its tape reel library since 1975;[353] Leupold notes that such examples of radio engineers taking so much interest in computing as to produce their own bespoke software were relatively rare.[354] As Joy Lisi Rankin has documented, Minnesota's status as a high tech hub in the 1960s and 1970s helped the state foster "communal and political computing citizenship," namely in "creating a statewide time-sharing network for all public school students."[355] Identifying optimistic paths for radio automation's computer era in spite of its life-sapping reputation to date, Leupold reflected an enthusiastic view of computing at a moment when the personal computer had not yet foreclosed the ethos of communal resource sharing that the mainframe era had necessitated.

For Leupold, researching radio automation was a practical opportunity to study the ongoing "automation of music."[356] Automation, as he saw it, could either entrench the more lifeless practices in music's dissemination or augment the most interesting practices. Behind the optimistic part of that position lay an intimate but also programmatic relationship with music. Long active as a trumpet player in various groups, Leupold was an avid musician with interests in recording and composition. When he returned to the University of Minnesota to teach broadcasting courses and complete a master's degree after a few years in radio news production, he took a class on "acoustics for musicians" in the physics department and became newly fascinated with auditory effects on sensation. Those effects overlapped the scope of psychoacoustics, as with binaural beats, but also exceeded it when they crossed into the emotional impact that musical programming could wield. Already familiar with musical production, Leupold wanted to better understand the production and orches-

[353] Ibid., 58.
[354] Lance Edward Leupold, Interview, June 6, 2023.
[355] Joy Lisi Rankin, *A People's History of Computing in the United States* (Cambridge, MA: Harvard University Press, 2018), 6.
[356] Leupold, Interview.

tration that produced the seamless transitions on a beautiful music station or the careful reassurance that programmed music delivered to airport passengers. Leupold's chosen examples point back to important moments at the nexus of industrial and artistic musical programming, including the symbiotic coupling between radio automation and the beautiful music format, as well as the therapeutic impetus that had pushed ambient music forward in Brian Eno's *Ambient 1: Music for Airports* just a few years prior to Leupold's research.[357] In focusing on the musical program as the unit of production, Leupold came to understand music "as a commodity... as widgets" in a factory-like process of assembling a larger product.[358]

The thesis allowed Leupold to develop this interest most directly in its final section, where he proposed an approach to computerized radio automation that might nourish new creativity in music radio. It was not lost on him that redirecting automation's established tendencies would be an uphill battle:

> An irony of my proposal, and an indication of my perspective, is that through a technique which even the casual radio listener would say has robbed radio of its vitality, automation, I hope to restore a bit of the sparkle that has been lost somewhere along the way.[359]

But a specific capability in the micromputer era spurred Leupold's plan and his belief that such a change of course might be possible: random access memory.

> My proposal seeks to direct radio automation designers to take advantage of the responsiveness of the computer's ability to random access data from disk in ways

[357] Monty Adkins and Simon Cummings, eds., *Music Beyond Airports: Appraising Ambient Music* (Huddersfield, UK: University of Huddersfield Press, 2019).
[358] Leupold, Interview.
[359] Leupold, "The Microcomputer in Radio Automation," 25.

that complement radio's affinity for immediacy.[360]

Access to digital music libraries would, Leupold expected, allow even automated stations to take the prerogative of musical programming back from the tape reel program services like IGM and Drake-Chenault and return it to their own DJs or program directors. In its loftiest stretch, the proposal entailed a nationally centralized, satellite-linked library of digital music that station employees could consult. They would copy the selected songs to local data storage between a day and a week ahead of their planned use in a broadcast show. This design would optimize for technical efficiencies in hard disk storage as well as reduce financial obligations to musicians and publishers should licensing fees be tied to the reproduction of recordings. The software components attached to this system would in equal measure assist music programmers and rein them in. The utilities would include a "song selector" program that would help users navigate the categorized song database and a "timing justifier" program that would compute the best set of songs to fit within an available music block. Top-level controls would determine who at a station could use these tools and when. "The degree of disk jockey involvement and system responsiveness can be varied depending on the program director's wishes," meaning that automated playback of the prepared playlists would be available as an alternative to letting DJs traverse the system live on air. Presaging the fixations of recommendation algorithm engineers in the 2010s, the controls built into Leupold's hypothetical selector program addressed the problems that "too much music"[361] would raise: "the program director or music director should determine who if anyone other than themselves should use the program and establish fairly distinctive categories to avoid large output."[362] If computerized automation might, through Leupold's

[360] Ibid., 86.

[361] Nick Seaver, *Computing Taste: Algorithms and the Makers of Music Recommendation* (Chicago, IL: University of Chicago Press, 2022).

[362] Leupold, "The Microcomputer in Radio Automation," 89.

proposal, disrupt the central hold of tape reel services on musical programming, it would do so with careful deference to the established hierarchies within stations themselves.

Random access in the technical sense was necessary for Leupold's vision of a responsive, centralized resource with flexible, distributed use; but the excess of such a system without proper informatic controls would have resulted in song selections that were *too random*, negating the very premise of the musical programming to which Leupold and commercial broadcasters aspired. Luckily for the purposes of his design, random access digital memory had a significant practical precedent in the radio studio in the form of tape cartridges. Leupold cited two products as evidence that existing automation components had all but achieved the kind of random access he imagined. Both involved computer control over analog tape players, one with 16 cassette decks and the other with 500 looping cartridges and a two-dimensional elevator to move them about. Alexander Russo has argued that looping tape cartridges, which began taking shape in the late 1950s and soon became infrastructural as both automation components and live DJ utilities, afforded (in contrast to tape reels) a sonic density that turned them from logistical media into creative and aesthetic media.[363] By the 1980s, this sonic density had become a troubling hallmark of broadcast radio's overall sound in the ears of artist critics.

Density's detractor—R. Murray Schafer's "Radical Radio"

The Canadian composer R. Murray Schafer had earned wide influence among sound artists and critics by the early 80s, in large part by lamenting the supposedly increasing density of the modern "soundscape"—a term that his 1977 book *The Tuning of the World* popularized. The book advanced what Marie Thompson has called an "aesthetic moralism" that held up silence as good and noise as bad, individual sound events as objects that "acoustic ecologists"

[363] Stuhl et al., "Sounds of Accompaniment: Transcript from an SCMS 2022 Panel on Music, Technology, and Labor."

should seek out and sonic density as a hinderance to that effort.[364] While Schafer by no means limited his acoustic evidence to radio, the medium drew considerable focus in his book, coming to represent how modernity had conscripted sonic channels to its detrimental ends. In turn, Schafer's acoustic-ecological approach shaped subsequent priorities for an emergent radio art movement.

Schafer hailed radio's potential to elicit "prolonged acts of concentration," mainly by way of bemoaning bygone programs from the BBC and other European broadcasters that had fallen aside as "the format of radio tightened, its tempo increased."[365] Rhythm would remain central to Schafer's radio critique. In an essay for *EAR* ten years after the book's publication, he rehashed fixations from *The Tuning of the World* while heralding the possibility of a "radical" (in the sense of a return to pre-technological *roots* for ethereal transmission) radio that might emerge if network gatekeepers (namely at the CBC) would only allow it. Temporality was the key axis of distinction.

> Radio today is the pulse of a society organized for maximum production and consumption. Of course, this is temporary; radio will not keep this beat forever.... And if industrial civilization is in decline—and it is—alternative radio rhythms may be closer than we think.[366]

Schafer's focus on rhythms drew him toward one of the same structuring symbols that Feld had lambasted. "Western broadcasting," Schafer wrote, "is tyrannized by an instrument we have accepted as inviolable: the clock." He referred to the obligation for social timekeeping radio had inherited from a previous era's church bells, but inadvertently de-

[364] Marie Thompson, *Beyond Unwanted Sound: Noise, Affect and Aesthetic Moralism* (New York, NY: Bloomsbury Academic, 2017).
[365] R. Murray Schafer, *The Soundscape: Our Sonic Environment and the Tuning of the World* (Rochester, VT: Destiny Books, 1994).
[366] R. Murray Schafer, "Radical Radio," *EAR*, February 1987.

scribed how the clock as an internal representation in format radio had become key to the regularization he heard. Regularity coupled with density was the acoustic crime that radio perpetrated and that wide-reaching broadcasts of slow-paced, minimally produced, "phenomenological" artist programs (Schafer mentioned proposals for a 24-hour "sounds of the ocean" program and for placing microphones to capture conversations among "women at a tea party, high school students smoking behind the school house, bums on a park bench") might begin to remedy.

> What if radio became an art form? Then its content would be totally transformed. No longer would it spin as the slave to machine technology, mechanical and clocked. No longer would it palpitate with the spasms of production and consumption. It would outstrip the impediments of mechanization.[367]

Despite setting up a direct opposition between art and machinery within radio, mechanical speed rather than mechanization itself still posed the real problem. This priority reflected Schafer's keen interest in Marshall McLuhan's media theory and particularly in his contribution to what Sarah Sharma has called "speed theory"—a highly influential complex of ideas from the late 20th century that rest on an over-simplified narrative of global acceleration.[368]

Speed theory was one of two tendencies that Schafer's radio writing crystallized and that also characterized an American radio art movement for much of the 1980s. Radio artists including Helen Thorington, Regine Beyer, and Gregory Whitehead—who solicited Schafer's 1987 *EAR* essay for a magazine supplement on their Festival for New Radio that aired on WKCR, with Beyer and Thorington launching New American Radio the same year—adopted ideas from *The Tuning of the World* and made especially frequent reference to McLuhan in

[367] Ibid.
[368] Sarah Sharma, *In the Meantime: Temporality and Cultural Politics* (Durham, NC: Duke University Press, 2014).

their own writing for *EAR*. The other tendency was a focus on harnessing large, existing radio stations and networks for radio art; though the US never had an equivalent of Canada's CBC, artists targeted NPR and Pacifica with hopes that they could provide an analogous combination of openness to artistic programming and wide reach.

Schafer closed his "Radical Radio" essay by recounting the *Soundscapes of Canada* series that he and other World Soundscape Project members had produced for the CBC in 1974. Curiously, he declined to mention that one contribution for the project had addressed radio specifically. Howard Broomfield's "A Radio Programme about Radio" had turned the collective's acoustic ecology methods toward radio itself. Using historical clips from 1930s radio dramas and interviews he conducted about people's radio listening habits, among many other sources, Broomfield playfully traversed broadcast radio, often with abrupt cuts that gave the impression of flipping through stations on the dial. This experimental reflection on radio's overall character performed at a practical, sonic level what Schafer's writing did: it treated the whole radio spectrum, rather than individual programs, as a sonic object. This zoomed-out treatment became an important mode of apprehension for other artists, including popular musicians, who leveled the critique that radio had become far too uniform. But Broomfield's composition also contrasted heavily with the approach Schafer favored (slow, pastoral, and courting concentration). In its jarring and irreverent resampling of broadcast sounds, it anticipated a radio art practice and a philsophy, antithetical to Schafer's, that would harness radio's mechanical and regularizing tools in service of something new.

Density's champion—Don Joyce and *Over the Edge*

In the San Francisco Bay Area, at the start of the 1980s, a small but influential cluster of experimenters drove sonic density to new extremes. A radio studio and its tape cartridge players facilitated a weekly live show where members of the pranksterish musical collec-

tive Negativland honed a reapproapriative practice that would ripple out into media art, activism, and popular culture.

Starting in 1981, Don Joyce had hosted an overnight show on KPFA—the Berkeley-based flagship station of the noncommercial Pacifica network—called *Over the Edge*. KPFA had already formed a significant conduit for artist investments in radio; Henry Jacobs aired audio collages and fake interviews there in the 1950s, Oliveros first met John Cage when the station interviewed both in the leadup to 1964's Tudorfest, and Charles Amirkhanian conducted in-depth interviews with experimental composers there in the decades following. But in the late-night slots that the station delegated to Joyce, its resources were turned away from the project of bringing artistic voices into conventional radio program formats and toward a project of exploding broadcast programming conventions from within.

Joyce had a background as a painter and worked in software development at times. Both these experiences influenced his approach to radio as a medium in the artistic sense—as a set of representational materials and constraints—and to the function of *programming* within that medium. *Over the Edge* became a vehicle in which he departed from a traditional DJ role in order to arrive at a new relationship with the medium. He reflected in *EAR* in 1989 that, despite an eclectic style in the early episodes of *Over the Edge*, his "approach to recorded material was still that of a disc jockey." Radio, he suspected, "could be used to originate," as painting did, rather than merely acting as the "messenger" for "some other aspect of culture." Specifically, he noted, "[m]ost radio is *about* the recording industry."[369] Following his first encounter with Negativland, Joyce began to see a way to repurpose the tools of recording for a type of live broadcast performance that could approach origination:

> Soon after beginning "Over the Edge" I became associated with Negativland, a

[369] Don Joyce, "Get Your Own Show," *EAR*, February 1989.

> variable group of three to five people who make records at home and perform occasionally.... I learned a lot from them about how the manipulation of content could become a new kind of content. Up to that time I had never even stopped a record before it was over. It's well known in the record industry that the studio is, itself, an instrument.... It was a small leap of the imagination to see the broadcast studio used as an instrument.[370]

From then until his death in 2015, Joyce, Negativland, and other visiting collaborators such as People Like Us (WFMU DJ Vicky Bennett) used every part of the radio studio in chaotic rotation. Tools designed to consolidate broadcast control for a single operator became opportunities to multiply labor as these co-improvisers crowded the studio. And despite—or rather in service of—*Over the Edge*'s charter to overcome radio's dependence on recording, tape cartridges held a special place in the assemblage. Jon Leidecker (an avid listener to Joyce's show and an eventual member of Negativland) recounts his first meeting with Joyce at his home, which also served as Negativland's studio, in 1987:

> Don still had his programming day job at that point, and I discovered him in his room tinkering with the code for a primitive typing tutor program on his Mac SE with his left hand, while his right hand hovered near a cassette deck set to record a talk radio station.[371]

Leidecker goes on to describe how Joyce used his cassette recorder to pull alternating snippets from the talk show's call-in segment, synthesizing a new and newly incoherent conversation. Joyce would then listen back through these materials that mainstream broadcast programs had provided him, recopying the most interesting parts onto tape cartridges.

[370] Ibid.
[371] Jon Leidecker, "Don Joyce: Unpause, Repause," *Ràdio Web MACBA* (blog), August 2015.

In the KPFA studio, those carts became parts of the always-shifting instrument on which he and his collaborators improvised.

Essentially, Joyce went to great length to produce the same gaps between sonic source and sound object that Schafer had branded as "schizophonic."[372] The resulting collages indeed shatter any effort toward prolonged concentration. In sampling mainstream radio, Joyce dialed up its frenetic pace and brash commercialism. Pulling from sensationalist and vitriolic strains of talk and religious programming helped Joyce populate an ultra-dense soundscape with floating, impassioned, incoherent loops. The divorce of these transmissions from reference was so complete that, as Leidecker recalls of his first time tuning in, the show gave the impression that the radio receiver was picking up multiple stations at the same time.[373]

Tape cassettes and cartridges facilitated this at either end of the process, with Joyce's home taping introducing a semi-controlled serendipity that his subsequent selection and playback with cart machines would amplify. Even though carts were equally crucial to automation, Joyce's breakthrough with Negativland had involved specifically overturning two original premises behind automated radio: the primacy of recorded sound and the one-at-a-time sequence as the end goal of production. Automation and automatic composition became, on *Over the Edge*, material neighbors and stylistic and conceptual opposites.

The techniques that Joyce developed in the back-and-forth between an obsessive broadcast-recording practice at home and the improvised radio studio workouts of *Over the Edge* formed the basis for "culture jamming," a term Joyce coined that would soon eclipse the radio art context.[374] Despite a very Californian flavor of political non-specificity in

[372] Schafer, *The Soundscape*.
[373] *How Radio Isn't Done - A Documentary about Don Joyce*, 2020.
[374] Marilyn DeLaure, Moritz Fink, and Mark Dery, *Culture Jamming: Activism and the Art of Cultural Resistance* (New York, NY: NYU Press, 2017).

Joyce's and Negativland's playful collages, the tactics of counter-appropriation and sensorial maximalism that characterized culture jamming coalesced into a charged new stance against consumerist society and monopoly capitalism.[375] It would also map out some of the aesthetic contours that early internet culture would fill in as a new multimedia domain with freshly democratic ethos opened up to more users. The ensuing transformation of culture jamming into a primarily visual and textual mode would belie its roots in a specific sonic coupling between random access and stylistic density.

Density's devices—Instacart

When Joyce's "Get Your Own Show" ran in *EAR* in 1989, eight years into *Over the Edge*, it marked an exception to a body of radio criticism that still largely adopted a Schaferian fixation with speed and disdain for sonic density. At times, though, this line of critique did reach a technical specificity that gestured toward apprehending automation as something against which artistic radio might distinguish itself. When Gregory Whitehead reported in 1986 on a new "tunnel radio station" that provided traffic information to drivers underneath Boston's Dewey Square, he called attention to a particular cart device. The station, he explained, employed

> a computerized, fully automated multi-message playback unit called "Instacart." Utilizing Instacart, the station operator is capable of pre-programming forty-eight carts in any order—the message sequence can then fluctuate with the specific mass of tunnel traffic. Automated pre-programming not only eliminates "waste" transition time between message units, it also reduces broadcast *labor* time to the vanishing point.[376]

[375] Christine Harold, "Pranking Rhetoric: 'Culture Jamming' as Media Activism," *Critical Studies in Media Communication* 21, no. 3 (September 2004): 189–211.
[376] Gregory Whitehead, "Out of the Jam, into the Tunnel," *EAR*, June 1986.

Introduced in 1968 by International Good Music (IGM—one of the major automation equipment and content providers since the early 1960s), Instacart (not to be confused with the 2010s' gig economy platform of the same name) represented a significant step toward flexible sound retrieval as the broadcast industry's "first instant random access cartridge playback device."[377] Like other tape cartridge devices, it was not exclusive to automated radio but nevertheless closely coupled with automation. Of the system's capabilities, IGM wrote in a 1970 ad,

> Permits automated, tight formatting of spot material, news actualities, music and special programming from multiple cartridge sources. Stacked-array configuration, with four motors, four drive shafts and 48 heads for 48 cartridges, gives Instacart its back-to-back random access capability.[378]

Rather than move carts into contact with a playback head via elevator or carousel, as automation systems had typically done, the Instacart design gave each potential cart its own playback head. In physical terms, it replaced transportation by multiplying reproduction.

Multiplying reproduction within sonic automation bore unexpected side effects: anecdotes abound in radio automation enthusiast communities about electrical surges causing every cart in an Instacart machine to play at once. In this way, perhaps, automated radio very unwittingly achieved a kind of transcendence that critics including Whitehead longed to hear. Schafer, repeating an idea from *Soundscape*, had opened his essay for *EAR* by noting that radio "existed long before it was invented;" its invisible voices were heard "in the wind, in thunder, in the dream."[379] Other writing by Whitehead meditated on futurist writer Velimir Khlebnikov's 1921 vision of a "stream of lightning birds" emanating from a world radio

[377] Bill Rhodes, "1978 Overview of Radio Automation," *Broadcast Engineering*, November 1978.
[378] "New from IGM: Instacart," *Broadcasting*, February 9, 1970.
[379] Schafer, "Radical Radio."

station, and fellow *EAR* contributor Douglas Kahn delved deep into "natural radio" with his book *Earth Sound, Earth Signal*. With this new turn in radio's longer-than-lifelong relationship with atmospheric phenomena, lightning gained a tool to unleash moments of ultimate sonic density—48 spots playing all at once—through unsuspecting, unstaffed radio stations.

But for Whitehead's purposes in analyzing the Dewey Square tunnel station, the Instacart's obliteration of sonic distance and labor was one part of an ominous "cluster of broadcast characteristics that have been so profitably embodied by Tunnel Radio" and mirrored a larger drift in both commercial and public radio. These characteristics included "programming based on the fully automated rotation of message units into seamlessly block-programmed modular 'spots,'" and they culminated in a situation where radio became the "universal lubricant" for a "world increasingly reliant for its own reproduction on the constantly accelerated circulation of traffic (traffic in goods, bodies, and information)."[380] The tunnel station became a neat microcosm for the larger medium in its subjection to information capitalism. Despite the distinctly urban context (on which Schafer would likely have seized), sonic density here did not function like a pollutant but rather as a means to maintain flow. Radio, Whitehead had written two years prior, had been "implanted as pacemaker for a culture embracing speed at a rate of acceleration that often jammed but never braked."[381]

Whitehead's emphasis on circulation added nuance to how Schafer described social rhythms of production and consumption, drawing attention to the distributive level where radio work occurred. Still, the forefront fixation on temporality and acceleration partially masked the significance of changing labor configurations for radio: automation in radio was incidental to its always quickening timekeeping function. But for managers and

[380] Whitehead, "Out of the Jam, into the Tunnel."
[381] Gregory Whitehead, "Speleology," *EAR*, March 1984.

engineers in radio, technologies like Instacart provided a flexibility that was much more political than temporal.

Automation incorporates the digital

Elsewhere in Boston, Instacarts had been central to another project whose effects would ripple out considerably farther than Dewey Square. A product called MediaTouch, which would by the late 1990s evolve into a full-featured automation system that led the market in Canada,[382] began as a much more targeted wedge in a personnel reduction effort. It originated at Boston AM station WEEI in 1984–85 at the direction of John Connell, who entered as Director of Engineering when the station changed over from the CBS network to independent ownership. Connell had already worked among the technicians, or operators, for WEEI's news-talk programming a few years prior. He had left after finding himself in an untenable situation with some of his supervisees. The new owners invited Connell to return under an agreement that he would provide a means to eliminate most of the operator roles.[383]

MediaTouch, in its first version, fulfilled this promise with a touchscreen interface. By routing touch control to audio switchers and Instacarts, the software shifted work from operators to announcers. Connell explains his choice of touchscreen by describing how it maintained a gesture already familiar to the announcers who would use it: where previously they would point through a plexiglass window to cue an operator to proceed with the next transition, they now pointed at a monitor screen to execute the transition through MediaTouch.[384] As had been the case in music production, even at its avant-garde ends in work by Iannis Xennakis, Connell's design invested the touchscreen with a supposedly democra-

[382] Scott, Interview.
[383] John M. Connell, Interview, July 13, 2021.
[384] Ibid.

tizing universality that would open sonic control to non-technical users.[385] Long-time radio automation vendor Dave Scott raises the possibility of an alternate explanation: similar to what April Feld recounted of WCAU, union work rules purportedly specified that any physical switch or fader had to be controlled by an on-duty operator at WEEI; virtual controls on a touchscreen, in this account, circumvented the *physical* parameter and thus made MediaTouch an effective "union-buster."[386] (Connell does not recall such a rule, and it is worth noting that Scott's later acquisition of MediaTouch ended in some amount of acrimony between the two.) In any case, the union representing WEEI's technical staff (IBEW local 1228) took part in the transition mainly by arranging one-year-salary buyouts for the laid-off operators, according to Connell.[387]

In this initial version, MediaTouch was not yet an automation system, as Connell is quick to clarify. It rerouted control over audio from one side of the studio to the other, eliminating an engineering role and conferring technical work on the news announcer; but it did not delegate significant aspects of that work to the machine, at least in Connell's view. This same working reconfiguration was already well underway in music stations, where a great number of DJs had already become "combo operators" and taken on record-cueing work that a technician would have once performed alongside them.[388] Automation systems for music radio built upon and furthered that conflation of engineering and announcing roles. WEEI also operated an FM music station, and the automation system there inspired Connell to use Instacarts for MediaTouch.[389] The project, in this sense, aspired to catch talk radio up with music radio's labor consolidation.

[385] Victoria Simon, "From Difficulty to Delight: The History and Politics of Touchscreens for Music Production" (Montreal, QC, McGill University, 2018).
[386] Scott, Interview.
[387] Connell, Interview.
[388] "McElhatton Returns to Radio."
[389] Connell, Interview.

True to this aspiration, the MediaTouch software would mature into a full-fledged automation system for both talk and music programming by the 1990s. Its ascent was aided by one piece of the radio work routine that the early version did automate, however: log generation.[390] In the pre-touchscreen way of doing things at WEEI or a similar station, the paper program log facilitated smooth collaboration between announcer and operator by listing out the sequence of events: all sound clips (including ads) and audio transitions. One or both of these workers would then fill in by hand certain details of the log, such as which particular ads had been played at what times. Since the software already managed these events, recording them in a time-stamped log was a trivial feature to add. But its implications were hardly trivial to station managers, who would no longer rely on their announcers' penciled log notes. The collapse of a difference between *plan* and *record*, in other words, tightened managerial control and became a major selling point for MediaTouch and similar software products. Connell recalls that Boston station WBZ, which became MediaTouch's first customer outside WEEI, took interest not because of a desire to lay off operators but primarily because of an announcer who was failing to air the required number of ads per hour.[391] Automatic logging, even if a secondary feature of radio software interfaces, placed announcers under rigid scrutiny by management at the same time that it granted them more direct access to broadcast technology.

Management's macros

Log generation and cart playback provided a common foundation for new automation software, even as first the logs and then the carts became data types stored within hard drives. A company called The Management had by 1990 produced applications called Super Log and

[390] John M. Connell et al., Computer touch screen radio station control system, Canada CA1273120A, filed December 30, 1986, and issued August 21, 1990.
[391] Connell, Interview.

Music Log, which facilitated record keeping for a station's advertising traffic and in its music scheduling, respectively. A software developer named Alan Freeman, who had worked as a DJ and radio engineer at various points, joined The Management when they needed an interface that could feed the generated logs into older Harris automation systems. The programs' implications were clear but untroublesome to Freeman, as he recounts it.

> I was fascinated with the fact that it could program the day. And it never bothered me that, wait, that takes away the choice for the DJ to make that decision. Because when I had worked at the little AM station in Granbury, KPIR, I had come to realize that not everybody has good music taste. Not everybody should be allowed to play what they want to play. Only me. And so I thought, this allows the music director to have better control over what's being played and make the station sound stronger.[392]

If the name of Freeman's employer matched his alignment with station managers in the contest for creative control over radio, so too did the name for the project he would next initiate there: Digital DJ would become The Management's first automation system and an early entrant to the field of hard drive audio automation tools. (Other systems under development around this time included the Digital Commercial System from the Computer Concepts Corporation, Digilink from Arrakis Systems, and Audisk from MacroMedia, Inc.) Freeman recalls lobbying his boss for permission to undertake the project after finding an early model sound card—one that the Walt Disney Company had commissioned for use in animatronics at its theme parks—in the company's back room. Freeman began coding a program that could use the sound card to record and play audio clips including music, commer-

[392] Alan Freeman, Interview, January 25, 2023.

cials, and station IDs, initially calling them DigiCarts.[393] The looping tape cartridge helped originate Freeman's project as a structuring metaphor: as a container format, it provided a building block for the program's architecture while also helping present a clear use case for digital audio. "The cart machine's replacement by a digital storage medium (most likely a computer hard drive) seems inevitable," Freeman wrote in a 1991 *Radio World* piece.[394] With an eager first client identified in Carlsbad, New Mexico, the project evolved into Digital DJ. It would, in turn, extend the cart metaphor in a way that recovered and refreshed radio automation's originary relationship between sound and control.

Some of the functions required of a PC automation system were immediately evident, such as the need for the software to read a log and sequence the appropriate carts for playback; or to react to incoming control tones from a satellite feed (satellite syndication of live programming from centralized, multi-format studios had taken music radio by storm over the course of the 1980s).[395] Others emerged only as Digital DJ gained more customers. Freeman devised a way to accommodate the ongoing need for provisional new features by adapting the central cart metaphor. Each cart in Digital DJ had a numeric ID that conformed to a general category system: one range for music, the next for commercials, and so on. To this taxonomy, Freeman added a section of "control codes that would cause the automation to do something different." A cart in this range "wasn't really an audio file," rather a vessel for instructions that could switch between audio sources or rotate between cuts (individual recordings, often variations on the same announcement) on another cart.[396] Just as audio could come and go from the hard drive the system ran on, these instruction carts could be added well after the software's initial installation. Freeman called them "macros." Together

[393] Ibid.
[394] Alan Freeman, "Buying a Digital Audio System," *Radio World*, August 7, 1991.
[395] Bob Andelman, "24-Hour Radio Programming," *The Pulse of Radio*, 1990.
[396] Freeman, Interview.

with other technical staff for The Management and their customers, he came to rely heavily on them:

> Our technicians got really good at making the software jump all these different hoops that it wasn't really ready for by using the macro codes.... The guys in the field, the technicians that were doing the installs, they would run across all these problems that they couldn't solve without using the macros. And so they would call me up and they'd say, can you put another code to this or that? Well, pretty soon... it got so complex that I had no idea what they were doing even.[397]

Macros in other kinds of software invited users to act as programmers. Some early programming languages even followed a principle called homoiconicity (borrowed from Charles Sanders Peirce's semiological theory) under which an application's internal code conformed to the same data structure as user input; in other words, there was no sharp line between interacting with a program and modifying it.[398] Digital DJ did not follow this logic. Its main control loop shows that users interacted with it by pressing individual keyboard keys that would trigger carts and functions. The range of carts reserved as macros held open an inlet for Freeman, not users, to modify the program.

Freeman's source code for Digital DJ, written in the BASIC language for Microsoft DOS, shows the special status that macros held in the system's operation. The main loop, after initializing the program's interface, next checked whether the variable `MacroPlaying` had a non-zero value. If not, the program waited for key presses that would trigger carts. Further down, the following code would check whether the cart number was between 100 and 111, which would indicate a particular kind of macro to pause system operation. If so, it would

[397] Ibid.

[398] C. N. Mooers, L. P. Deutsch, and R. W. Floyd, "Programming Languages for Non-Numeric Processing—1: TRAC, a Text Handling Language," in *Proceedings of the 1965 20th National Conference*, ACM '65 (New York, NY: Association for Computing Machinery, 1965), 229–46.

then display a stern warning before executing the pause (text inside quotation marks after `QPrintRC` statements, in the following code excerpt, is text that would appear on screen).

```
IF CartNum > 100 AND CartNum < 111 THEN
    Running = TRUE
    PageSave 0, 4
    MakeBox " MACRO RUNNING ", 13, 29, 19, 75, 5, 78, 126, 1
    QPrintRC "WARNING", 15, 47, 207
    QPrintRC "Pre-Programmed" + STR$(VAL(Cart.Length)) + " Sec PAUSE Running.", \
      16, 34, 244
    QPrintRC "Wait      Seconds. Don't Press Any Keys!", 17, 32, 116
    QPrintRC "(The ESCAPE key will abort this pause.)", 18, 33, 113
    IF NOT MacroPlay THEN IF DJASeg$(3) = "+" THEN SegIt = TRUE
    Count = VAL(Cart.Length)
    MacroPause = TRUE: TSec% = 0
    DO
        IF VAL(RIGHT$(TIME$, 2)) <> Prev THEN
            Prev = VAL(RIGHT$(TIME$, 2))
            Count = Count - 1
            QPrintRC STR$(Count) + " ", 17, 37, 126
        END IF
         I$ = INKEY$: IF I$ = CHR$(27) OR I$ = CHR$(0) + CHR$(64) \
          THEN Count = 0'bail
    LOOP UNTIL Count = 0
    MacroPause = FALSE
```

Other macros were stored outside the program alongside the audio files for other carts. In a function called `PlayMacros`, the main program would retrieve them when called upon and display a generic warning message.[399]

```
PlayMacros: MFile$ = "MACRO" + RIGHT$("  " + STR$(MacroPlay), 2) + ".MAC"
    IF Exist(SoundPath$ + MFile$) THEN
        FileNum = FREEFILE
        OPEN SoundPath$ + MFile$ FOR INPUT AS #FileNum: X = 0
        DO
            X = X + 1
            IF NOT EOF(FileNum) THEN LINE INPUT #FileNum, Step$(X)
        LOOP UNTIL X = 10
        CLOSE #FileNum: MacroPlay = TRUE
    ELSE
        GOTO MacroDone
    END IF

    IF DJASeg$(2) = "+" THEN SavedSeg = TRUE ELSE SavedSeg = FALSE
    PageSave 0, 3
    MakeBox " MACRO RUNNING ", 13, 29, 18, 75, 5, 79, 126, 1
    QPrintRC "Please Wait ... Macro At Work ... ", 15, 37, 116
    Running = FALSE: Trigger = FALSE: Macro = 0
```

In the first two lines of the above code, the program first puts together the filename from

[399] Alan Freeman, "Digital DJ Control Module - Auto Mode," BASIC (Fort Worth, TX: The Management, November 1991).

a specified macro number and the custom filed extension `.MAC`, and then completes the full path to the macro's code by appending it to `SoundPath`—that is, the same directory where the system stored audio files. In this way, at a moment that might have seen further separation between sound's control mechanisms and sound itself, the two were made neighbors in the same data directory. This closeness harkened back to the first 25 Hz cue tones that Ampex had introduced in 1953, which also remained operative in the Digital DJ software by way of an expanded cue tone system that interfaced between satellite receivers and the automation system. It also carried forward, as automation systems produced for industry entrepreneur Dave Scott (who would employ Freeman by 1995 and eventually acquire the software assets of both The Management and MediaTouch) adopted a similar macro system, according to Freeman. But, despite using shared terminology with a computing philosophy that sought to extend end users' control over software, radio automation macros took shape within the strict control hierarchy that Freeman endorsed: station management requested features, the software programmer added them, and software ensured that DJs followed the program.

One Digital DJ installation, at a rural Wisconsin station, appeared prominently in a 1992 segment for the CBS TV program *48 Hours*. As David McElhatton had at KPIX San Francisco in 1980,[400] these TV producers held radio automation up against a romanticized vision of pre-automated radio. The segment covered WIBU's change from a unique format—all polka music, played by local DJs—to a beautiful music service that the Satellite Music Network (SMN) delivered. Lance Leupold called SMN, which launched in 1981, "the first operational 24 hour radio music service."[401] While the syndicated programming business model largely carried over from tape reel services, the technical side of satellite syndication offered a much starker view of centralization. Cutting from Poynette, Wisconsin to SMN's offices in

[400] "McElhatton Returns to Radio."
[401] Leupold, "The Microcomputer in Radio Automation," 54.

Dallas, *48 Hours* showed viewers a corridor where each door sported the logo for a different music format; behind each door was a standard broadcast studio where a DJ supplied many stations around the country at once with the same music. Back in Poynette, WIBU's new PC running Digital DJ took care of switching between the satellite feed and the local ads and announcements it stored on its hard drive. WIBU's owner, Lee Harris, narrated much of this detail himself, coming across as a weary, honest business owner begrudgingly "pulling the plug" on a beloved part of local culture.[402] Even if an individual manager had to play a mildly villainous part in the *48 Hours* narrative, commercial radio's management structure was not its villain. Rather, it was the decline of profitability for radio and the implicit impossibility that local or unusual broadcast formats might hold out against the technological team—satellite dishes and computers running automation software—that could consolidate the whole nation's DJing needs into a single office complex. These technical objects were drifting into position as potent symbols in a popular awareness of increasing sonic homogenization in America.

Radio is dead

During the same years that radio automation had been extending its grasp by folding new digital techniques into its existing structures, artists' interest in radio had been converging on a more and more pessimistic discourse. Despite Thorington's success with New American Radio, which would run until 1998, the radio column she helped edit in *EAR* presented a dire and eventually outright defeatist outlook on the possibility of reclaiming the medium for artistic ends. Using a vocabulary that drew more from media theory and new music circles than from commercial broadcasting, *EAR*'s radio writers ultimately articulated a very similar critique to what April Feld had expressed in 1982. The magazine tended toward op-

[402] "The Last Polka."

timism about new software tools for composition, reflecting the same informed interest in computing's musical potential that Pauline Oliveros explored. But in its radio coverage, the same villain Feld had identified—the rationalization and quantification complex that consultants drove and computers aided—featured in a generally pessimistic outlook on radio's present trajectory. The "obsession with numbers," as Thorington put it in a 1987 column, had yielded "bland, totally unremarkable programming." She lamented that a new energy wave in sonic art met with such closed conformity in the largest means of sonic distribution:

> The acoustic world is charging up, it's hot. There has probably never been a time when so many were regarding sound with such interest. It's a real crime that at this time radio should be hard at work creating sound to be disregarded.[403]

Other contributors invoked technology, along with Muzak, to express the medium's flatness. Reviewing the Woody Allen film *Radio Days*, Carl VP Groome noted its representation of

> the pre-natal experience of today's downlinked, uplinked, satellite-webbed, cable-girded, fiber-opticed, transmission-crammed, technorganic adult medium.... [T]hose halcyon days are gone, like the guitar player exiled from his heritage, like the idyllers replaced by idlers, time-wasters, and background noise: muzak from rock to easy listening.[404]

Except by association with its companion infrastructures like satellite audio delivery, radio automation did not yet feature very prominently in this discourse. With Don Joyce's 1989 essay as a notable exception, live manipulation of the medium was not a priority; indeed, New American Radio commissioned works on tape and syndicated them to participating stations that could well have used automation to play them back. But *EAR*'s fixation with

[403] Helen Thorington, "Radio Diary," *EAR*, November 1987.
[404] Carle VP Groome, "Popular Myths of Radioland," *EAR*, July 1987.

Muzak (resulting in multiple columns that reported on what Muzak the company was up to) recovered the old association among background music, automation, and absence. To percussionist and New American Radio contributor David Moss, by 1989, the absence of creative input in radio appeared total and permanent.

> This is what I thought and hoped for years: that radio was a perfect medium in which to propagate subversive artistic activity. Its very normalcy would function as a culture dish for art bacteria—it would *grow* an audience. Sound art music would enter and alter the mainstream of American life. After 70 successful years in the wallpaper business, however, radio has mainly the power to flatten, smooth-out, disembody, and trivialize the information it conveys. In the 1990s "new work on radio" is a contradiction in terms. Radio is dead. Long live other information dispersal systems![405]

Moss's declaration, for all its affinity to a surrounding discourse, was remarkable in explicitly discounting "new work on radio" even as he and collaborators worked to produce exactly that. It named and heightened an intense internal contradiction that had germinated in between artists' hopes for radio's utility to change sonic culture and their hopeless outlook on the medium's actual trajectories.

Pop radio pessimism

EAR's authorship reflected a relative narrow circle of musical experimenters, mostly on the American east coast. But aspects of the same pessimistic discourse that it fostered in the late 1980s would recur in commercial and much more widely-heard media. When pop culture had invoked radio automation in the 1970s it had served as a wedge for authenticity dilem-

[405] Moss, "The Beat and the Box."

mas in narratives that were ultimately quite sentimental toward radio.[406] But computerized automation became available as a symbol within a newly cynical and deeply negative vein of radio commentary by pop musicians and writers. Ascendant MCs in an explosive moment for American hip hop expressed the cutting edge of this anti-radio sentiment, taking aim variously at the entrenched broadcast industry's hostility to their music and at the medium's degraded output.[407]

In 1990, in his debut solo album *AmeriKKKa's Most Wanted*, Ice Cube included a track called "Turn off the Radio." In between clips that sampled and parodied an R&B radio establishment adamant on excluding stylistic innovation from young Black people, Ice Cube rapped,

> What I'm kicking to you won't get rotation
> Nowhere in the nation
> Program directors and DJ's ignored me
> 'Cause I simply said "Fuck Top Forty"

The next year, KRS-One, appearing on the opener of R.E.M.'s *Out of Time*, lambasted the medium for its uniformity and for addicting and brainwashing its listeners with sensationalist programming:

> DJs communicate to the masses
> Sex and violence classes
> Now our children grow up prisoners
> All their life, radio listeners!

[406] See Chapter 2's discussion of *WKRP in Cincinnati*; also, George Lucas's 1973 *American Graffiti* featured tape cartridges (and celebrity rock & roll DJ Wolfman Jack) in a scene that tied a radio authenticity knot into the core of the film's nostalgic soundtrack.

[407] Amy Coddington, *How Hip Hop Became Hit Pop: Radio, Rap, and Race* (Oakland, CA: University of California Press, 2023).

If Ice Cube and KRS-One differed as to whether radio needed to court more or less intensity, they were united in a fervent (and, in Ice Cube's case, explicitly violent) antipathy toward radio programmers. In contrast to LL Cool J's "I Can't Live without my Radio," a 1985 ode to the boombox that opened the MC's debut album *Radio* and hailed his forthcoming command over New York airwaves, some hip hop artists had come by the start of the 1990s to see radio as hopelessly closed: its program directors were opposed to creative innovation, its content was simultaneously base and listless, and its DJs were worse than useless.

In 1994, a narrative ploy riding on the trope of lackluster DJs yielded perhaps the all-time most widely viewed referential moment for radio automation, in an episode of *The Simpsons*. A pair of announcers on a formulaic morning drive-time show activate the plot by promising and initially failing to deliver a live elephant as a call-in contest prize. A sharply dressed station manager delivers an ultimatum: fix the situation or lose their show to "the DJ 3000," a wall-sized unit that "plays CDs automatically."[408] Sporting an intimidating array of screens, knobs, faders, and VU meters, the DJ 3000 suggests a multi-audio-format assemblage not far out of line with how automation systems of the 80s had tended to accrete reel, cartridge, and digital components before giving way to entirely computer-contained systems. The system's less true-to-life novelty came in a robotic voice that actually replaced the speaking DJ. It was a Bravermanian gag: DJs had already seen their craft degraded[409] to the point that the robot's "three distinct varieties of inane chatter" would suffice to replace them. Following a quick demonstration, the younger of the two announcers exclaims, "Wow, that thing's great!," at which his older, surlier colleague (voiced by longtime radio host Harry Shearer) admonishes, "*Don't praise the machine*."[410]

The joke strongly suggests that the *Simpsons* writers assumed American audiences would

[408] "Bart Gets an Elephant," *The Simpsons, Season 5*, March 31, 1994.
[409] Braverman, *Labor and Monopoly Capital*.
[410] "Bart Gets an Elephant."

generally be familiar with the notion that radio could be automated; further, that an older generation of radio workers had already endured multiple rounds of management's threats to automate their jobs. *The Simpsons*'s cynical representation of radio neither celebrated nor bemoaned the prospect of more automation. Depicting DJs as unimaginative troublemakers and computers as sophisticated enough to mimic them, the show took part in condensing widespread sentiments about radio's lack of vitality into a *trope of automatedness*: a sense that American radio of the 1990s *might as well be automated*. Automation triumphed when radio's programmatic character had eclipsed any individuating character to its programs—when varieties of expression within the medium had flattened into uniform and predictable *content*, to use the going term within today's automated media platforms.

In the historical picture, DJs were not simply the victims at this brink of automatedness; rather, they had been a step in moving the medium toward it. As Jody Berland wrote in 1990,

> The dj arose as an innovative cost-cutting strategy during the time that radio was severing its ties from the networks and becoming a local, low-cost, music-oriented medium. In the current period he or she retains the tenuous local and immediate sound of music radio, which is otherwise one step this side of total automation.[411]

Automatedness, to a range of radio critics spanning media theorists, experimental artists, and popular musicians, now stood in for American radio's national uniformity and its closure to new voices. In turn, these frustrations would draw new attention to radio automation as an actual mechanism and to the possibility that artists could more directly confront it.

[411] Jody Berland, "Radio Space and Industrial Time: Music Formats, Local Narratives and Technological Mediation," *Popular Music* 9, no. 2 (1990): 190.

Rethinking artistic radio

The trope of automatedness helped spur a new, more optimistic approach to creative radio transmission. In the early 1990s, artist networks in the US and Canada began devoting more attention to how they might intervene in radio from outside its technical and institutional power centers.

Canadian radio art scenes reflected, to an extent, the aesthetic and political gap between the American east and west coasts. As with the contrast between the California-based Joyce and *EAR*'s New York radio columnists, a network of artists and community stations in Vancouver developed radio art practices more by adapting broadcast production tools toward sonic collage than through the academic or activist priorities that often characterized milieus in Montreal and Toronto.[412] As Peter Courtemanche (also known as Absolute Value of Noise) has recounted to fellow Vancouverite radio and transmission artist Anna Friz:

> Hank [Bull] introduced me to the term "radio art" and we put together this odd piece "hyperspace radio" with CITR, Radio Radia in Banff Alberta, Co-op Radio in Calgary, and the Western Front (acting as the hub of communications). Norm Van Rassel was the hyperspace voice of Vancouver for the event and Anthony Roberts made effects-pedal noise in the background. In the 1980s and into the early 1990s, there was a very non-academic community of people who were making radio and sound art. A lot of the work was very experimental and visceral. Many artists didn't explain their work in words or text. It was a very raw form of art at that time.[413]

Hank Bull's earlier connections to Fluxus and a telecommunications arts movement of the

[412] Friz, Interview.
[413] Anna Friz, "Art on Autonomous Airwaves: Radio Art in Canada," *Glissando*, 2018.

1970s had helped form a durable link between the Western Canada scene and a European radio art scene (Bull referred to the ongoing correspondence as an "imaginary city," "Wien-couver")[414] that Austrian National Radio's Kunstradio program would reinvigorate starting in 1987. At the turn of the 1990s, more arts programmers began to pull on this kind of thread and helped consolidate disparate scenes into a more coherent radio art movement.

The Banff Centre for the Arts had acquired a small FM transmitter toward the end of the 1980s and began looking to radio makers who operated outside North America and outside regulated broadcasting modes—including the Irish activist Margaretta D'Arcy and the Japanese micro-FM pioneer Tetsuo Kogawa—for ways that "a community can be created around a low-watt transmitter that is so limited in size that listeners are most likely to be producers as well."[415] Daina Augaitis and Mary Anne Moser, who through the Walter Phillips Gallery initiated a project at the centre called *Radio Rethink* in 1992, wrote, "as a tool and forum, artists are using radio in ways that illuminate a profound and significant set of questions about community, technology, and domination" now that "radio no longer appears as the seductive medium it once was."[416] The project convened artists, some of whom had already been working to counteract the formulas of commercial radio programming, in a setting where they would program and transmit on their own terms rather than trying to inject other rhythms into more powerful signals.

EAR's radio coverage also hinted at a shift. In a 1991 column, composer and sound technician Philip Perkins asked that artists revisit the whole premise under which radio art had so far tried to broaden its place in the medium.

In the overlapping worlds of radio art, sound art, and *hörspiel* nearly all the work

[414] Heidi Grundmann, *Art + Telecommunication* (Vancouver, BC: Western Front Publication, 1984).
[415] Augaitis et al., *Radio Rethink*, 2.
[416] Ibid., 1.

> is recorded in a studio and then shipped to stations for broadcast. Although working on tape is tempting, a live radio work can dispense with the whole recording, manufacturing, and distribution apparatus and address the same audience directly. Working live admits randomness and the various little anomalies that we card-carrying post-Cageians have come to accept, providing an antidote for that golem of modern media, the completely automated or "robot" station.[417]

What Perkins suggested was, in a way, to rotate the continuum along which artistry was measured in radio. Rather than holding conventional commercial programming up as artistic radio's opposite, he proposed that *automated radio* was radio art's true antithesis. Like John Cage and Max Neuhaus, Perkins sought out indeterminacy—here in the "randomness" that live broadcasting preserved—as a way to counter a programmatic regime in sound. But where Cage and Neuhaus had each allied in his own way with automatic technology, Perkins wrote from a context where automation—radio automation in particular—now epitomized that regime. That symbol brought clarifying power to the ongoing struggle of sound art versus musical programming. Artworks that opposed convention only through alternative approaches to programming, and not through their approaches to *mediation* as a material practice, would inevitably be limited in their power to disturb the underlying "apparatus" that had incubated and elevated those conventions in the first place.

Radio Naked

Many of the artists in *Radio Rethink* had also gathered at Montreal station CKUT in 1991 for *Radio Contortions: An International Festival of Radio Art and Theory*, curated by Julia Loktev, Christof Migone, and Bryan Zuraw. The event brought American artists including Helen Thorington into a context—influenced by the distinct values of Canada's

[417] Philip Perkins, "The Remotes: A Case for Live Radio," *EAR*, February 1991.

campus-community radio sector—that put greater emphasis on spontaneous, autonomous broadcasting than the network around *EAR* typically had.[418] It also helped germinate projects by Migone that intervened in radio programming at levels that artists could not reach if they only produced recorded programs.

Migone had arrived at CKUT soon after the station gained its FM license and had worked as its first music program director and later its production director. A tension, as he recalls it, developed between his "creative, critical side" and the role as "enforcer of CRTC rules" that the positions required of him.[419] This tension drove a series of experiments on Migone's show, Danger in Paradise, where he held a goal to invert and relocate control over the broadcast. Like Don Joyce (who, with Negativland, would perform on Migone's show during a tour stop in Montreal), he made liberal use of phone lines and tape cartridges. In his production role at the station, he tested regulatory limits by recording heavily collaged station identification announcements (which federal rules, as in the United States, mandate must be aired clearly near the top of each hour). Migone recalls that the backdrop of interfacing with CRTC rules provided the initial push into a gradual project called *Radio Naked*—a project that would operate on radio programming from outside the medium.

Between 1992 and 1994, *Radio Naked* took shape as a series of prompts that address someone at the controls of a radio studio. Migone calls it "a manifesto that naively impels the radio programmer to dispense (or at least question) all of the conventions and expectations of what radio should sound like."[420] Suggested actions ranged from practical, minor sabotage—

1. Always give the wrong time, date, weather and news report.

—through impractical, major dissolution—

[418] Brian Fauteux, *Music in Range: The Culture of Canadian Campus Radio* (Waterloo, ON: Wilfrid Laurier University Press, 2015).
[419] Christof Migone, Interview, September 27, 2021.
[420] Migone, *Radio Naked*.

15. Dissect the equipment of your radio station into its component parts: transistors, capacitors, integrated circuits, etc. and send one out to each of your listeners.

—into a more abstract unmaking of radio's information infrastructures—

18. Find out how a radio broadcast is broken down into categories by your government's regulatory body and mimic that analysis on the air. Their analysis assumes content is quantifiable. The categorization system becomes the content and they are left empty-handed.

The piece confronted the material and ideological bases for Canadian and American radio programming head on. What it proposed was not an alternative rhythm or philosophy of programming, as artist-critics like Schafer and Thorington had tried, but rather a disposition of *deprogramming*.

As a recipe for imagined (often impossible) dismantling, *Radio Naked* elaborated how radio artists could understand themselves and their desires in relation to the sociotechnical arrangement that broadcast technology helped maintain. This situation was not an evolving conflict; the regime of unidirectional and over-rationalized broadcast programming had won. A medium that could be automated, as popular critiques of radio had determined, was a medium that was already closed to effective resistance. Resistance to technology, whose near-eponymous historical example is the Luddite revolt in early 19th century England, has been productively understood as resistance to the process that *installs* a particular technology—and, more significantly, a new social order alongside that technology. As Keith Grint and Steve Woolgar argue in revisiting historical explanations for the Luddites, a machine's symbolic role—standing in for the political forces that seek to install it—helps explain

why machinery becomes an appealing target for destructive resistance.[421] The trope of automatedness, by making radio automation available in this symbolic role, had helped focus the diffuse power of *musical programming* within an object whose agency and whose predisposition toward management's interests were easy to understand. But the process of installation was complete. Per the "trojan horse" model that Grint and Woolgar offer—their answer to the remaining question of "why machinery [is] taken to symbolize the 'real' issues"—the technology had successfully played its part in facilitating politics by other means, having reduced the complex matter of work restructuring in radio to the simple question of whether or not stations would accept automation. Useful resistance, at this advanced stage, was necessarily speculative and necessarily negative.

But despite *Radio Naked*'s negativity (in the sense that it mainly proposed destructive actions and silences rather than new, practical modes of broadcasting), the work expressed a distinct optimism for the medium's future directions. Writing in 1996 for a special issue of *The Drama Review* on radio art, Migone revisited David Moss's proclamation in *EAR*:

> David Moss once pronounced radio dead (Moss 1990). This leaves the field open for resuscitations: radio is dead, long live radio.... The politics that espouse that everybody should arm themselves with a transmitter can now make the leap to the following scenario: radio without transmitter. Perhaps this is the required script to trigger the post-digital age. Skip the digits' demands for detected errors and corrected codes. Skip the automation which "looks empty but sounds full" (Oakwood n.d.). Fast forward to the post-digital age, an age with a taste more savory than the antiseptic and a time beyond the accelerated.[422]

[421] Grint and Woolgar, *The Machine at Work*.

[422] Christof Migone, "HeadHole: Malfunctions and Dysfunctions of an FM Exciter," *The Drama Review* 40, no. 3 (1996): 47–57.

Pulling from an ad for MediaTouch (Oakwood Audio was its Canadian distributor), Migone placed automation at the center of what artistic radio needed to discard: a computational complex that limited and scrutinized sonic transmission rather than expanding its capacities. Computerization had helped concretize, and in many cases accelerate, the functions radio automation had accrued since the 1950s. These functions, operating in software as sets of rules, redoubled the sense in which radio was *programmed*. In doing so, they also helped make automation freshly salient as an object that conveniently contained much of what an anti-programming radio art practice might orient itself against. That orientation, for artists like Migone, gestured not back to a nostalgic pre-digital radio era but to a "post-digital" media regime.

Conclusion

It had been clear to most observers by the end of the 1970s that a new degree of power and availability for computation would accelerate radio automation's reach. Yet the period raised the need for new conceptual strategies from engineers and artists that could direct or counter, respectively, the forces that radio automation would amplify when it became a software object.

Three of this chapter's central characters represented a range of outlooks from within the American radio industry toward the prospect of a computerized radio medium. At one end, April Feld saw a coupling that was already complete: much as counterculture activists had predicted back in the 1960s, the computer age would entrench the rein of consultants, and an excess of rationalization would irrationally strip the medium of all that made it worthwhile. In the middle, Lance Leupold's study of microcomputers in radio automation acknowledged the vitality-sapping trajectory that automation was on but anticipated that computerization, with the right steering, could be an opportunity to restore creativity and

local differentiation to musical programming. In proposing to augment this craft, however, Leupold retained traditional power structures in commercial music radio, reestablishing the program director as the hierarchical authority over the creative work DJs and other programmers performed. And at the opposite end from Feld, Alan Freeman saw in computer programming a chance to bring radio studios into greater compliance with the wishes of station owners, in large part by simply replacing DJs with software.

Feld, Leupold, and Freeman had all enjoyed working as radio producers, DJs, and/or musicians. All three held and hold informed opinions about what makes a good music broadcast. But the opinions that so starkly differentiated their approaches to computerization were less about *how* programming should be done and more about *who* should have the power to program. For Feld, music radio was not worthwhile if DJs and music directors were not afforded enough creative autonomy. For Freeman, that autonomy was a liability that necessitated new tools for station management—specifically, software tools that could abstract management's rules into parameters that a "Digital DJ" would automatically obey. Leupold saw in distributed computing an opportunity to have it both ways. He proposed a system that would facilitate a dramatic increase in local DJ autonomy over the tape reel syndication era, but only so far as station program directors chose to open it.

The critique that Feld laid out in *Billboard* in 1982 matched the contours of a radio critique that would appear in artist venues later in the decade. Drawing heavily on sentiments expressed by R. Murray Schafer, an overlapping group of writers for *EAR* and producers for New American Radio depicted a bleak state for the American broadcast radio spectrum and bemoaned its lifeless uniformity even as they gained some traction in efforts to insert artist programs into public radio networks. When artists and writers began to confront the automatedness of radio, which had emerged as a recognizable trope by the early 1990s, they

also started to identify a new set of priorities including live broadcasting, autonomous transmission, and direct confrontation with not just programming conventions but broadcast programming *itself* as a convention. The collective movement away from investments in radio's commercial and public sectors was well timed. If computerization had aided station owners in flattening the sound of American radio, it was nothing compared to what deregulation of ownership would accomplish in 1996.

Chapter 4: Radio Rearticulations (1996–2010)

The 1996 Telecommunications Act, which lifted limits to how many radio stations a single company could own in American broadcast markets, accelerated the conditions under which radio automation seemed to advance hand in hand with American radio's demise.[423] At the same time, automation more quietly took up an infrastructural role in efforts to revive and reinvent radio. Corporate station owners raced to buy up stations following the 1996 bill; the debt they accrued in doing so necessitated sweeping personnel reduction, which sophisticated automation systems greatly aided. But automation also became newly available and by some views newly necessary for anti-corporate radio groups. Unlicensed, "pirate," and community broadcasters wanted to keep their transmitters running at more hours than small teams of volunteers could sustain. They turned first to simple techniques for recording and replaying their own programs, and then to free or cheap software tools that could run on consumer hardware. Radio automation thus became a tool for progressive and artistic movements that opposed corporate domination in the medium, even as it retained the status it had accrued through the 1980s and 90s as an avatar of that dominion.

This chapter centers on stories around two radio automation systems: the free and open source software (F/OSS) Rivendell, developed by radio engineer Fred Gleason for the Christian-conservative network Salem starting in 2002; and Google Radio Automation, which the internet giant marketed to commercial stations between 2006 and 2009. These technology projects each took a similar feature set, based on products from Scott Studios

[423] Patricia Aufderheide, *Communications Policy and the Public Interest: The Telecommunications Act of 1996* (New York, NY: Guilford Press, 1999); Nina Huntemann, "Corporate Interference: The Commercialization and Concentration of Radio Post the 1996 Telecommunications Act," *Journal of Communication Inquiry* 23, no. 4 (October 1, 1999): 390–407; Klinenberg, *Fighting for Air*.

that led the automation market at the start of the 2000s, and attached it to very different software architectures under very different ambitions. Google, which began its project when it acquired Scott Studios itself, sought to splice its internet ad auctioning service into a core infrastructure for broadcast radio and thereby show investors it could expand into "traditional media." Gleason, inspired by the practicality and ethics of the F/OSS movement, wanted to create a resource that could prove useful to broadcasters across a wide variety of radio niches (and perhaps even galvanize interest in the F/OSS ecosystem among more radio practitioners). Despite considerable differences from Salem in scale and in political orientation, broadcasters in a progressive radio movement became users and even contributors to the Rivendell project. Google found less success in its vision: it shuttered the radio automation project after three years, pivoting its focus to music streaming.

That grassroots radio movement came about as disparate groups in American radio's periphery—including pirate broadcasters, media activists, technologists, and experimental artists—began to share a clearer sense of opposition to corporate-owned radio. It solidified through a regulatory push for low power FM (LPFM) licensing and through the Prometheus Radio Project, a progressive advocacy and community-building organization founded in 1998. In studying how Prometheus and the LPFM movement mediated these social and activist efforts through on-the-ground technological work, Christina Dunbar-Hester shows how LPFM participants imputed new meanings to FM radio's old technology and cleaved it from the "dominant meanings of broadcasting."[424] Radio automation, by now a complex technology internal to radio and also a symbol of its corporate domination, was particularly tricky to disentangle. In 2008, Prometheus circulated a "Handbook on Radio Automation"

[424]Christina Dunbar-Hester, *Low Power to the People: Pirates, Protest, and Politics in FM Radio Activism* (Cambridge, MA: MIT Press, 2014), 129.

that Jeff Shaw—Station Director at LPFM station KDRT in Davis, CA—had authored. It detailed KDRT's use of Rivendell, alongside 21 other automation software options and notes from 15 other community stations on their automation setups. First, though, Shaw confronted automation skepticism in his milieu:

> Some people might think radio automation is inherently evil. Perhaps this is what the majority of volunteers at your station think. If so, maybe investing time and energy in automation is not the best route for you. It might be best to simply concentrate on building a large pool of programmers and DJ's to fill your broadcast day, whether it be for 6 hours a day or 24 hours a day. In reality, though, automation—however you define it—is just a tool.[425]

Contrary to Shaw's simplification, it was precisely the difficulty of (re-)defining automation that made a station's choice to install it a complex and consequential one. By installing an automation system, station engineers enrolled their coworkers in a negotiation with automation designers that the system and its *scripts*, in Madeline Akrich's terms, mediated.[426] After 50 years of slowly expanding and settling into broadcast practices, radio automation carried scripts not just from an individual system's developer but from a long, iterative design trajectory that commercial radio's owner class had propelled. The Rivendell radio automation software project was liberal in its approach to software and conservative in its approach to radio automation: Gleason hoped to show that open source software could reproduce and eventually surpass the functionality that a commercial product offered, not to radically reconfigure the operating routines that those existing automation systems had helped make standard. Against the notion that a technical artifact is "just a tool," Akrich

[425] Jeff Shaw, "Handbook on Radio Automation" (Philadelphia, PA: Prometheus Radio Project, 2008), 3.
[426] Akrich, "The De-Scription of Technical Objects."

(writing within a robust line of STS reactions to that same notion) argued that "technical objects have political strength" not merely because they "change social relations" but also because they "stabilize, naturalize, depoliticize, and translate these into other media."[427] Even Shaw's account of automation at KDRT evidenced this naturalized warping of social relations: Shaw noted that automation happened to provide ways to incentivize broadcasters' adherence to quality standards under what he called (using quotation marks) "volunteer management."[428] As it had back in the 1960s (see Chapter 2's discussion of CJRT Toronto), automation provided an inlet for managerial and hierarchical patterns in settings where such control structures might be antithetical to a station's mission.

But radio automation's political tendencies gave artists and activists a difficult task, not an impossible or naive one. Their work, when it ran into automation, posed implicit questions: can radio have automated convenience without automated consolidation of power? How could people decouple a technology from the forces that had installed it into their working context? The challenge was to *rearticulate* what radio could mean in a changed media landscape. Cultural studies theorist Stuart Hall proposed *articulation* as a way to understand how separate ideas become linked within an ideological discourse such that expressing one expresses the other. In one of his examples, religion—which "has no necessary political connotation"—comes to be "bound up in particular ways, wired up very directly, as the cultural and ideological underpinning of a particular structure of power."[429] Ideological struggle, as Hall saw it, is the process of "rearticulating and disarticulating" concepts, taking them out of the discursive chains that link them together and appending them to new ones.[430] For radio practitioners, this process was technological as well as discursive.

[427] Ibid., 222.
[428] Shaw, "Handbook on Radio Automation," 4.
[429] Stuart Hall, *Cultural Studies 1983: A Theoretical History* (Durham, NC: Duke University Press, 2016), 143.
[430] Ibid., 137.

LPFMers needed to refashion a functioning chain of ideas, technical objects, and practices in such a way that its use could express an ideology opposite to that which had characterized American radio since its emergent years—commercialism and corporate stewardship.[431]

Google also tried to rearticulate radio, if only to change *which* corporate stewards would see the medium into its next phase. Part of an effort to automate commercialization itself with a pan-media approach to programmatic advertising,[432] Google Radio Automation attempted to plug radio into a new order where internet platforms would govern older media's economic and technical workings. Its choice of radio automation to anchor this project, even if partly an accident of how a series of acquisitions unfolded, was clever strategy: automation was already computational and multifaceted, and at the same time essential and largely accepted, in the radio sector Google approached as a newcomer. A new addition, namely integrating Google's Audio Ads as a microservice in the software, could in this ground-level vehicle generate less controversy than if it were more visibly imposed from above. But Google's project failed; and when it did, so did the idea that had motivated it: that internet companies would need to integrate across older media in order to keep growing. Google shifted its focus and resources away from radio and into music streaming, helping establish the latter as formally and industrially separate from radio.

Why did a loose network of artists and activists find better purchase in their radio rearticulation than Google did? It was, at least in part, because the former group took a greater interest in the nuances and ongoingness of *disarticulation*. Google failed to anticipate that an infrastructure as settled as radio automation could in fact be more corrosive than conducive to other infrastructures around it: the radio industry's own rampant consolidation

[431] Susan Smulyan, *Selling Radio: The Commercialization of American Broadcasting, 1920-1934* (Washington, DC: Smithsonian Institution Press, 1994); Douglas, *Inventing American Broadcasting, 1899-1922*.

[432] Lee McGuigan, *Selling the American people: advertising, optimization, and the origins of adtech* (Cambridge, MA: The MIT Press, 2023).

placed Google in a bind of having to partner with Clear Channel Communications—the company that won a pyrrhic victory in the post-1996 race to buy up stations—and thus stir up resentment among smaller customers. Within that turn of sentiment, automation began to emerge back out of its uncontroversial place in commercial radio studios and to represent forces that seemed excessively corporate even in the view of (smaller) corporations.

By contrast, the LPFM movement celebrated the disarticulation it hoped to effect for radio; constituents had a much clearer view of the power structure they wanted to break than the political priorities they wanted to install in its place. Avant-garde sound and radio artists contributed to this capacity for disarticulation. It was, in part, through the negativity of artistic radio discourse and its trope of automatedness that disassembling radio into its component parts and concepts seemed appealing—even necessary—for a creative renewal (see Chapter 3). Initiatives that spanned radio art's saboteurial imaginaries and community radio's pragmatic infrastructure-building—in particular the transmission arts organization Wave Farm and WGXC, the FM station it launched in rural New York in 2010—gave institutional weight to a vision for the medium that differed drastically from what Google or Clear Channel had sought with radio in the twenty-first century. Artist radio would remain, of course, in a slim periphery of a medium still today dominated by the old articulation and the corporate owners it upholds. But through the establishment of contact zones between that periphery and what had been fully outside the radio medium, a question changed from *What else could radio have been?* to *What else has radio become?* in the wake of a crisis for the medium.

1996: implosive growth

The Telecommunications Act of 1996 looms immensely in the rear view when American radio practitioners recount major changes in the medium. Automation developers and radio

artists alike, if for differing reasons, consistently cited it as the most significant recent development for radio's quality and character—and especially for the prominence of automation within radio—in the interviews I conducted for this research. By deregulating the broadcast industry's ownership structure, the Clinton administration, legislators, and the FCC facilitated a frenzy of ownership convergence in commercial radio. The accompanying pushes for personnel reduction and toward conservative, nationally uniform programming shifted how DJs experienced change within the medium. As career DJ J.J. Johnson recounted of the time, "None of my contemporaries are put out by the idea of evolution in radio. That was expected; even hoped for. We're put out by the idea—very real to us—that the industry has mostly *de*volved."[433] Station owners using automation to consolidate and constrain DJ work was, of course, nothing new. Yet the sudden surge in streamlining's scale and pace helped cement specific negative meanings for automation—or "robot radio" as Johnson terms it—at a time when automation, again preparing for a technical metamorphosis as personal computing progressed into networked computing, might have taken up different shapes and connections.

Predicated on assumptions about competition between broadcast media and a quickly emerging host of internet media, the 1996 Act purported to manage—or better allow market forces to manage—the industrial unsettling and resettling among media in a new digital era. Radio automation became one seam, on the production side rather than in the more widely studied audience interface layer, where junctures between internet and broadcast media were proposed and tested. In the case of Google Radio Automation, which failed in its goal to integrate radio and platformized advertising, ownership consolidation ultimately helped thwart that kind of juncture.

[433] J. J. Johnson, *Aircheck: Life in Music Radio* (Planet 3 Publishing, 2016).

Leading up to 1996, the commercial broadcasting lobby had used the threat of incursion from digital media to justify their own deregulation. As Patricia Aufderheide explained in her account of the 1996 Telecommunications Act, broadcasters "wanted to abolish concentration of ownership and cross-ownership restrictions, especially for radio" and "argued that radio advertising was underpriced, financially crippling the medium, because of limits to concentration of ownership."[434] The result of success in this lobbying effort set off a consolidation race that Dal Yong Jin has described as a cross-media convergence wave rooted in corporate strategy and with implications reaching across technological and economic sectors.[435] By the early 2000s, Clear Channel had developed a substantial lead over other radio conglomerates in this race. In 2002 Clear Channel Communications, which had owned just 39 radio stations in 1995, owned 1,205 stations in the United States, gaining a 27% share of national radio listenership and dominance in most major metropolitan broadcast markets.[436] For anyone who saw themselves as occupying radio's outskirts, sound artists' pessimistic sense of hegemonic flattening in the medium now had clear political economic backing.

free103point9: autonomy, artistry, and automation

When Tom Roe, Violet Hopkins, and Greg Anderson began the FM broadcasting outfit free103point9 in Brooklyn in 1997, the effects of radio consolidation were at the forefront of their attention. Galen Joseph-Hunter, who began working with the collective after 2000 and has been the organization's executive director ever since it obtained non-profit status in 2002, notes the nearly audible sense of decay that had set in as a kind of ground against

[434] Aufderheide, *Communications Policy and the Public Interest*, 48–49.

[435] Dal Yong Jin, "Deconvergence and Deconsolidation in the Global Media Industries: The Rise and Fall of (Some) Media Conglomerates," in *The Political Economies of Media: The Transformation of the Global Media Industries*, ed. Dwayne Winseck and Dal Yong Jin (London, UK: Bloomsbury, 2012), 167–82.

[436] Peter DiCola, "False Premises, False Promises: A Quantitative History of Ownership Consolidation in the Radio Industry" (Future of Music Coalition, November 2006).

with free103point9's figure emerged:

> The principal inspiration for starting free103point9 was the collective's shared view that the existing radio airwaves were dead zones that needed to be revived, and their conviction that the opportunity to communicate thoughts and new ideas was being wasted by a handful of corporations intent on using the nation's airwaves solely for profit. First and foremost among free103point9's concerns was that the community lacked access to its own airwaves.[437]

Localism should be understood as a partly negative construction, characterizing radio at times when stations produced more of their programming locally and by contrast to times when they sourced it from networks or syndicators.[438] The term has often appeared when smaller-scale actors in radio strategically foreground what the United States' corporate-first radio model fails to provide, such as local news and culture or timely emergency alerts. This is not to suggest that it should be understood cynically: providing geographically relevant communication or entertainment in a small radius is a deeply meaningful motivation for countless radio practitioners, and one from which their listeners derive real value.[439] But it is important to note that when a persuasive frame like localism arises, it also channels other motivations—including direct pleasures in transmitting sound and tinkering with transmission systems—that may be equally meaningful for participants yet harder to articulate as a public good. The oppositional outlook of independent radio broadcasters, fixed on how corporations were *wasting* the medium, has helped draw artistic and community-service priorities into a continuum. Here, sound art comingles with the autonomy long prized by

[437] Galen Joseph-Hunter, "Out of the Air: A Case for Transmission Art," in *Listen Up!: Radio Art in the USA*, ed. Anne Thurmann-Jajes and Regine Beyer (New York, NY: Columbia University Press, forthcoming), 239.
[438] Hilliard and Keith, *The Quieted Voice*.
[439] Rory Solomon, "Meshiness: Mesh Networks and the Politics of Connectivity" (Ph.D., New York, NY, New York University, 2020).

radio pirates in Roe's reflections on the start of free103point9.

> Roe recounted, "We thought that the airwaves were incredibly boring and not being used in an artistic way. So we became an art radio station within the pirate radio movement." One journalist described the medium as "a newly emerging form of sound-art based primarily on manipulation of the live airwaves."[440]

free103point9 and Wave Farm would become instrumental not only in New York experimental music scenes but in articulating "transmission art" as a category that encompasses technical and conceptual interventions in the materialities that undergird broadcast media. Joseph-Hunter, in the 2011 book *Transmission Arts: Artists & Airwaves* that she co-authored with Penny Duff, explained:

> The act of transmission—taken literally as the wireless sending and receiving of electromagnetic waves—is a term interchangeable with "radio." "Radio art," however, typically denotes works conceived for FM broadcast, and while radio artworks play an important role in the history of transmission art, it is a narrow one. Transmission art practitioners demonstrate an interest in an expansive idea of radio and often pursue its demystification and innovation through a do-it-yourself, hands-on relationship with transmission technology.[441]

Joseph-Hunter's coinage marked a significant threshold in the gradual shift that had begun in the 1980s as American radio artists grew first despondent with the state of broadcast radio and then, through the inspiration of artists like Tetsuo Kogawa, increasingly interested in autonomous broadcasting as an artistic outlet and as a material phenomenon. These

[440] Cisco Bradley, *The Williamsburg Avant-Garde: Experimental Music and Sound on the Brooklyn Waterfront* (Durham, NC: Duke University Press, 2023), 59.
[441] Joseph-Hunter, Duff, and Papadomanolaki, *Transmission Arts*. xi.

ideas percolated over the 2000s in the junctures free103point9 maintained between sound art and ad-hoc, unlicensed transmission. The FM transmitter itself, contrary to the basic premise of a radio "station," moved from place to place depending on who wanted to broadcast. What was transmitted was not a broadcast *program* but an activity—"a party or an event or a lecture or something"—that was ready to extend out into the air. Despite the marked difference in operations between a fixed broadcast station and free103point9, which routinely loaned its FM transmitter out for other groups' events, its interests nevertheless converged on certain broadcasting conventions including what Roe, in retrospect, terms automation:

> When we started free103point9, we were mostly using eight hour VHS tapes as our automation. We could record, we would have performances and we could record them all eight hours uninterrupted on a VHS tape set on the extended play setting. And that way, when we went to sleep at night, we could put in an eight hour video tape to play in the transmitter and it would play overnight all night.... So that was late nineties automation software.[442]

As Roe explains, this "automation" (which, as it had to radio automation's inventors, simply meant pre-recording plus a means to extend playback) aided the group's conflicting goals of lending their transmitter out and reaching listeners. By supplying the borrowers with tapes and setting the transmitter rig up days ahead of an event, they increased the chance for neighbors to find the frequency in time for the main broadcast, which they meanwhile advertised with telephone pole fliers in the broadcast radius. Maximizing the time a transmitter spent transmitting was a valuable pursuit for commercial stations and mobile artist-broadcasters alike, and it was a pursuit that automation had always aided.

The exchange of techniques between licensed and pirate radio moved in both directions.

[442]Tom Roe, Interview, July 28, 2021.

Roe moved to New York in 1995 but had been active in pirate radio for years prior in the area around Tampa, Florida. His vantage point, embedded in a national community of pirate broadcasters, afforded him a nuanced view of the changes that regulatory change brought about in the 1990s. He recalls that the pirate community's conferences saw a surprising wave of interest from former commercial broadcasters after 1996:

> We heard stories in the late nineties about commercial radio stations that were independently owned coming to pirates to find out how to do a pirate radio station, because they were being forced by the Telecommunications Act, basically—and economic forces—to sell out to large corporations, and they were being priced out of their markets.[443]

These encounters comingled radio practitioners across commercial and (often staunchly) non-commercial lines. They also, Roe emphasizes, continued a political comingling from pirate radio where left and libertarian-right viewpoints both had ample representation. As organizations like Indymedia and the Prometheus Radio Project began to seek regulatory legitimization for broadcasters in the pirate community, chances to form politically uneasy but tactically advantageous alliances arose. Christina Dunbar-Hester has documented how contingent, messy allegiances between left-wing community radio activists and church group broadcasters assisted the drive for legislative change that in 2010 resulted in the Local Community Radio Act.[444] This legislation ultimately won back LPFM licensing possibilities that had been opened in 2000 only to be effectively squashed under lobbyist pressure from NPR and the National Association of Broadcasters.

As the LPFM movement opened a path for radio pirates to legitimize their outfits, these

[443] Ibid.
[444] Dunbar-Hester, *Low Power to the People*.

practitioners now needed to rationalize their operations in accord with regulatory structures. This push steered many participants toward more sophisticated forms of automation than VHS tapes. But it did so under an ethical and practical framework that Roe describes as "open source:"

> The people that were working together nationally, going to these [pirate radio] conventions, [included] a lot of the same folks in the independent media center movement in the late nineties. They were all about teaching and helping others and were very willing to give out advice. It was a very open source kind of aesthetic.

Closer to the industrial center that had driven radio automation for most of its history, open source principles would send a more powerful form of automation toward independent radio on an unusual trajectory.

Rivendell: open source automation

The project that would become Rivendell began while its lead developer, Fred Gleason, worked for Salem Communications in the late 1990s. Announcers for Salem's news radio network had become frustrated with the software the company used to splice a pre-recorded "sounder" into the start of its newscasts, and a bureau director asked Gleason if he could develop a more flexible system. Gleason surveyed the options for digital audio systems that could accommodate this need and came up only with full-featured radio automation suites—he mentions Scott Studios in particular—with five-figure price tags.[445] Gleason opted to engineer a custom solution, and the undertaking coincided with a growing personal interest in Linux, a project that serves as the technical basis for a wide array of

[445] Frederick F. Gleason Jr., Interview, June 22, 2021.

open source operating systems and sits at the center of the F/OSS ecosystem. Gleason's project eventually expanded into a full-fledged automation system and began to replace installations from Scott Studios and other commercial vendors at Salem stations.[446]

Making Rivendell a F/OSS project meant more than building it to run on Linux systems; it meant guaranteeing that anyone could freely install or modify their own copy of the software. Developers typically ensure this by including one of several open source licenses alongside the source code. Gleason chose the GNU General Public License (GPL). He distinguishes the choice to open-source Rivendell as pragmatic and not, in his words, ideological: "not so much for any ideological reason [as] because we're going to get the best quality that way—because you're going to get peer review, you're going to get feedback... you're even going to get help, and all of that has happened over the history of the project."[447] Yet the GPL is very much an ideological document, especially in the context of the "hacker" milieu that spawned it and that it helps sustain. Gabriella Coleman has argued that hacker enterprises revolve around a "*productive freedom*" that "institutions, legal devices, and moral codes" including the GPL maintain; the participants "extend as well as reformulate key liberal ideals such as access, free speech, transparency, equal opportunity, publicity, and meritocracy."[448] F/OSS development, for Coleman, is simultaneously a kind of apotheosis for liberal ideals and an internal critique whereby liberalism disrupts its own bond to commercial circulation.

But while Rivendell's development adhered to one ideological context through its investment in free and open source principles, its initial funding and installation were bound up in a different one: conservative Christian media. Salem was, by the mid-2000s, "the most exten-

[446] Ibid.
[447] Ibid.
[448] E. Gabriella Coleman, *Coding Freedom: The Ethics and Aesthetics of Hacking* (Princeton, NJ: Princeton University Press, 2013), 3, emphasis original.

sive operator of commercial Christian Radio stations" in the United States and a major syndicator, through its Salem Radio Network, of conservative talk and news programs.[449] The company set up a small office called Salem Radio Labs for Gleason and his colleague Scott Spillers, who had been "the in-house automation support guy" whom station staff "would call if they had problems with their automation."[450] Radio software moved from being an embedded concern at the station or production studio level for Salem and toward a higher-level, more autonomous activity within the company.

Rivendell's freedom in the F/OSS sense depended on Gleason's freedom to attach the GPL to it. Once executives had recognized a "substantial opportunity for cost savings" in Gleason's project, Salem left fundamental decisions about the its architecture—and, crucially, the copyright for the software—to Gleason. In Gleason's opinion, he might not have been afforded this freedom just a few years later. Salem in 2002 was, he emphasizes, "a broadcasting company," and furthermore a company that was coping with a large expansion in its station ownership following the 1996 Act. "Salem was not interested in making money with [Rivendell]; they were interested in streamlining their operation."[451] By the end of the 2000s, Salem had diversified into online media; today, as Salem Media Group, the company operates a range of digital services in addition to radio. But Rivendell began early enough that the company, from Gleason's perspective, did not yet see software as an area they might directly commercialize. As such, Gleason retained a *distributive freedom*—producing Rivendell to meet needs that his employer outlined, but steering its circulation freely—that allowed him to choose the GPL license and that gave Rivendell a life outside Salem stations.

By gradually replicating the functionality that software like Scott Studios' flagship SS32 system offered, Rivendell became a success story for F/OSS and the empowerment it of-

[449] Bob Lochte, "Christian Radio in a New Millennium," *Journal of Radio & Audio Media* 15, no. 1 (2008): 67.
[450] Gleason, Interview.
[451] Ibid.

fered software developers, even as a very traditional chain of control for radio broadcasters formed its primary use case. Rivendell carried forward a convention that early PC radio automation applications like Digital DJ had translated from tape-based into digital audio automation designs (see Chapter 3): it used virtual "carts" as the fundamental building blocks for its operation. And as with Digital DJ, a cart could contain either audio or a "macro," an instruction that the system would execute. Macro carts were a significant feature: in the `NEWS` file embedded with Rivendell's source code directory (similar to what other software projects often label a "changelog"), an entry dated January 22, 2004 reads, "Major changes: Macro carts are now implemented." It was the first entry to follow the one for Rivendell's "initial BETA release," a large milestone that signals a software project is ready for use by testers.[452] The sequence indicates that Gleason, once the software was usable in its basic configuration, next turned his attention to extending the flexibility of control that its operators could wield. Internally, macro carts became neighbors with audio carts, stored in the same database table. As a schema for that table included in the source code's documentation showed, "Audio" and "Command" were the two hard-coded values that a cart could have for its "Type:"

```
FIELD NAME           TYPE              REMARKS
-----------------------------------------------------------------
NUMBER               int(10) unsigned  Primary key
TYPE                 int(10) unsigned  1 = Audio, 2 = Command
GROUP_NAME           char(10)          Index
TITLE                char(255)         Index
ARTIST               char(255)         Index
```

[452] Frederick F. Gleason Jr., "Rivendell," SuSE Linux, C++ (2014; repr., Paravel Systems, 2007).

```
ALBUM                char(255)         Name of release album
YEAR                 date              Year of release
```

Where other table fields reflected metadata properties that were open-ended (`char` fields could hold an arbitrary string of alphanumeric characters), the `TYPE` row reflected radio automation's persistent, defining duo: sound and control. But where Digital DJ's lead developer had seen macros as a conduit through which he—and only he—could continue extending the software after a station installed it, Gleason deployed the F/OSS productive freedom ethos to grant that ability to Rivendell's users: he documented the available macro commands, which users could string together when they added a macro cart, in a specification for "Rivendell Macro Language". With the macro `RN`, users could have a cart trigger an action (a "shell command") in the computer's operating system, not just in Rivendell.[453] When users opened Rivendell's RDLibrary utility to add or edit carts, this work of broadcast programming took on the capacities of computer programming. It was an unusual distribution of control that made good on F/OSS goals to extend programming power in all directions; but it was also a subtle exception within a user workflow that generally conformed to radio automation precedents.

On its journey to the airwaves, an audio recording in a Rivendell *cart* (representing one of as many as a thousand *cuts* on that cart) would be called up by a chain of other intermediating structures: a *group*, which identifies the cart as, for instance, an ad, a station identification, or a song; an *event*, with rules for selecting one or more carts by group, duration, and other metadata (*scheduler codes* can correspond to music genres); a *clock*, which segments a broadcast hour into events; a *grid*, which assigns a clock to each hour of the broadcast week; and finally a *log*, which the software produces by consulting the grid and its subcomponents

[453] Ibid.

and sequences a day's worth of carts to be played back.[454] These cascading metaphors and category systems carry forward assumptions from decades of commercial radio programming, even as the macro carts offer ways for a particularly motivated operator to hypothetically bypass them.

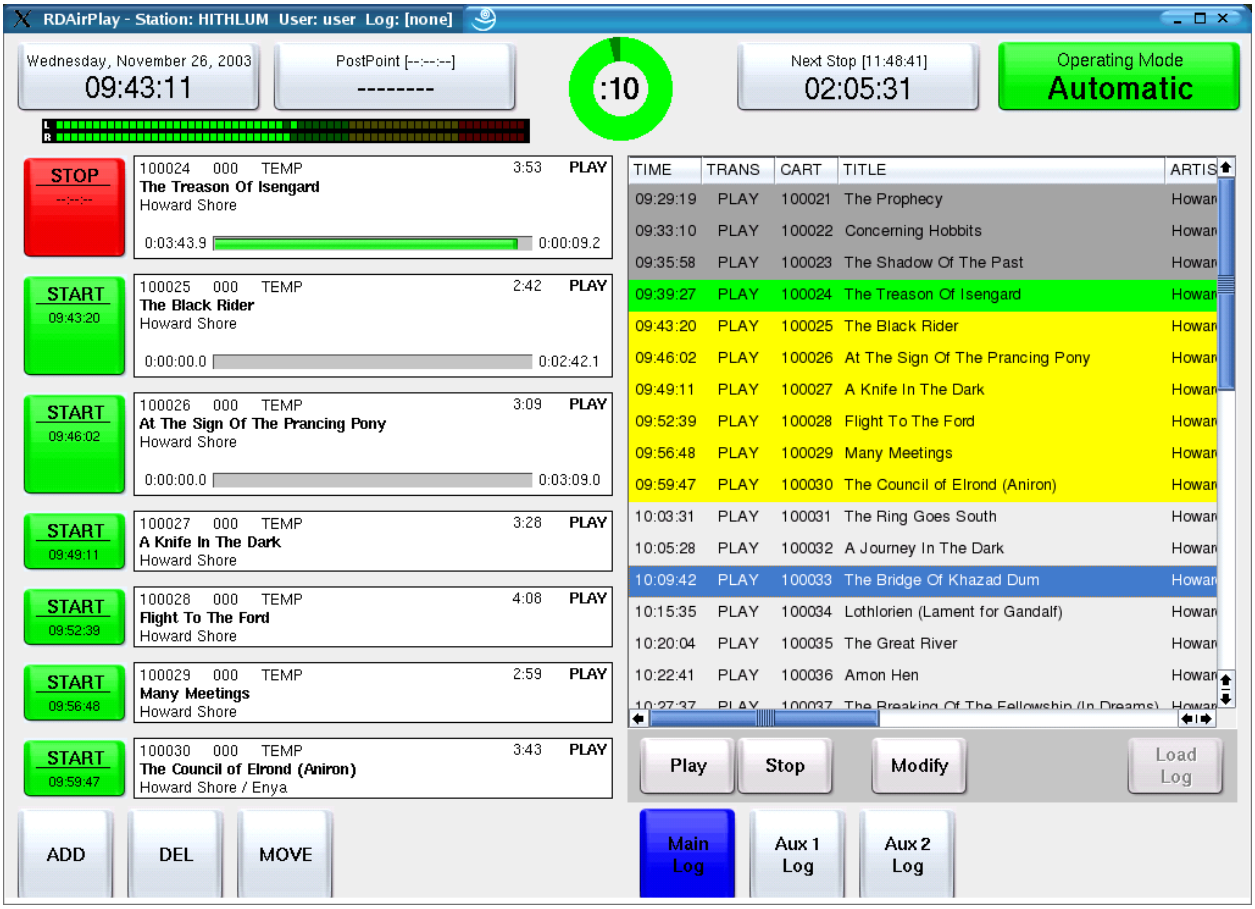

Figure 16: In a 2007 screenshot, Rivendell's RDAirplay tool automatically plays carts as sequenced by the log it has loaded. Image courtesy of Paravel Systems and the Internet Archive.

As a no-cost and high-powered radio automation solution, Rivendell soon became a popular resource for small, independent stations. Non-commercial stations with low-power FM (LPFM) licenses in particular often relied on community fundraising and sought to minimize expenses wherever possible. Addressing the directorial staff of "the low-budget sta-

[454] "Rivendell – How to Schedule Music," *Broadcast Engineering Stuff* (blog), December 31, 2009, https://thebrettblog.wordpress.com/2009/12/31/rivendell-how-to-schedule-music/.

tion" on behalf of the Prometheus Radio Project, Jeff Shaw of KDRT-LP Davis approached automation first as a matter of relations among a station and its volunteer programmers, and only second as a technical concern. "Some people," he acknowledged of the grassroots radio milieu, "might think radio automation is inherently evil." Though he rejected this idea of inherent moral valence, characterizing automation as "just a tool," Shaw emphasized that it was nevertheless a tool with distinct potential to tip balances in a station's working culture: "Behind every automated broadcast hour still lurks a human, programming logs or maintaining scripts. Regarding volunteer effort, automation as a tool can both improve station culture, or contribute to its toxicity." Citing automation's useful place in a "'volunteer-management' toolkit," Shaw's writing evinces a tendency for automation to encourage managerial hierarchies even in a progressive, volunteer-run operation. There, automation functions as a wedge between good and bad volunteer habits: "recording shows and replaying them can lead to either 'long-term volunteerism' or 'habitual absenteeism'."[455] In other words, Shaw observed that radio automation and its intrinsic relationship with prerecording could either sustain an individual volunteer's labor by temporally consolidating and reproducing it (an analogous appeal to what automation boosters like Paul Schafer had long promised for DJs) *or* sap that volunteer's motivation to produce new shows in the first place.

This pitfall aside, Shaw's automation handbook for Prometheus documented a successful use case at KDRT, which had used Rivendell since the station's launch in 2004. Automation's largest appeal at KDRT came, as for free103point9 and many other stations, through the incentive to broadcast overnight; if the transmitter turned off, listeners might hear a larger, farther away station on the same frequency and mistake its programming for KDRT's.

[455] Shaw, "Handbook on Radio Automation," 3–4.

Rivendell, at the time the only F/OSS automation software Shaw knew of (though by 2008 Campcaster, SomaSuite, and OpenBroadcaster had joined it in the handbook's list), was an appealing solution in that it cost nothing and could run on donated computers. It was not without its frictions, yet it also afforded the means to work around them, as a KDRT engineer recounted:

> Engineer Darrick Servis gives this background overview on Rivendell: "We were very stubborn about having to turn off the transmitter and didn't want to go that route. In 2004 Rivendell was extremely unpolished and very hard to install. Plus, needing to save disk space we hacked in support for mp3 files. Currently Rivendell is much easier to install and documentation has become much more robust. However, the developers of Rivendell (Salem Radio Labs) are focused on the more high-end bells and whistles. Whereas KDRT requires a suite simply to easily archive and playback audio materials at scheduled times or on-demand. The Salem Radio Labs folks are mainly radio engineers with much higher budgets to purchase high end audio cards, studio consoles, satellite receivers and switchers which can be controlled by the Rivendell software and integrated with proprietary 'traffic managers.' So suffice to say their focus is a little different then what LPFM is."[456]

In Servis's account, the open-source aspect of Rivendell—the ability to "hack" in support for MP3 playback, in this case—was key to integrating it into a different tier of the broadcast radio medium than that in which its development took place. Gleason had hoped for this kind of adaptive co-production when he elected to open-source the project.

Distributive freedom, in Rivendell's case, saw hacker liberalism run a line between out-

[456] Ibid., 25.

lets to either side of liberalism ideologically. KDRT used Rivendell to air *Democracy Now!*, the daily current affairs show (and Pacifica Network flagship program) from journalist Amy Goodman whose political coverage is considerably left of NPR's and American television networks'. At Salem stations, Rivendell aired right-wing talk shows from hosts like Mike Gallagher who routinely antagonized Muslim Americans and detractors of the country's invasion of Iraq; Salem's syndication network has provided a significant launching pad for the careers of several reactionary commentators, and the company has since its 1973 origin played an important role in articulating Christian and conservative movements across media and electoral politics.[457] But despite reaching a wide ideological spread among its users, Rivendell did not appeal to every kind of broadcaster. Its uptake followed a particular topology.

Donut theory

"The potential user community for Rivendell is a donut," Gleason explains. "The hole in the middle, which is all the big conglomerates, there's nothing there." The large station owners (Gleason lists iHeartRadio, formerly Clear Channel, and Cumulus) have all acquired or developed their own in-house automation systems that stations must use, so outside vendors like Paravel Systems—the consultancy that Gleason and Spillers formed after both left Salem—cannot attract their interest. While some Salem stations still run Rivendell, the Salem Media Group is also a commercial conglomerate; its drift back toward propietary automation software started not long after Rivendell's first release and contributed to Gleason's resignation.

The hole includes one other notable group besides commercial conglomerates: National Public Radio (NPR). Gleason had expected, early in Rivendell's development, that the project

[457] "The Divided Dial," *On the Media* (New York, NY: WNYC, 2022).

would attract interest from many NPR stations, given their not-for-profit charter. Though a "couple" of NPR stations did adopt Rivendell, Gleason came to feel that the software was "culturally not a good fit for that organization"—he attributes the lack of interest to an NPR style of internal infrastructure building that revolves around grant applications and thus pursues paid rather than free solutions.[458] NPR's inclusion in the "hole" in fact parallels the network's perhaps counter-intuitive allegiance with commercial station groups on the lobbying front. As Nina Huntemann has documented, NPR joined the National Association of Broadcasters (NAB) in successfully pressing legislators to curtail the FCC's LPFM initiative in 2000. This argument used signal strength measurement—which engineers for the NAB and FCC had each conducted independently, to opposite conclusions—as a technical proxy for a political contest over what kind (or size) of participants would be allowed to take part in FM broadcasting. To advocates for LPFM, the lobbying seemed like straightforward anti-competitive pressure that NPR extended beyond the commercial sphere in its ambition to make its network synonymous with public radio in the United States.[459]

Against this powerful allegiance spanning commercial and non-profit radio, LPFM advocates have depicted themselves in a precarious exterior. For "the vanishing breed of indies (independents)," Gleason notes, Rivendell is "very popular there. The LPFMers like it." Joining this exterior into a continuous space means overcoming differences of opinion in regard to automation as well as in regard to political agenda. Members of Prometheus articulated LPFM licensing as a non-partisan cause—*articulated* not only in the rhetorical sense but insofar as they built real (if contingent) alliances with rural church groups in order to forge an effective advocacy front under a Republican controlled Congress and FCC. This articulation functioned with more nuance at the level of infrastructure building than at that of lobbying.

[458] Gleason, Interview.

[459] Nina Huntemann, "A Promise Diminished: The Politics of Low-Power Radio," in *Communities of the Air: Radio Century, Radio Culture*, ed. Susan Merrill Squier et al. (Durham, NC: Duke University Press, 2003).

"The only type of broadcaster-applicant that Prometheus would not assist was the Christian broadcaster. They referred these applicants to another organization whose mission was to assist Christian community broadcasting groups."[460]

But Gleason's list of users continues. "And the other really interesting group, to me, is the network head-end people. It gets used at Radio America, for example.... Radio Free Asia, which is an international broadcaster, their whole operation is Rivendell." The set of broadcasters who came to rely on Rivendell was not only diverse in political ideology but also in scale. Or, rather, scale is not a linear quantity when it comes to putting different players in radio broadcasting into or out of relation within the political economic terrain of American broadcast radio in the 2000s. Radio Free Asia (RFA), a broadcaster established and funded by the US government, built "one of the largest Rivendell installations [Gleason is] aware of. They run about a couple dozen workstations on that, all networked together on one database." The considerable size and aggressive reach of RFA do not exempt it from an *us* that includes the smallest-scale local stations in the US, because the center of the donut—commercial stations owned by conglomerates—constitutes such an identifiable *them*. The delineation, even as it arranges a hegemonic center against a diverse set of margins, is still mediated by the software's practicalities. The incentive to use Rivendell, which Gleason describes foremost as financial, does not apply to a conglomerate like iHeartMedia (formerly Clear Channel) since switching to the system would entail purchasing new hardware, retraining staff, and abandoning one of their own assets in their proprietary automation system. That this financial incentive *does* apply to other broadcaster categories, regardless of their size and resources, provides a major benefit to Rivendell's ongoing development. Gleason explains that RFA funded the addition of UTF-8 character support, a deep-reaching ef-

[460] Dunbar-Hester, *Low Power to the People*, 19.

fort to enable Rivendell to display text in non-English alphabets. Rivendell is hardly the only technology to receive infrastructural support from RFA, which as the original host of the US's Open Technology Fund has shored up such large-scale internet software efforts as the Tor Project.[461]

From its outset, Rivendell incorporated a modular structure, which came along with Gleason's investment in the "cultural" principles surrounding linux: modularity is, in his words, "a tradition in Unix, which was the world Linux came out of... the culture is [to] make a tool that does one thing and does it well and make it so it can interact well through the ecosystem with things around it."[462] But in Rivendell, modularity specifically ensured flexibility of scale. Gleason began a design overview, dated April 26, 2002, by explaining,

> The overall structure of the Rivendell system is envisioned as being an interconnected system of software components. Depending upon the size of the facility served and degree of redundancy required, these functional blocks will be able to work in a wide variety of hardware configurations, from a single computer to a large, LAN connected cluster.[463]

None of the quantities that would intuitively map onto "scale" in a radio context—transmitter power, number of stations, financial backing—accurately describe a boundary for Rivendell's potential user community. But neutrality in regard to scale and politics, even as it facilitated Rivendell's simultaneous passage into some of the most and least powerful American radio operations, could not fully absolve automation of its cultural attachment to the donut's center.

[461] Dan Blah, "December Update," *Open Technology Fund News* (blog), January 15, 2014, https://www.opentech.fund/news/december-update/.
[462] Gleason, Interview.
[463] Frederick F. Gleason Jr., "Rivendell Design Overview," April 26, 2002.

Google Radio Automation

In 2004, as Rivendell reached its beta release, the software that had most directly inspired its functionality was swept up in a process of acquisitions and redevelopment that would transform it into Google Radio Automation—a vehicle through which the internet giant unsuccessfully tried to integrate itself into broadcast radio. Known best for its search engine, Google had already remade itself as a *platform* through an ad space auctioning service that provided its core revenue engine.[464] Now, investors wanted to see that its reach could extend beyond the web, and broadcast radio (alongside print media and TV) offered a chance to prove it could.[465]

Google tried to rearticulate commercial radio as part of a platformized media hierarchy where internet firms would naturally aid and coordinate other media's inner workings. For two years after launching Google Radio Automation in 2006, it found good initial purchase for this approach: Google took up Scott Studios' software and its place at industry conventions, using the established fact of automation in radio to garner enthusiasm for the improvements a sophisticated software company could make to the industry's production tools. But by 2009, the venture was brought down by problems at both the top and bottom: in an over-consolidated radio industry, Google had to operate on Clear Channel's terms and thus alienate smaller station owners. These now already-skeptical broadcasters were impressed with neither the quality of ads that Google's system brought them nor the profit it delivered, and these negative attachments threatened to make radio automation newly controversial to its users. As Clear Channel foundered in the 2008 recession's wake, Google abandoned radio automation and ramped up development of a music streaming platform in

[464] Nick Srnicek, *Platform Capitalism* (Cambridge, UK: Polity, 2016).
[465] Jessica E. Vascellaro, "Radio Tunes Out Google in Rare Miss for Web Titan," *Wall Street Journal*, May 12, 2009, sec. Tech.

its place. The articulation changed: platformization in sound media would mean replacing, not integrating, radio.

At the outset of these events, Scott Studios, helmed by founder Dave Scott, was the leading vendor in the U.S. market for radio automation software. Its products included SS32 and Maestro, flagship systems for prerecorded and live in-studio broadcasting, as well as supplementary tools like Voice Tracker that facilitated remote pre-recording for DJ shows. A 2004 promotional brochure for SS32 touted, "More stations pick Scott Studios' air studio systems than the second and third ranked vendors combined. Of the 25 largest broadcasters, 24 use Scott digital audio systems."[466] In keeping with the radio automation sector for most of its history to that point, Scott Studios was a radio company first and a software company second. Scott himself had worked as a DJ, owned stations, and helped develop syndicated programming libraries for automated stations as the CEO of TM/Century prior to launching his own automation software outfit.[467]

In October 2004, Scott sold the three companies he now owned—Scott Studios, Computer Concepts, and Scott Concepts—to Chad and Ryan Steelberg, who had founded a radio advertising company called dMarc Networks. The Steelberg brothers brought these assets together under a new firm called dMarc Broadcasting.[468] While the California-based dMarc emphasized its digital media prowess, the transformation that would ensue for broadcast radio was as much geographic and organizational as it was technical: already, control of radio infrastructure had begun shifting from *radio technology* companies toward the *technology* sector proper, and from various points around the United States toward Silicon Valley. A press release from dMarc touted the software they now owned in terms that a network or

[466] "SS32 Is Radio's Most Popular Digital System!" Scott Studios, December 14, 2004, https://web.archive.org/web/20041214212704/http://www.scott-studios.com/.
[467] Scott, Interview.
[468] "dMarc Buys Scott Studios; Looking for Others," *Radio World*, October 6, 2004.

station group owner would use:

> The integrated company will boast the largest installed customer base for radio automation and digital systems, with more than 4,600 radio station clients and over 1,800 stations in Arbitron-rated US markets. This represents over 40% of the stations in the top 50 radio groups."[469]

The former dMarc Networks had focused on integrating advertising into a new facet of terrestrial radio: the Radio Data System (RDS), or "radio text," that enables stations to encode short digital messages into their analog broadcast signals (typically the station name and current song title as displayed on a car stereo console). Pitching radio stations and advertisers on a capability to sell advertisement space within this text layer, dMarc had developed an infrastructure for radio ad sales. Acquiring Scott Studios gave dMarc an inroad, in terms of both technology and product recognition, to the heart of the medium. Analysts explained at the time that dMarc's purchase of the Scott systems "enabled them to get closer to radio stations at the broadcast point."[470] The automation products additionally served as a financial incentive for stations to give dMarc access to their advertising inventory: under a barter program announced alongside the acquisition, stations could upgrade or obtain new SS32 and Maestro systems in exchange for ad space.[471] While advertising revenue drove dMarc's efforts forward, the automation products facilitated access and integration crucial to their project.

In January 2006, Google announced that it would acquire dMarc Broadcasting. The firm's eagerness to fold radio advertising into their existing AdWords and AdSense services

[469] "dMarc Broadcasting Acquires Scott Studios, Computer Concepts and dMarc Networks' Broadcast Assets in Transaction Valued at $29 Million," dMarc Broadcasting, October 6, 2004, https://web.archive.org/web/20041206160951if_/http://www.dmarc.net/Press1.htm.

[470] Randy J. Stine, "What Google Wants With dMarc Broadcasting," Radio World, February 15, 2006, https://www.radioworld.com/news-and-business/what-google-wants-with-dmarc-broadcasting.

[471] "dMarc Offers Barter Program for SS32, Maestro," *Radio World*, February 14, 2005.

reflected what industry commentators at the time saw as a pressure on Google to prove they could expand their growth beyond online revenue streams into older media industries. Google's move into radio coincided with a similar venture into print publishing. According to the *Wall Street Journal*, the firm had been eyeing these other media sectors for some time, with the idea of eventually offering advertisers a centralized dashboard for purchasing ad space across media—and dMarc emerged as an appealing avenue through which to pursue the radio leg of that envisioned platform.[472] dMarc had combined industry credibility and an ad sales mechanism through products (SS32 and Maestro) already centrally positioned in many stations, and Google saw an opportunity to harness this combination for the entrance they hoped to make.

To legal analyst Jon M. Garon, the dMarc purchase fit clearly into Google's "strategy of acquiring companies to expand beyond ad placement into the role of ad broker and broadcaster"—a strategy, specifically, to "purchase technology companies that provide toeholds into advertising delivery in each media, allowing it to expand both horizontally and vertically."[473] By contrast, another Google purchase later that year seemed riskier and more strategically murky even from a 2010 vantage point: YouTube. Noting YouTube's continued failure to generate a net profit, Garon pointed out that "traditional media" were shrinking but still profitable; and, furthermore, that with Hulu, a web distribution channel that worked within the broadcast TV ecosystem instead of competing with it, Fox and NBC had "already earned greater revenue than YouTube on a fraction of its audience." YouTube's apparent value to Google lay in its function as a "beachhead against other participants entering the business" of digital media distribution and in its provision of synergy with the broadcast TV industry—where Google had not quite yet, at the point of Garon's writing,

[472]Vascellaro, "Radio Tunes Out Google in Rare Miss for Web Titan."

[473]Jon M. Garon, "Searching Inside Google: Cases, Controversies and the Future of the World's Most Provocative Company," *Loyola of Los Angeles Entertainment Law Review* 30 (2010): 436–37.

given up on its advertising efforts. Despite the setback with radio (and print), it still remained apparent that Google "has been motivated by a strategy to control ad placement across all media."[474]

Analysts at the time of Google's dMarc purchase responded to it as a promising experiment in media convergence: a "merging of Internet with legacy traditional media."[475] A successful outcome in this experiment, they felt, might trigger a shift in strategy from other tech giants as well as changes within the radio world. Google product manager Josh McFarland, quoted in *RadioWorld*, said that the firm viewed "radio [as] a very complimentary medium to online" for the purposes of ad sales integration, and that "dMarc is a very good business fit on both the technological level and the team level."[476] With Google bringing on the Steelberg brothers and retaining most of the Scott employees at their existing office in Dallas, the Scott Studios radio automation systems provided continuity for broadcasters as the advertising technology attached to these products underwent an ambitious expansion.

A press release from Google touted the tools dMarc had developed for automatically scheduling advertisements and placing ad audio in the broadcast programs of participating stations; the company planned "to integrate dMarc technology into the Google AdWords platform" and create "a new radio ad distribution channel for Google advertisers."[477] Automation in broadcast ad scheduling was nothing new. Only a decade or so after American radio had moved from sponsorships to the spot broadcasting model,[478] and less than a decade after the term "automation" had been coined, broadcast advertising agencies had endeavored to automate as much of the process of selling and scheduling spot advertise-

[474] Ibid., 435–36.
[475] Stine, "What Google Wants With dMarc Broadcasting."
[476] Ibid.
[477] "Google to Acquire dMarc Broadcasting," News from Google, January 17, 2006, https://googlepress.blogspot.com/2006/01/google-to-acquire-dmarc-broadcasting_17.html.
[478] Russo, *Points on the Dial*.

ments as they could, following logics of optimization and quantitative analysis similar to those Silicon Valley would tout a half century later.[479]

What dMarc had done, beyond the relatively gimmicky exploration of RDS text as advertisement space, was to begin reinventing programmatic radio advertising in a significant time and place for American technology industries: dMarc was, in the words of William "Dub" Irvin—who worked for Scott and followed the automation products to dMarc, Google, and finally WideOrbit—a "professional company in California... a completely different kind of company" from the Dallas-based Scott Studios (a "mom and pop company" by comparison).[480] For Irvin, who happily accepted dMarc's invitation to relocate to California, the opening of an industrial conduit between the broadcast technology niche and the West Coast's far more glamorous technology sector was a welcome development. To other employees and for Google itself, the merger of cultures would soon become more problematic.

By the close of 2006, Google had made its first announcement that a radio option would join services for advertisers. In a December 7 post to the AdWords blog, a member of the new Audio Ads team (quoted as "Josh M.," likely McFarland) revealed that the group had completed their effort to integrate dMarc's advertising system into the AdWords platform. The post explained that, while the new capability to purchase radio ads was not yet enabled for general users of the platform, a "U.S. beta test of Google Audio Ads with a small group of AdWords advertisers" was underway. It stressed the ease and efficiency of the integrated system, as well as the provisions for targeting and tracking that Google's data-focused approach brought to the table:

[479]Lee McGuigan, "Automating the Audience Commodity: The Unacknowledged Ancestry of Programmatic Advertising," *New Media & Society* 21, no. 11-12 (November 1, 2019): 2366–85.
[480]William Irvin, Interview, July 15, 2021.

> Google Audio Ads brings efficiency, accountability, and enhanced [return on investment] to radio advertising by providing advertisers with an online interface for creating and launching radio campaigns. You'll be able to target your customers by location, station type, day of the week, and time of day. After the radio ads are run, you will be able to view online reports that tell you exactly when your ad played.[481]

While posted to the AdWords blog, the message seemed to address advertisers already using radio campaigns, emphasizing the appeal of AdWords in terms of an increased return on investment by way of integration with a maximally datafied system.

Next, Google pitched the broadcasters on Audio Ads. Referring this time to "Google AdSense™ for Audio," a press release in April 2007 announced that the system for ad sales and delivery was "now supported by the leading radio station systems"—not only "Google's own automation systems, SS32 and Maestro," but also broadcast systems owned by competitors who had agreed to integrate support for Google's ad services.[482] The wording this time addressed station managers, explaining how the automated capacities of the new integration could benefit commercial stations without disruption:

> AdSense for Audio is an automated way for radio stations to supplement their existing revenue streams by making their inventory available to Google advertisers, most new to radio, that aren't otherwise easily accessible today. By integrating directly with stations' systems, AdSense for Audio allows ads purchased by Google's Audio Ads advertisers to be placed directly into the stations' broadcasts,

[481] "Bringing Radio Advertising to Google Advertisers: An Update," *Inside AdWords* (blog), December 7, 2006, https://adwords.googleblog.com/2006/12/bringing-radio-advertising-to-google.html.

[482] "Google AdSense for Audio Now Compatible with Industry Leading Station System Providers," News from Google, April 16, 2007, https://googlepress.blogspot.com/2007/04/google-adsense-for-audio-now-compatible_16.html.

> while at the same time making sure stations retain total control over their inventory through the tools and systems they're already accustomed to. Radio station system compatibility is built on the AdSense for Audio API.[483]

The automation systems again served as an anchor or assurance for broadcasters, as Google played down its efforts to destabilize the attached technological and financial arrangements of advertising.

Google, Clear Channel, and the "box"

At the same time that these entreaties from Google were nearing a public stage, its project showed what some analysts interpreted as a significant sign of trouble: in February 2007, the Steelberg brothers left Google. Responding to news of the abrupt departure, Google affirmed that they remained "committed to the audio business" and were still pursuing their plans for radio.[484] But the news made outside onlookers doubt that the criteria for pay-out targets Google had set in its acquisition of dMarc—an additional $1.136 billion beyond the $102 million cash purchase, contingent upon "certain product integration, net revenue and advertising inventory targets"—had been met.[485] A *New York Times* story following the Steelbergs' exit identified frustrations and skepticism toward the Audio Ads project on the part of radio station owners and advertisers. Integration with AdWords meant offering an automated, auction-style purchasing system that would let advertisers purchase time and deliver audio for their ads up until shortly before broadcast. Google insisted that an ability to reserve ad slots further in advance distinguished their offerings from what radio insiders derided as "remnant inventory,"[486] but the *Times* piece noted that the head of one partnering

[483] Ibid.
[484] Rafat Ali, "dMarc Founders No Longer At Google," *paidContent.org* (blog), February 8, 2007, https://gigaom.com/2007/02/08/419-dmarc-founder-leaving-google/.
[485] "Google to Acquire dMarc Broadcasting."
[486] "Google Audio Ads: Questions & Answers," *Inside AdWords* (blog), April 30, 2007, https://adwords.googleblog.com/2007/04/google-audio-ads-questions-answers.html.

station network had in fact used this term to describe the ad space his stations had opened through Google.[487]

The danger that Audio Ads would devalue stations' ad time was not the only thing that made some radio professionals bristle at Google. Rumors had already begun to circulate by late 2006 that a deal between Google and a newly gargantuan radio station conglomerate, Clear Channel Communications, was in the works. Clear Channel's impact on radio had been so profound as to surpass economic effects on the radio industry and extend to effects on the character of the radio medium, transformations for which the name Clear Channel served as a metonym and in which automation figured prominently. Before digital competitors for listenership emerged as "external threats" to radio, Eric Klinenberg wrote, American radio had experienced an internal erosion:

> "Clear Channel had become the industry's own worst enemy, flooding the airwaves with standardized formats, automated programs, rip-and-read journalism, endless commercials, and a uniform diet of politically partisan, parochial talk shows that dulled local radio and pushed large segments of the audience off the dial."[488]

Given Clear Channel's market share, it was hardly surprising that insiders would assume (correctly) that Google would court the firm as a partner in its radio venture. But even before Clear Channel's size in the industry led to uneven terms in their contract with Google versus smaller station owners', alienating the latter,[489] the prospect of their involvement combined with the material trappings of Google's project to provide fodder for detractors within the radio industry. A November 2006 blog post quoted the owner of a competing

[487] Miguel Helft, "Google Encounters Hurdles in Selling Radio Advertising," *The New York Times*, February 10, 2007, sec. Technology.
[488] Klinenberg, *Fighting for Air*, 63.
[489] Vascellaro, "Radio Tunes Out Google in Rare Miss for Web Titan."

radio advertising company: "Google requires a 'box' in the station to deliver commercials. If you were a station manager, would you allow Clear Channel/Google to place equipment into your station?"[490] This "box"—the Mk-14 rack-mounted server that hosted Google Radio Automation, updated from its Scott Studios and dMarc incarnations to sport a distinctive green color and a multicolor Google logo—could either embody the company's success in integrating into radio stations or become the foreign barb that provoked a kind of immune response from the radio industry's working interior.

Figure 17: The Google-branded MK 14 Server that hosted SS32 and subsequently Google Radio Automation software in station equipment racks.

[490] Donna Bogatin, "Google: Radio Star or Bit Player?" *ZDNet* (blog), November 10, 2006, https://www.zdnet.com/article/google-radio-star-or-bit-player/.

According to Amelia Arsenault, the kind of cross-media synergies that Google hoped to achieve depend on "the ability of a corporation to successfully merge cultural customs, machine code, methods of operation, and external network associations across multiple holdings."[491] Google was well equipped to handle machine code and to scale its modes of operation. It was the first and last items in Arsenault's list that tested the limits of the firm's ability and control. External associations would significantly mark the project for broadcasters who resented Clear Channel, with whom Google confirmed an "important strategic relationship"[492] on April 16, 2007, the same day it announced the new compatibility arrangements between AdSense for Audio and automation systems. Under the long sought deal, Google would become the broker for a portion of advertisement time in the schedules of 675 stations—more than half of Clear Channel's radio holdings—around the country. Having incurred negative but perhaps unavoidable attachments in radio's existing network of power, Google's fortunes now rested largely on cultural integration between Silicon Valley and the US radio industry.

The timing of multiple announcements on April 16 was hardly a coincidence. That evening, Eric Schmidt appeared as a keynote speaker for the National Association of Broadcasters (NAB) convention. The NAB has been the main trade association and lobbying group for commercial broadcasters in the US since the 1920s, and in 2007 and 2008 its annual convention would host the most visible efforts by Google toward cultural integration with the radio industry. Speaking immediately on the heels of the Clear Channel news, Schmidt could not avoid addressing this development, which was the subject of

[491] Amelia Arsenault, "The Structure and Dynamics of Communications Business Networks in an Era of Convergence: Mapping the Global Networks of the Information Business," in *The Political Economies of Media: The Transformation of the Global Media Industries*, ed. Dwayne Winseck and Dal Yong Jin (London, UK: Bloomsbury, 2012), 111.

[492] "On the Radio: More on Audio Ads," *Inside AdWords* (blog), April 16, 2007, https://adwords.googleblog.com/2007/04/on-radio-more-on-audio-ads.html.

his interviewer's (news anchor John Seigenthaler) first question. Schmidt embraced the deal as a critical success, even calling it "the defining deal for our radio business."[493] But despite this triumphant tone at the outset, Schmidt spent much of his time assuaging the sentiments that the time and place of his appearance presumably provoked—namely, fear and resentment that a rising technology giant had, just a year after deciding to enter the radio industry, inked a deal with its dominant player and been ushered into the brightest spotlight at its annual gathering, from where it might try to dictate how things were going to be from now on in a broadcast industry remade in the internet's image. To the contrary, Schmidt insisted (after Seigenthaler helped him transition into the defensive mode by noting that "you're kind of walking into the lion's den… with broadcasters here today") that "Google is a new phenomenon. It doesn't replace radio or television."[494] As the hour-long keynote progressed into questions about Google's role as a content aggregator in its relationship to broadcast industries (a one billion dollar copyright infringement suit by Viacom against YouTube and Google was also fresh news), Schmidt depicted Google both as a revolutionary user experience and as a narrowly concerned advertising business that would bring non-disruptive benefit to existing media concerns.

Radio splits the stream

Despite the strains that had become apparent with the Steelberg brothers' exit, Google pushed ahead with the radio advertising project and with the refinement of the automation software that provided its point of contact for radio broadcasters. Behind the scenes, work had already begun under dMarc's tenure to build a new code base that would underpin the software successor to the SS32 and Maestro automation systems. This process involved collaboration between California-based engineers that dMarc had hired and Scott employ-

[493] *Eric Schmidt at NAB 2007* (Las Vegas, NV, 2007).
[494] Ibid.

ees, with Irvin acting as product manager, and it accelerated under Google's ownership.[495] By May 2007 the web address google.com/radioautomation displayed information on SS32 and Maestro under the heading "Google provides complete digital audio solutions to radio broadcasters."[496] A minimum viable product for the updated system was ready by January 2008, giving Irvin and his team time to perform a first installation at Nucléo Radio in Monterrey, Mexico ahead of the software's official launch as Google Radio Automation at the 2008 NAB convention.[497]

Google's presence at NAB 2008 differed markedly from the previous year. The firm's entrance in 2007, focusing on Audio Ads, had combined the most and least visible forms of engagement between Schmidt's keynote and a series of "private meetings in suites with our customers, laying out our vision and getting buy-in;" in 2008, it joined other industry vendors on the trade show floor with an exhibit that was "primarily automation focused"[498] and that another Google employee who attended described as a "Scott Studios-as-Google booth."[499] In a demonstration for a journalist on the show floor, Irvin focused foremost on the system's utility from an in-studio broadcaster perspective, only noting toward the end that a major appeal of automation features was to arrange content remotely and in advance and thereby to reduce personnel needs.[500] The presentation indicated Google's sensitivity toward established roles in broadcasting, steering away from a consideration of whether their automated system might replace more of these roles.

The automation software was the operational object through which the union of radio broadcasting and platformized programmatic advertising would or wouldn't play out. It

[495] Irvin, Interview.
[496] "Google - Radio Automation," Google, May 16, 2007, https://web.archive.org/web/20070516065025/https://www.google.com/radioautomation/.
[497] Irvin, Interview.
[498] Ibid.
[499] Andrew Widdowson, "Re: Google Radio Automation Research Question," March 5, 2019.
[500] *Google to Present "Google Radio Automation" System* (Las Vegas, NV, 2008).

was, in Google's aspirations, what Susan Leigh Star and Geoffrey Bowker have termed a "boundary infrastructure:"

> What we gain with the concept of boundary infrastructure over the more traditional unitary vision of infrastructures is the explicit recognition of the differing constitution of information objects within the diverse communities of practice that share a given infrastructure.[501]

Facing the NAB audience, Google Radio Automation acted as a familiar yet newly high-tech production tool. From its other end, this same infrastructure was to act as a frictionless inlet to the radio medium for online ad-buyers. Google Radio Automation would create that inlet by integrating Audio Ads. The technological integration would also depend on some degree of social integration between that internet-first media world and the radio broadcasting community. That community, conveniently, had already accepted automation. But Google placed new strain upon that long-established acceptance.

Google's efforts at NAB and in promotional materials to play up continuity with Scott Studios (an updated web page in 2008 touted first the industry mainstay status of SS32 and Maestro and, second, the cutting-edge technological supports and modular architecture that Google had contributed)[502] belied a high degree of turnover in the two acquisitions. Dave Scott had left the radio automation industry soon after the sale to dMarc,[503] and a first wave of his employees departed as the Steelberg brothers closed down some projects and pressured developers to work from the California or Dallas offices.[504] Even within California, following Google's acquisition of dMarc, cultural tensions reportedly flared around the

[501] Geoffrey C. Bowker and Susan Leigh Star, *Sorting Things Out: Classification and Its Consequences* (Cambridge, MA: MIT Press, 1999).

[502] "Google Radio Automation," Google, July 25, 2008, https://web.archive.org/web/20080725170046/http://www.google.com/radioautomation/.

[503] "Radio Pioneer and Digital Systems Innovator Dave Scott Retires," *PR Newswire*, January 10, 2005.

[504] Freeman, Interview.

"brash salesman" persona that the Steelbergs cultivated—Chad Steelberg reportedly told stories about "wrestling a shark on the beach in front of his home" that resonated poorly with Silicon Valley engineers.[505] Conversely, Google's preference to hire only graduates from elite colleges foreclosed the usefulness of the Steelbergs' tactical connections in a radio ad sales world where power was far less correlated to college degrees.[506]

Ultimately, circumstances presented a clear answer to whether Google Radio Automation could succeed as a boundary infrastructure: many stations that had upgraded to the new system, including that first installation in Monterrey, never even activated the integration with Audio Ads by the time Google shuttered the project in early 2009.[507] Google had turned an automation software asset, acquired in their multi-media ad tech acquisitions, into an object that could signal their seriousness about joining the radio industry while also acting as a convenient on-ramp to stations who might join in their larger ad sales pursuits. A 2008 iteration of the web page for Google Radio Automation showed off a sleek new interface with Google-style blocks of primary color and touted "the industry's only third-generation Radio Automation System," yet still placed greater emphasis on reliability and continuity.[508] But this object was tainted by radio's internal politics before its installation began, and only in a minority of instances did both halves of this boundary object actually get to function in tandem (Clear Channel stations used an in-house automation system, so they participated only in Audio Ads).[509]

Following the Clear Channel deal, station owners found new frustration in the preferential treatment Google had, by necessity of their partner's outsize market share, offered the conglomerate in terms of inventory control and minimum pricing for auctioned ad

[505] Vascellaro, "Radio Tunes Out Google in Rare Miss for Web Titan."
[506] Ibid.
[507] Irvin, Interview.
[508] "Google Radio Automation."
[509] Irvin, Interview.

spots; and adopters reportedly saw their ad time prices driven further down.[510] Google had demonstrated that it could incorporate and upgrade radio technology with the Google Radio Automation project but not that it could produce profits for smaller actors in the industry through Audio Ads. Instead of a high-technology lifeline that could rescue and refresh older media industries, the view of Google from within radio that won out was one where it simply helped accelerate the sinking trajectory the medium had already put itself on.

Google's Clear Channel deal, almost immediately, introduced top-down troubles alongside the qualms of broadcast professionals on the ground. Just a week after the two companies announced their partnership, Clear Channel sold off 161 radio stations to Providence Equity as a streamlining measure it had initiated in 2006 after announcing plans to pursue a buy-out from another set of private equity firms.[511] That initial buy-out offer had valued Clear Channel at $26.7 billion, and Providence had agreed to take on the firm's $8 billion of debt.[512] Clear Channel, once "the epitome of the mega-media company made possible by the 1996 Telecommunications Act,"[513] began to signal a wave of deconvergence as conglomerates divested many of the assets they had raced to acquire at the end of the 1990s.

When the 2008 recession and global financial crisis hit the economy, it seemed to some analysts that the already troubled outlooks for Clear Channel and for Google's Audio Ads initiative were doomed.[514] In January 2009, Clear Channel laid off around 1,500 employees—roughly seven percent of its workforce. The layoffs fell primarily on ad sales,[515] suggesting an alignment with Google's aims to automate these roles; or perhaps a desperate optimism

[510]Vascellaro, "Radio Tunes Out Google in Rare Miss for Web Titan."
[511]Sarah McBride, "Clear Channel Sells Part Of Assets for $1.5 Billion," *Wall Street Journal*, April 21, 2007, sec. News.
[512]Frank Ahrens, "Clear Channel Sale to End Era," *Washington Post*, November 17, 2006.
[513]Jin, "Deconvergence and Deconsolidation in the Global Media Industries: The Rise and Fall of (Some) Media Conglomerates."
[514]Randy J. Stine, "Impact of Google's Exit Is Minimized," Radio World, April 13, 2009, https://www.radioworld.com/news-and-business/impact-of-google39s-exit-is-minimized.
[515]Sarah McBride, "Clear Channel to Cut U.S. Work Force by 7%," *Wall Street Journal*, January 17, 2009.

that Google's efforts would succeed.

A blog post on February 12, 2009 to Google's "Traditional Media Blog"[516] announced that the company had "decided to exit the broadcast radio business and focus our efforts in online streaming audio."[517] Citing a level of impact that had fallen short of the firm's expectations for the experiment, the post explained that the exit from radio would entail shutting down the Audio Ads program and seeking a buyer for the automation software. The post did note that Google would continue on with a newer project in ad technology for television; this experiment, though, would come to a similar end in 2012.[518] In August 2009, the media management software firm WideOrbit purchased the Google Radio Automation assets.[519] With a remolding as WideOrbit Automation for Radio,[520] this software product completed its journey through a world of new media integration, ending Google's brief tenure as a radio company.

Radio allowed the emerging internet to host "the first major instance of digital *convergence* in the contemporary media era," Andrew Bottomley argues, when college radio station began to transmit their signals as online streams in the 1990s.[521] The recession helped trigger both an industrial and formal swing toward *deconvergence* and the intensification of rhetoric that distanced "new media" from their predecessors. Google's pivot to streaming coincided with a growth spurt for the emergent on-demand music service sector: Spo-

[516] Kate Pacher, "Introducing Google's Traditional Media Blog," July 1, 2008, http://google-tvads.blogspot.com/2008/06/google-offline-goes-online.html.

[517] Susan Wojcicki, "Google Exits Radio but Will Explore Online Streaming Audio," February 12, 2009, http://google-tvads.blogspot.com/2009/02/google-exits-radio-but-will-explore.html.

[518] "An Update on Google TV Ads," *Google TV Ads Blog* (blog), August 30, 2012, http://google-tvads.blogspot.com/2012/08/an-update-on-google-tv-ads.html.

[519] "WideOrbit Acquires Google Radio Automation," WideOrbit, August 5, 2009, https://web.archive.org/web/20090808193011/http://www.wideorbit.com/wideorbit.com/index.php/company/new-press/334-wideorbit-acquires-google-radio-automation.html.

[520] Diane Perro, "More than 1,000 Stations are Live on WideOrbit's Radio Automation Solution," *Business Wire*, March 18, 2014.

[521] Andrew Bottomley, *Sound Streams: A Cultural History of Radio-Internet Convergence* (Ann Arbor, MI: University of Michigan Press, 2020), 2.

tify had launched its beta version in 2007 and would emerge as a majority venture capital owned platform company by 2009.[522] Google launched its own music streaming service in 2011. It renamed the service as Google Play Music and revitalized it with the acquisition of Songza—an independent player founded in 2010 that had helped, as Christina Baade argues, entrench expectations for ubiquitous, ambient, on-demand music in American culture.[523] Google Play Music would spend several years competing seriously with offerings from Apple, Amazon, and Spotify before Google migrated it into YouTube in 2020.

The 2006 YouTube acquisition, of course, had set in motion another possible future for Google's participation in media industries. This vision, wherein user-generated content would fuel new media that could subsume and replace broadcast media, seems like an obvious bet from the vantage of 2023, when YouTube remains a powerhouse in a crowded field of media platforms that combine amateur production, professional licensing, and social engagement.[524] Yet even in the recession's wake, it was not yet clear that this vision would win out. Garon wrote:

> The question remains whether Google's acquisition of YouTube was a short-sighted folly or a long-term strategy for dominance. If the broadcasters continue to decline, a central site that delivers content to computers, portable music/video devices, cellular phones and Internet-equipped televisions could become the new media hub.[525]

For Google's (new) new media vision to succeed, in other words, broadcast media needed

[522]Maria Eriksson et al., *Spotify Teardown: Inside the Black Box of Streaming Music* (Cambridge, MA: MIT Press, 2019).
[523]Christina Baade, "Lean Back: Songza, Ubiquitous Listening and Internet Music Radio for the Masses," *Radio Journal: International Studies in Broadcast & Audio Media* 16, no. 1 (April 1, 2018): 9–27.
[524]Thomas Poell, David B. Nieborg, and Brooke Erin Duffy, *Platforms and Cultural Production* (Cambridge, UK: Polity, 2022).
[525]Garon, "Searching Inside Google: Cases, Controversies and the Future of the World's Most Provocative Company," 435–36.

to fail decisively. Deregulation, consolidation, and financial crisis had ensured that they would hardly need Google's help in doing so.

Conclusion: sonic seams in *Playlist* and *The Joy Channel*

The notion—and the sounds—of a failing medium offered new source material for artists in the 2000s. Some of their artworks went further, though, than reveling in radio's apparent disintegration; they aestheticized that disintegration and, taking up some of the parts it had shaken loose, modeled new ways they could become creatively useful.[526] Sharing in an imaginary of subversion and destruction that Christof Migone's *Radio Naked* had developed (see Chapter 3), works by Wobbly (a.k.a. Jon Leidecker) and by Anna Friz and Emmanuel Madan responded both to the political economic situation in radio and to the material affordances that had emerged in a radio landscape with increasingly stark differences between center and periphery. Wobbly's *Playlist* and Friz and Madan's *The Joy Channel* amplified three things at once: the stale and cynical sonics of centralized corporate radio, the affective relief that noise and density offered, and the possibility of directly repurposing corporate radio's tools to free the medium from corporate control. *Playlist*, more directly than any other artwork this study has identified, seized on radio automation's sounds and tools in this process.

Since the 1980s, Don Joyce's show *Over the Edge* on KPFA Berkeley had repurposed cart decks in an experimental anti-format that celebrated much of what radio automation promised to eliminate: liveness, improvisation, and cacaphony (see Chapter 3). Jon Leidecker—who had in the 1980s turned from an avid *Over the Edge* listener to a collaborator with Joyce and Negativland and in 2015 would become the show's new host after Joyce's passing—carried this ethos forward in his own, sampling-centered work. In 2002, Leidecker released an album called *Playlist* under his moniker Wobbly. *Playlist* made prominent use

[526] Heidi Grundmann et al., eds., *Re-Inventing Radio: Aspects of Radio as Art* (Frankfurt am Main, DE: Revolver, 2008).

of promotional audio from the automation service Broadcast Programming International (BPI). Releasing the album on mini-CD, Leidecker spliced nine interstitial recordings into the countdown space of the album's longer tracks. Each interstitial featured sounds of BPI spokespeople touting various formats available for automated playback. Leidecker's selections amplified musical programming's extreme fixation with demographic categories: "the affluent, loyal, 35–64 year-old audience, what we call the money demo," for instance.[527] Together with the spokespeople's upbeat and carefully enunciated diction, they presented a perfect backdrop of sonic squareness for the frenetic and irreverent sampling in the Wobbly compositions: "The obvious thing to do was to [take] the most unlistenable bits of music I'd been working on and cut it in as if that was what they were selling."[528] But Leidecker's use of BPI material was not random; it was bound up in his day job and a web of technical affordances that transected his artistic and professional spheres.

Leidecker, at the end of the 1990s, worked for the radio technology company Orban as a software tester on a new automation product. Orban, which had gained a major industry foothold through its Optimod signal processor (which, Leidecker notes, became central to the sound of rock radio), joined in a long tradition where trusted radio engineering brands added automation to their product lineups. Their digital system, dubbed Airtime, faltered in a suddenly oversaturated PC radio automation market; Orban scrapped the project around 2000 due to internal staffing problems, as Leidecker recalls. But the project advanced far enough that it brought in materials like the BPI CD and immersed Leidecker—for whom, since high school, community radio had been a forefront occupation ahead of his artist practice—in the world of automation and the various ways it worked to alter the medium.

[527] Wobbly, *Playlist*, Mini CD (Illegal Art, 2002).
[528] Leidecker, Interview.

Orban also marketed a digital audio workstation (DAW), Audicy, primarily to producers in radio—the designers tailored it to "electronic cart" production and facilitated easy uploading of carts from the editor straight into an automation system like Airtime or Broadcast Electronics's AudioVault.[529] Leidecker also worked on Audicy, and this early DAW became his "introduction to digital audio." It featured, he recalls, certain affordances that would soon fall away from DAW design conventions when Digidesign's Pro Tools won out as the industry leader. Furthering the continuity between broadcast carts and random access memory, Audicy recorded into the computer's RAM rather than onto a hard drive. Motivated by insufficient hard drive speeds at the time, this choice constrained the recording duration but led to rapid and responsive controls: Audicy was "much more of a hot rod and much faster at editing than the early versions of Pro Tools." The software also featured a unique "scrub wheel algorithm," designed by Barry Blesser for non-linear movement across the audio timeline, that yielded many of the "weirder" sounds on *Playlist*.[530]

Playlist records an insider send-up of automated radio and an audio collagist's passage into digital sound, both parts tangled in a mix of professional and artistic contacts. Much as his mentor Don Joyce had done by multitasking with work and broadcast-sampling, Leidecker found ways to pull creative dividends from a technology job; and the engineers he worked with were happy to see that repurposing, as he recalls:

> They ended up giving me one of [the Audicy systems] or letting me take home one because... I began spending a lot of a lot of time composing music on it. And that warmed their hearts. Engineers love it when they see young kids doing creative, unexpected things with them and making music.[531]

[529] Rob James, "Review: Orban Audicy," *Studio Sound*, June 1997, 10.
[530] Leidecker, Interview.
[531] Ibid.

This sanctioned creative side-use reflected Orban's San Francisco Bay Area setting, where artist groups and technology companies had long intermingled to unusual extents (for instance the San Francisco Tape Music Center and its relationship with Ampex). "A lot of the other people working at Orban at the time were Mills College electronic music graduates," Leidecker recall. "So it was a scene.... It was a cool environment." But even if this conduit to one of the country's most noteworthy experimental music centers was unique in the broadcast technology industry, Leidecker sees the way he traveled it as part of a pattern that has played out in music for at least a century. As a historian of musical practice (his nine-hour series *Variations* for Radio Web MACBA explores the history of sampling),[532] he believes that automation as a category encompasses other forms of sonic mediation—including sound recording itself—and that reactions to automation have continually catalyzed musical change: "When I think about the history of electronic music, I'm always trying to come up with master threads of why certain kinds of electronic genres happen; and it's always creative responses to automation."[533]

Playlist took part, for Leidecker, in a continual process where engineers replicate musical labor in a new mechanism and musicians then find ways to derive unexpected sounds from the same mechanism. Under this model, automation does not augment creative agency amid chaotic systems, as John Cage and other avant-garde artists had understood it to in the 1960s;[534] rather, by abstracting working routines and introducing new technical objects, automation inadvertently creates opportunities for creativity. This version of creativity is one that, rather than extending and negotiating control, rides atop the crest of a wave that would continually subsume and quash creativity. If automation had facilitated broadcast radio's hyper-rationalization, then its supporting materials (both software tools

[532]"Variations," *Radio Web MACBA* (Barcelona, ES: Museu d'Art Contemporani de Barcelona, January 6, 2011).
[533]Leidecker, Interview.
[534]Turner, "Romantic Automatism: Art, Technology, and Collaborative Labor in Cold War America."

and promotional sounds internal to the industry) could be flipped and repurposed to expose the absurdity of that over-rationalization; and further, to herald its overcoming by glitching sounds that seemed immune to rational control.

The Joy Channel, which Anna Friz and Emmanuel Madan first performed in 2007, is a work of speculative fiction audio art that made radio transmission central to its narrative, to its sound production, and to its own dissemination. In its story, it depicted a clash between ultra-consolidated broadcasting power and a diffuse, bodily, affective mode of transmission; in its execution, it convened artists and institutions around the goals that two distinct projects—experimental sound art and licensed community broadcasting—held in common.

For the piece's first version, Friz and Madan responded to a call from Berlin's TESLA Gallery. The Radiovisionen: 250 Jahre Radio series asked artists to imagine what radio would sound like 150 years into the future.[535] Friz and Madan's answer drew on either's explorations in radio art and software art. For Friz, the project extended a practice that centered embodiment, affect, and autonomy in and through transmission. Madan had, since 1997, been half of an artist duo called [The User] with architect Thomas McIntosh. [The User] used sound to probe architectures, technical objects, and ideas about automation and instrumentality.[536] Their installation works included a quartet of software-controlled and microphone-amplified dot matrix printers, as well as *Silophone*—an internet-connected audio circuit that piped user-submitted sounds into an abandoned grain elevator and returned the reverberations. Reflecting a larger media-infrastructure crisis in the wake of 1996, a familiar theme of collapse haunted this work as beset radio at the time: "in the *Silophone*, social decay also overlays sonic decay: the decaying structure of a largely abandoned building; the decayed dreams of circa-2000 net art; and the decay of media formats and technical

[535] Friz, Interview; RadioTesla, "Willkommen/Welcome," Radiovisionen | 250 Jahre Radio, June 25, 2008, https://web.archive.org/web/20080625215452/http://www.radiovisionen.de/willkommen.php.
[536] Emmanuel Madan, Interview, August 6, 2022.

infrastructures."[537]

Like many speculative fiction authors, Friz and Madan imagined a world outward from its central threat: for them, high-powered commercial radio transmission. In their dystopian North America of year 2157 (or 2146—in the second version, the setting changed from 150 years after the work's debut to 150 years after 1996), "[w]hat remains of contemporary American capitalist republicanism has relocated to the geopolitical stronghold known as Fortress Alaska, which is still rich in fossil fuels and benefits from a now balmy climate."[538] From here, the monopolistic Hi-Zenith Corporation broadcasts across the continent with a power that exceeds mere sonic transmission. As Friz explained in her dissertation,

> Madan and I proposed that in the future radio would no longer be characterized by broadcast programming as it is currently understood, but would feature the transmission of actual emotions.... Drawing upon familiar science fiction tropes such as a future post-apocalyptic landscape and a struggle between a corporate establishment and corporeal outlaws, we imagined the invention of "emo-casting", the commercial product utilizing this recording and transmission of brain waves which would seek to dominate the airwaves with the broadcast of emotions.[539]

Like executives at Muzak in the 1950s, Friz and Madan envisioned the frictionless transmission of mood as the end goal of commercial radio programming. With "emo-casting," that programmatic telos transcended the underlying broadcast technology. In contest with the dominant corporation, the story's "corporeal outlaws"—or "wavefinders"—keep

[537] Jonathan Sterne, "Learning from Silophone," in *[The User]: Instruments, 1997–2008*, ed. Daniel Canty and [The User] (Berlin, DE: Künstlerhaus Bethanien, 2014), 62.
[538] Anna Friz, "The Radio of the Future Redux: Rethinking Transmission Through Experiments in Radio Art" (Toronto, Ontario, York University, 2011), 191.
[539] Ibid., 175–76.

up a scattered community outside Fortress Alaska and experiment with the capacity for "tele-empathy" that underpins emo-casting. In these opposed parties, Friz and Madan made clear reference to radio corporations and ham radio operators. They developed that division through contrasting approaches to radio sound.

Much like *Playlist*'s alternation between an automation company's promo-speak and Wobbly's dense sample collages, *The Joy Channel* juxtaposed emphatically corporate sounds—inane banter from a DJ character, peppy jingles sourced from network-era sponsor announcements, cold recitations of disclaimers—with ethereal, dissonant drones that emerged from and receded into static. Many sounds in the latter category were sourced from low-power FM transmitters and receivers, which Friz had been deploying in "live performances, installations, and pirate interventions since 1998 in order to create self-reflexive art where radio is the source, subject and medium of the work."[540] This characterization applied also to *The Joy Channel*'s second version, which the Austrian public broadcaster ORF's program Kunstradio commissioned in 2008 as a piece to be played on the air. Friz and Madan began developing a third, expanded of the piece through a 2012 residency at Wave Farm,[541] the site that free103point9's Galen Joseph-Hunter and Tom Roe had established in New York's Hudson Valley as they prepared to leave Brooklyn. In that version, the wavefinders—now given speaking roles, with lively chatter modeled after ham radio practices—find a way to disrupt and "sabotage" the corporate emo-casts.

Stitching together techniques and sounds from broadcasting's apparatus, Friz and Madan sonified and dramatized an idea that North American radio contained the means of its own undoing. By projecting American radio's newly stark center-versus-periphery layout into the future, they put dystopian tropes to work in suggesting that any new technical

[540] Ibid., 4–5.

[541] Anna Friz, "The Joy Channel (I & II)," Anna Friz, accessed October 19, 2020, http://nicelittlestatic.com/sound-radio-artworks/the-joy-channel/.

breakthrough in transmission would be swept up in the same cycle of capture, devastation, and refashioning. This future projection also helped them express the hope that people on the medium's margins might yet win back influence over its character—if only haphazardly, through individual and unplanned acts—from centralized power. Transmission art had come about partly on the momentum of a pessimistic turn in sound artists' sentiments toward broadcast radio. Now, in addition to Canadian stations like CKUT Montreal and CITR Vancouver—where Friz and Madan, as well as Christof Migone, had honed their own radio art practices in the 1990s—the same kind of institutional foothold seemed possible within American radio. In 2008, the FCC awarded Wave Farm a permit to begin constructing a full-power community broadcast station. That station, WGXC Acra, launched as an online station in 2009 and would hit the FM airwaves in early 2011.[542] Transmission art, a movement that probed at broadcast radio from outside its technical and regulatory borders, had opened an enduring conduit into the medium proper.

Automation, throughout this decade of sped-up consolidation and reconfiguration for radio, had on one hand retained its status as a symbol for what artists reviled in American radio: it was immediately present in *Playlist*, which turned the promotional sounds of automation-syndication inside-out, but also in the robotic contours to the voices and power of the titular emo-cast in *The Joy Channel*. On the other hand, aided by a proliferation in F/OSS tools, automation took up its place in the broadcast studios of stations who shared those artists' general outlook. WGXC, at its launch, used Campcaster to automatically air syndicated noncommercial programs such as *Radio Survivor* and continues to rely on automation software today.[543] Counterintuitively, automation had settled without major controversy (though surely with smaller controversies at individual stations) into this anti-

[542]Joseph-Hunter, "Out of the Air: A Case for Transmission Art."
[543]Roe, Interview.

corporate tier of the medium and kicked up considerable controversy in its most familiar context, commercial radio.

In both contexts, a problematic materiality remained as automation settled more deeply into a virtual form. For Google, radio automation initially offered a powerful and convenient inlet for the company and its ad tech to enter the radio industry; but as the project began to take on negative associations—a partnership with Clear Channel and a reputation for low-quality ads—the physical server box routing a station's signal chain through Google Radio Automation was readily available to symbolize those attachments. In Rivendell, the persistence of carts, clocks, and logs structured a default operation that maintained radio automation's managerial control logics—and even forwarded them to anti-corporate, volunteer-run stations. The project's F/OSS-inspired flexibility masked, or at least proved a worthy trade-off for, these predispositions that had inhered in automation software. In transmission art and the artistic micro-radio pursuits that had preceded it, comfort with contingency and with repurposing unsavory actors' tools was part of the process. The disposition that these artists had advanced, first in loose affinity with pirates and LPFM advocates and eventually in direct cooperation, was one that could process internal contradictions and ambiguities through its orientation against a clear dominant force. They articulated radio not as a medium that should become stable again but rather as a site for disassembling and reassembling processes of mediation. Automation had, over the course of sixty years, aided this process from an opposite starting point: it had rationalized and stabilized radio routines to such an extent that absurdity and instability came to characterize the medium it had helped hollow out.

Conclusion

I end this thesis with the consideration that someone will perhaps come to it wondering what kind of automation to install at their radio station, or whether to incorporate AI in their sonic art practice, or perhaps how to design their own automatic tool for broadcasters. Automation does not on its own determine the social situation around it, nor is it a "determined technology";[544] broadcasters and artists have for decades been adapting it (or its components) to help realize ideas outside of commercial radio's narrow interests. Yet the characteristics I listed in the introduction—programmatic, linear, managerial, re-centralizing, and synonymous with pre-recording—are often already latent or ready to impose themselves on non-commercial settings. Automation has shown considerable power to nurture them, turning these tendencies into standard operating procedure in individual stations and into qualities of the radio medium at a general, national level. They must be countered directly and intentionally if the people installing and using an automation system do not want them to characterize their station. For AM/FM broadcasters, the question about radio automation for most of its history has not been whether to invite and grapple with these tendencies; it has been, simply, whether to turn off the transmitter every night or to automate. With the start of the COVID-19 pandemic, the choice for many stations became even more stark: to shut down indefinitely or to automate.[545] Now, these stations face the difficult task of disentangling unintended changes in their operational culture from the vital flexibility automation offered. To draw out some considerations that might guide this task, I will start

[544] Williams, *Television*.

[545] Evan Minsker and Noah Yoo, "How College Radio Is Responding Amid Coronavirus-Prompted Campus Closures," *Pitchfork* (blog), March 16, 2020, https://pitchfork.com/news/how-college-radio-is-responding-amid-coronavirus-prompted-campus-closures/.

here from the most recent moment in the history I have covered and work back through the chapters.

In Chapter 4, I showed how this same challenge arose (and remains unresolved) with the utility that free software tools for radio automation offered anti-corporate broadcasters. The free and open source software (F/OSS) community overlapped ideologically and rhetorically with the pirate, activist, and artist-run radio scenes that galvanized the low-power FM movement. Yet a F/OSS radio automation project like Rivendell did not automatically confer democratic qualities on automation, whose default workflows maintained sturdy roots in the commercial, hierarchical context that had shaped it. As Jeff Shaw of KDRT-LP Davis put it, the flexibility that Rivendell offered at the community station seemed to usher broadcasters into one of two groups: long-term volunteers, for whom pre-recording and automation averted burnout, or habitual absentees, for whom the same working order sapped motivation to broadcast new programs.[546] Any station, in considering automation, should also consider the existing social dynamics that this wedge will enter. Which volunteers already trust that the time they spend producing a new show each week will be worthwhile? Which volunteers, rather than feeling they take part in a lively circulation, might already suspect that their main function is merely to *fill a gap* in the station's programming?

Radio automation controversies extend beyond questions of volunteer retention, and certainly beyond Rivendell. Automation still retains an imputed, coarse politics that—as Shaw noted in 2008—often characterizes it as fundamentally anti-autonomy if not "inherently evil."[547] Automation does not negate autonomy in radio; but it is also not simply a tool. "The automation" might be a particular machine or application at a radio station, but radio automation as a category overlaps uses of recording and software in general—practices that

[546] Shaw, "Handbook on Radio Automation," 4.
[547] Ibid., 3.

are by now ubiquitous in broadcasting. Even if these infrastructures could be simply discarded, to do so would be to disengage from work that refreshes radio's meaning. Any effort to renegotiate radio's forms and radio's place in a changing media ecosystem will, necessarily, involve negotiating with (if not *through*) radio automation. That necessity, which corporate powers have felt just as keenly as autonomous media activists, gave rise to Google Radio Automation—a project that aimed, very plausibly at the time of its origin, to merge broadcast media and internet platforms through a shared advertising infrastructure. Google's effort to *rearticulate* radio ended in decisive failure, while a post-1996 community radio movement won regulatory victories and institutional footholds for theirs. I have argued that the latter group owed their success partly to a comfort with the *disarticulation* that must accompany rearticulation. Transmission arts, which established an ongoing conduit to American community radio with Wave Farm and WGXC Acra, became an arena for this ongoing process; its techniques that undo radio's medium-ness can be useful within the medium, to broadcasters seeking to forge more deliberate relations with their broadcast technology.

The cycle that led avant-garde sound artists toward transmission arts swung, as I showed in Chapter 3, between optimistic and pessimistic outlooks over the course of the 1980s and 1990s. It played out in parallel with radio workers' hopeful and bleak assessments, which in their case responded more directly to the opportunities that microcomputers or personal computers introduced to an already heavily automated medium. On the pessimistic side, displaced radio workers like April Feld saw that computers were cementing the medium's domination by program consultants and their conservative, over-rationalized edicts for music radio. For others, like Alan Freeman, this development was not negative; if DJs or engineers became computer programmers, they could make themselves highly valuable to the broadcast programmers and to the whole medium by building software (such as Free-

man's Digital DJ) that extended managerial control. In the middle ground, Lance Leupold lamented the centralization of control that automation had so far brought to radio but saw in microcomputers a chance to design new resources that would increase DJs' autonomy and satisfy station owners at the same time.

Even as a similar hope for computational reconfiguration guided some of most influential American sound art of the late 20th century—Pauline Oliveros's sonic meditations—musicians rarely applied this techno-optimism to radio. Instead, avant-garde and popular musicians alike described radio as homogeneous, closed-off, and "dead."[548] Within that discourse, automation became an avatar for the corporate consolidation and hyper-rationalization that they blamed. It helped spur a sense, by the 1990s, that artists interested in radio had better pursue radical departures rather than adaptations for the medium; well ahead of 1996's acceleration to radio automation and those attendant forces, the cultural groundwork had already shifted toward disarticulation. The figure of the sonic programmer had taken on new meanings and new power in this process, both by embracing control (as with automation software developers) or by redistributing it (as with Oliveros). But not all accepted the control relationship that programming entailed. One way out was to misappriopriate broadcast technology, as Don Joyce and collaborators did on *Over the Edge* when they put looping tape cartridges to work in live broadcasts that opposed nearly every quality of programming that automation enforced. Another was to misappropriate the organizational power invested in the programmer role itself: to think from the vantage point of this figure poised to issue instructions for the medium, and to imagine how that capacity might undo itself. This disposition, which I call *deprogramming*, guided Christof Migone's 1992 work *Radio Naked*—a speculative instruction manual that can help programmers begin

[548] Moss, "The Beat and the Box."

eroding arbitrary confines that professional and technological arrangements maintain in radio.

In Chapter 2, I showed how the those confines settled into place when radio automation first flourished. Through the 1960s and 1970s, automation went hand in hand with rationales about professionalism and commercial profit—even at stations that had structural guards against all three. Those stations included CJRT Toronto, where the presence of a new automation system became a cudgel to ward broadcasting students away from the station that was intended to serve as their training lab; and WCFL Chicago, whose ownership by organized labor did not spare it (or its air staff) from automation.

Automation's steady momentum earned skepticism within the broadcast industry, particularly in depictions on TV; but even techno-skepticism could be leveraged in favor of the social order automation helped maintain. White media producers (including, oddly, a spokesperson for a leading automation vendor) felt that automation posed an inherent threat to authenticity for Black broadcasters. They articulated this sentiment in a way that held both automation and Black empowerment in suspicion, insinuating that affirmative action and race-conscious approaches to broadcasting would sap Black radio of its authenticity just as much as automation. But at WJLD Birmingham, automation was not an existential threat to authenticity for the station's Black air staff; it was an ambivalent mediator in their ongoing struggles with the station's white management. WJLD's automation system did not purely serve to enforce the managers' rules, but also afforded what staffer Ron January called *reprogramming*—swapping tape reels and carts out ahead of schedule, working within the confines of the system but using strategic deviation to make up for its unimaginative use and robotic sound. The addition of racist segregation at WJLD to the usual labor/management divide may help explain why this disposition was not more widespread

among radio workers elsewhere: white DJs often aspired to enter management (by becoming program directors, principally), where they were promised (even as their Black peers were warned against) new degrees of power and creativity through automation. This creative empowerment through control could extend an individual's reach to wide swaths of the radio medium, whether they intended to streamline and rationalize it—as did program consultant and automation tape vendor Bill Drake—or to invert it as in Max Neuhaus's artistic radio interventions.

Before radio automation could elevate the radio programmer as a technologically empowered medium-controller, a more subtle and more enduring logic of *musical programming* helped automation secure its contextual meaning for radio. Chapter 1 showed how Muzak, which had built an industry around musical programming—simultaneously, the instrumental control of music and the *use of music* to control worker and consumer behavior—established with its Programatic Broadcasting Service the technical, commercial, and aesthetic configuration that would propel radio automation. This configuration depended on the innovation that broadcast engineers had performed to bring about radio automation in the first place: Ampex's "automatic programming" system and other, parallel inventions used subaudible "cue tones" to grant sound recordings the ability to control the machines that played them back. To these engineers and organizations, cue tones simply extended existing techniques that used magnetic tape for long-running and modular playback of sound recordings. Many of the potentials, and much of the controversy, that automation would confer for artists or station managers were thus already active with transcription disk syndication and network programming. They were active, too, in the same figure whose work automation would most directly consolidate, displace, and regulate: the DJ. As DJ shows made up more and more radio programming through the 1940s, they (by necessity, as net-

works moved on to TV) had helped shift American radio's function away from *relaying sonic events* and toward *filling time with sound*. From the perspective of working musicians and their labor representatives, the practice created an equivalence between sound reproduction and automation—a term, as I argued in the introduction, that the American Federation of Musicians would likely have applied during their 1940s recording bans had it been coined in time.

Would a truly pro-labor radio station need to dispense with recorded audio entirely, then? I do not believe so, but I do believe that a useful first step toward reforming radio automation—that is, toward retaining the vital convenience radio operators have found in automatic tools without inviting in managerial and programmatic tendencies—is to imagine automation without sound recording. Artists have already put that imagination into practice, as when Neuhaus used custom automatic devices to carry out his medium-inverting *Public Supply* and *Radio Net* productions. The New Zealand and UK-based artist duo r a d i o q u a l i a developed a "Free Media Timetabling System" called the Frequency Clock starting in 1998; "a networked timetabling system, connecting globally dispersed FM transmitters so they could broadcast the same internet audio simultaneously,"[549] the Frequency Clock rearticulated radio in the internet age as an endpoint for horizontally-shared, live, artistic broadcasts.[550] More recently, the p-node platform, centered in France, has followed similar motivations and developed tools to support and relay autonomous radio broadcasts through internet audio delivery; streams that are currently "live" are marked as such and boosted to the top of an aggregate list on the group's homepage.[551] Since 2014, an event and web platform called Reveil has assembled live audio streams from around the

[549] Radioqualia, "Frequency Clock Free Media Timetabling System," 2002, http://openfc.sourceforge.net/.
[550] Radioqualia, "The Apparatus As Interstice: FM & Real Audio Bisect via The Frequency Clock," 1999, https://web.archive.org/web/20160312035115/http://radioqualia.va.com.au/ctl/texts/hh1.html.
[551] "∏Node," accessed May 1, 2024, https://p-node.org/.

globe one day each year, transitioning between streams in different time zones to follow the dawn.[552] These projects, while still often ad-hoc in character, move away from the singular authorship of Neuhaus's radio interventions and closer to infrastructures that stations can use on an ongoing basis. They suggest answers to the question that liveness as a constraint can pose of automation: if recordings cannot be used to keep the transmitter running, what other sounds would take their place? With network phone lines and later satellite dishes, commercial radio and NPR have long used technology for live syndication; independent stations and their automation systems have so far under-utilized the capacity internet audio gives them to boost and make use of one another's live broadcasts.

But liveness, which as a category only arose in fetishistic contrast to recording,[553] does not in itself oppose automation's tendencies. We have to untangle transmission from recording, even if the two actions can never be fully, ontologically separated in any actual media situation.[554] We can still attend to the fundamental, phenomenological differences between pre-recording a radio program and sending audio straight to a transmitter—this is an effort that transmission art aids very directly. Even less intrusive mechanisms of recording than automation make a difference in the affective, experiential registers where radio *as activity* finds its meaning: "Intrinsic to pirate radio," Matthew Fuller argues, "is that the hardware delay loop operated by all other stations, by means of which any transmission can be screened and brought back from the brink of the forbidden, has been taken out."[555]

The opposite of automated radio is not live radio but rather what Fuller hears in pirate radio and what WJLD personality Shelley Pope enacted when, sometime in the the late 1970s, he cast off the term "DJ" and called himself a "human radio station." Pope's monologue dis-

[552] Ella Finer, "Soundcamp 2020 / The Reveil Platform / Acoustic Commons" (Acoustic Commons, October 22, 2020).
[553] Philip Auslander, *Liveness: Performance in a Mediatized Culture* (London, UK: Routledge, 1999).
[554] Peters, *Speaking into the Air*.
[555] Fuller, *Media Ecologies*, 33.

assembled the station into its component parts—tower, transmitter, turntables, building—and claimed the whole apparatus as part of a radiophonic self.[556] Encompassing radio in this way went together with apprehending the possibility for refusal: if one *is* the medium, one can cease to mediate. Pope's on-air resignation from WJLD, as recalled by a colleague, brought racist management conditions out from behind the scenes and left the station airing the noise of a record's soundless inner groove (without which, it is quite likely that WJLD's automation system would have detected silence and kicked in).

Refusal, not liveness, is what counters managerial control; it is, along with deviation from the encoded rules, what automation-as-sabotage forecloses. In radio, if a station can be said to use automatic technology on the station's and not the technology's terms, it must first be true that refusal, deviation (e.g. "playing the wrong kind of music,"[557] as one automation booster complained in 1966), and error are not only possible but consequential. These are eventualities that radio's owner class reduced in order to establish the "opacity" that radio needed if it was to succeed as a medium.[558] By delegating that reduction to radio automation, they set in motion a process that left so little variation in radio sound that radio's meaning frayed and its automatedness became audible. Radio today largely acquires new meanings when artists, fans, or broadcasters call attention to the distinct technologies and protocols that its producers once sought to hide. Transmission artists take up this disposition, but so do radio nostalgists. Among them, admirers of radio automation's pre-1980s golden era have painstakingly restored vintage automation systems in their garages and basements, delighting in the look, feel, and sounds of technology that was never itself meant to be seen or heard by listeners.[559] Radio automation, in spite of and in excess of its best efforts, has

[556] Pope, *I'm a Human Radio Station*.
[557] Raney, "Automation Panel," 64.
[558] Gitelman, *Always Already New*; VanCour, *Making Radio*.
[559] "Analog Radio Automation with Todd Edwards," *This Week in Radio Tech*, September 24, 2021.

helped people open up a medium to see what else can be made from its parts.

What will generative AI unmake?

Media industries now face an interlocking set of crises around a present wave of generative "artificial intelligence" applications that re-synthesize text, sound, and images out of material scraped from the internet. Generative AI has upset industrial relations between media workers and companies, has raised legal and ethical questions around plagiarism and its detection, and has set off debates over how creativity and skill are valued.[560] How can the history of radio automation help us understand the cultural trajectories that generative AI might be on? The relative degrees of technical complexity, to be clear, are vastly different. So too are the modes of appeal that have helped install these two forms of automation: radio automation has been pitched to a narrow audience of internal managers and producers in a specific practical context, while generative AI companies typically bill their products as universally applicable, consumer-facing utilities. In many cases these applications aim to automate mediation itself, for instance removing the step of selecting a search result from in between the steps of entering a query and of seeing web content. Yet, like tape players in the early 1950s, these mechanisms are fundamentally "reproducer machines"—even if a far more complex intermediating chain stands between source and output. This media automation, like radio automation did seventy years ago, involves categorizing units of expression so they can be reassembled in automatic, modular, and content-agnostic fashion.[561]

But more significantly, the primary use cases so far for generative AI—the channels that its output populates, that is—were already characterized by extensive automation of *distribution* by the time this new automation of (image, text, sound, video) *production* became pos-

[560] Jenna Burrell, "Automated Decision-Making as Domination," *First Monday*, April 14, 2024.

[561] Emily M. Bender et al., "On the Dangers of Stochastic Parrots: Can Language Models Be Too Big?" in *Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency*, FAccT '21 (New York, NY, USA: Association for Computing Machinery, 2021), 610–23.

sible. Generated text makes up more and more top results in web search, a medium whose basic premise always involved a high degree of automation and that, through increasingly complex and interconnected programmatic advertising systems, had strongly incentivized textual recycling of the very kind that GPT et al. now automate. AI-generated images, meanwhile, show up in the endless-scrolling "feeds" of platforms like Facebook that have already hurried along several rounds of race-to-the-bottom devaluation for web publishing. Internet media have provided the informatic and cultural prerequisites for generative AI by (for the most part unwittingly) supplying training data and establishing automation-friendly processes of representation, in what Mark Andrejevic calls a pattern of "social de-skilling… in the communicative realm."[562] Now, these same media appear in popular discourse as victims of the automation they have inculcated. Retracing pronouncements by radio artists in the 1990s, online culture advocates have proclaimed the "death" of the internet.[563] They almost certainly overstate, as radio critics did, the extent of automation (here, also "bots" and "AI"), as they find with alarm that automation's tendencies already characterize so much non-automated expression in these media. If AI is indeed killing these media in the experience of their producers and audiences, then automation's relationship to radio can guide our attention to two further patterns.

First, this new technology is more contiguous with older techniques (for instance Markov chains, in the text generator case) than its branding would suggest. What is actually new is a formation that links together the technology, a business model, and aesthetic parameters. Like the "adult music" that Programatic Broadcasting Service offered in 1959, the style of what fills the automated medium has a negative definition. AI models inherit

[562] Andrejevic, *Automated Media*, 5.

[563] Kaitlyn Tiffany, "Maybe You Missed It, but the Internet 'Died' Five Years Ago," *The Atlantic* (blog), August 31, 2021, https://www.theatlantic.com/technology/archive/2021/08/dead-internet-theory-wrong-but-feels-true/619937/.

all manner of social bigotry when their training data has been automatically scraped from the web; and instead of structurally addressing that issue at the collection or training stages, AI companies address it through "guardrails" after the generator stage.[564] These and other subtractive processes yield a bubbly, inoffensive style that we can read in ChatGPT's peppy responses or hear in the predisposition of music generators toward upbeat and advertisement-ready sounds ("chill," "heartfelt," and "atmospheric" are the adjectives presently on offer in suggested prompts on one tool's landing page).[565] We should expect that this style, as "beautiful music" did in American radio, will enjoy an outsize presence in popular media for some time to come, even as technologists find better ways to automate other styles. We might also expect the aesthetic markers that propelled the business model early on to stick around as shorthand references for it—in other words, that "ChatGPT voice" might in 30 or more years mean something similar to what "Muzak" has meant for critics of corporate radio (and still means for critics of music streaming platforms).

Second, generative AI works through and works upon the figure of the programmer—a figure subject to and dependent upon cultural representations that can legitimize its claim to media-spanning power.[566] In fact, since the AI companies tout code-writing as one of the activities they can now automate, we may well see the end of a long equivalence between "programming" (whether in its computational sense or in any number of contextual senses like "parts programming"[567] or "broadcast programming") and the creative, managerial work that automation promises to those whom it displaces. The pattern will not change, but the word may need to; "prompt engineer" and "AI specialist" are going candidates. Regardless of how the terminology shakes out, this role will be invested with both social and

[564] Tom Slee, "The Incompatible Incentives of Private-Sector AI," in *The Oxford Handbook of Ethics of AI*, ed. Markus D. Dubber, Frank Pasquale, and Sunit Das (New York, NY: Oxford University Press, 2020), 107–23.
[565] "Suno," accessed April 26, 2024, https://suno.com/.
[566] Chun, *Programmed Visions*.
[567] Noble, *Forces of Production*.

technical power, and the manufacturers (as we are already seeing) will be eager to have artists help bolster its status by elaborating the creative control that automation expands. For artists who face the question of whether to incorporate generative AI in their work, this relationship should pose an additional consideration: alongside a calculus of environmental harm and ethical liability for plagiarism, they might consider how their work acts upon the subjectivity toward which the AI companies would have people aspire. Creative engagement with media automation does not necessarily endorse or strengthen it; as I have shown of radio workers' and sound artists' responses to automation, alongside the choice to embrace programming there is also an option to reprogram, to subtly adjust the script within an automated system so that it operates on terms closer to your own. There is also deprogramming: thinking from the position of the programmer (or prompt engineer, as the case may be) in order to nullify the control structure that maintains that position.

To anticipate medium-unmaking from AI is most of all to tune in to the ways that automation is dissolving the "opacity" of the media that install it—the conditions under which their individual parts and protocols evade attention.[568] For radio, transmission artists have shown how the process of disassembly can be a generative terrain. As automation hollows out a medium from its commercialized core, internal workers and outside artists can grab hold of the process and further it along, whether through speculative or material intervention. In the unmaking that AI aids, then, we might await new articulations between technical practices that explore computation in its barest, least powerful states[569] and the cultural actions—searching, posting, streaming—that activate internet media. Thinking with Shelley Pope, we can imagine a *human internet*, a virtual-bodily incorporation of data center,

[568] Gitelman, *Always Already New*; Eacho, "Auto-Play: The Automation of Performance Action, Writing, and Control."

[569] Aymeric Mansoux et al., "Permacomputing Aesthetics: Potential and Limits of Constraints in Computational Art, Design and Culture," in *Computing Within Limits* (LIMITS, 2023).

fiber optic cable, router, browser—and the power-outside-control that media workers, so expanded, might wield in acts of refusal.

These ways to apprehend automation and media are not exclusive to radio, or even to contexts where *automation* has been announced and labeled as such. All media—all stabilized forms that reproduce and transmit expression—take on both internal and external tendencies toward automation, when those media develop in capitalist settings. Internally, media consolidate their own working routines into automatic processes, as magnetic tape did for radio. Externally, media make a show of replacing the workers who previously performed that reproduction and transmission, as early phonographs did with regard to stenographers;[570] and they also encourage automation's rationalizing tendencies in the broader activity whose expression they mediate, as automated radio formats and now streaming platforms have done to music. What results may be a cyclical process of stabilization, contradiction, and reformation; but it is one in which people have considerable agency, perhaps most of all at those moments of fraying that automation precipitates. Automation gathers into technology the social forces that make media, and it bends them toward unmaking.

[570] Sterne, *The Audible Past*, 212.

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