

Acoustic Infrastructure: The Sounds and Politics of Radio Tests in American Emergency Broadcasting

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ABSTRACT

Background:

The Emergency Alert System is an emergency broadcasting infrastructure originating in American radio and serving as the basis for systems in newer media and in Canada. Its design of self-propagating acoustic signals anticipates a nation-scale catastrophe but subordinates smaller crises.

Analysis:

Adopting theory from infrastructural media studies, I examine the reasoning and functionality evident in regulatory proceedings, broadcaster and media researcher assessments, and the sonic structure of test and warning signals.

Conclusion and implications:

A machinic approach to addressing media publics took shape in the acoustic operations of the EAS. Tied to a deregulatory drive that has eroded radio's emergency function, the EAS produces a suspended temporality that must be understood as a combined effect of the infrastructure, its content, and its context.

Keywords:

Broadcasting, Broadcasting policy, Disaster and Emergency communications, Radio

A piercing, synthetic tone arrests the country song playing over a car radio in Texas. A smartphone in Ontario emits an unfamiliar alarm, flashing an Amber alert notification on its screen and startling its owner awake. A local television station in North Dakota airs its national network content uninterrupted as a panicked resident scans through channels, hoping to hear information about a rumored toxic event in town. These moments arise as the interaction--or non-interaction--of media publics in the United States and Canada with an emergency communications infrastructure that interlaces these multiple media-industrial and geographic contexts. In those alert tones, in the substance behind their particular shrillness, and in the manner by which they travel autonomously through unattended broadcast sites, a complex tangle of infrastructural politics takes audible form.

To begin examining what that tangle can say to infrastructural media studies, this article focuses on radio and on the Emergency Alert System--the present name for the node in this system that operates within American broadcast media. At its highest and first envisioned level, the EAS gives “the President of the United States the capability to address the American public during a national emergency” (Federal Emergency Management Agency, 2011). AM/FM radio offers the most direct path into the EAS’s conceptual and material interior: between its historical development and the envisioned catastrophe where it should outlast phone and power lines, terrestrial radio is the first and last medium of American emergency broadcasting.

The type of national emergency that would justify a Presidential EAS alert would be a catastrophic event, where access to electrical power and communications systems may be significantly degraded or even eliminated. Under such conditions, the one communications media platform likely to continue operating is broadcast

radio, accessible from battery powered consumer receiver sets and other means, such as car radios and hand-cranked radios. Accordingly, the EAS was designed to provide a simple live audio feed from the President, delivered initially to PEP [Primary Entry Point] radio stations.... [O]ther EAS Participants receive and, in turn, transmit the alert via the hierarchical broadcast-based EAS distribution system to consumers (Federal Communications Commission, 2013, p. 6).

No president has ever employed the EAS in this capacity; nor had FEMA and the FCC, the federal agencies which jointly oversee the system, ever coordinated a test of the whole network prior to doing so in 2011 as “part of larger efforts to strengthen the nation’s preparedness and resiliency” (Federal Emergency Management Agency, 2011). In the meantime, routine test messages and localized public safety warnings play through sub-levels that encoded-yet-audible metadata define within the messages themselves. An EAS alert, somewhat like an internet data packet, constitutes the structure through which it travels: an acoustic grid that materializes temporarily among enlisted broadcast transmitters. The materiality of media infrastructures--and even more so the effects when material features of separate media interact--matter a great deal to how and what signals pass through them, Lisa Parks and Nicole Starosielski (2015) have convincingly argued. But sound has so far mainly featured in such analysis as a signal type or as an infrastructural effect, not as a material event capable of producing infrastructure in its own right. Lingering in the historical and ongoing context of broadcast radio, this article undertakes a sound-first account of media infrastructure.

A focus on radio also foregrounds the material continuity that infrastructures like the EAS maintain between older and newer media. When researchers mine radio history for insights into internet culture or identify broadcast media as objects of “remediation” by subsequent digital designs (Bolter & Grusin, 1999), they recover important ties between media eras that industry spokespeople (and, at times, new media scholars) too often describe as cleanly distinct. In spite of such corrections, it can be easy to forget that radio and television still, today, persist alongside and interact with digital media in consequential ways. New media inherit not just formal and industrial conventions from broadcast media but also the infrastructural projects that developed within them.

EAS messages encode a legacy of national defense, apocalyptic imaginaries, and institutional decay. These themes are familiar to historians of infrastructure who focus on America in the 20th century. Any reading of the system should follow the grain of that history, attending to how technical revisions in emergency communication accompanied changing configurations among media, American society, and the threat scenarios it envisioned. Toward that end, Tung-Hui Hu’s (2015) notion of the “graft”--both a spatial-historical description of how network infrastructures interrelate and a “method of analysis, a way of uncovering a structural relationship between power and networks” (p. 8)--casts light on the central role that network designs for resilient military communication have played in the EAS’s political nexus between entertainment media and crisis infrastructure. In Hu’s illustrative figure, an older network forms the root structure to a newer one’s scion, serving as a hidden foundation while imparting its political qualities; disguising the juncture, the new medium paves over the tracks that give it form. But the ongoing lives of radio and the EAS, which have continually transformed one another in material and

definitional registers, complicate the graft's sequential aspect. These two infrastructures have developed together in a more perpendicular conjuncture that has not so much transferred political qualities from one into the other as it has opened an inlet for power to modify both. The middle section of this article describes how a convoluted negotiation between the distributed network model and a centralizing radio industry seized upon the EAS as a tool. Apprehending networks' shapes can help us track what happens materially and politically when media infrastructures intersect; but for a fuller understanding, I argue, we must also consider the signal patterns and temporal mechanics that attend and enact those shapes.

Prior work on test pattern signals has identified moments where the boundaries between technical systems and systems of representation can dissolve for media audiences. Dustin Tahmahkera (2014) recounts how the "Indian Head test pattern" bracketed each day of RCA television programming in the 1940s and 1950s and reads it for the ideological function that attended its technical utility. Describing the ritual regularity with which some television owners would inspect this calibration screen while adjusting their sets each morning, Tahmahkera shows how the test pattern ushered the "colonizing representation" of its logo into an intimate role in many American lives (p. 1). As internal calibration images for the television industry projected a mono-racial fantasy of America into technical standards that steered color technology (Mulvin & Sterne, 2016), production practices animated that vision: Susan Murray (2018) describes as "living test pattern" the role of the "'color test girl'--a white woman employed as the singular standard of flesh and fidelity--who would stand before cameras in a studio before the broadcast of any color program while technicians and cameramen made color adjustments." At the transmission's other end, viewers joined in a final step of the color calibration process (pp. 107-

114). These routines directed producers, performers, and home viewers to reorient their bodies in accord with cues from their media devices. The first section of this article will examine an expectation on the part of the EAS design that radio listeners will form a responsive element in a similar human-machine chain when its tests and alerts activate it. Later, the final section will return to the sounds that EAS radio signals make and the form of machinic listening they prescribe.

Like the Indian Head test pattern, the distinctive tone bursts that begin EAS tests have become recognizable enough to recirculate as cultural objects--an unwelcome development for the government, since a recorded alert played back over the air could in theory activate EAS receivers in other stations. The FCC regularly levies substantial fines against broadcast networks for using the system's attention tone in comedy skits, zombie dramas, or advertising spots, to list recent examples (Wiquist, 2019). The system's audibility as a state intervention into broadcast media has made it an object of fascination as well for media politics provocateurs--one very direct example being the music and video art group Emergency Broadcast Network, whose 1995 *Telecommunications Breakdown* resampled popular music, war-apologist politician clips, and frenetic television oddities into a "hypermedia" artifact (Bolter & Grusin, 1999, p. 42). Counter-cultural and conspiracy-seeking interests continue to cling to the EAS today in venues like YouTube.

But rather than any grand conspiracy of mass manipulation, the EAS has been complicit in an internal media crisis brought about by broadcasters' and regulators' repudiation of localism--the principle that holds a media station responsible to its geographic broadcast area. Toward the end

of the 20th century, localism gave way under practices of centralized, remote, and unattended operation (Hilliard & Keith, 2005). FCC rule-making processes conceived the EAS as an automatable update to its predecessor in order to align with these practices, only to then cite the EAS's capacity for automatic operation as a reason why the practices should be further accommodated. In the wake of this loosening, broadcast studios sit unattended while local crises unfold outside; meanwhile, by broadcaster accounts, EAS warnings more often than not run up against administrative or informational blockages in the system before they can reach the air. Considering the meeting of failure and futurity within infrastructural sites, Akhil Gupta (2018) proposes *suspension* as a "particular type of temporality" in effect when a project has neither been made fully functional nor explicitly abandoned (p. 68). I bring that temporal logic to bear on the EAS by following a sonic awareness's invitation to stretch and compress timescales: from the milliseconds in which alternating tones arrest machines and listeners, to the decades over which the system has expanded its reach and retreated from its function, suspension characterizes the EAS. Suspension helps explain a unique affordance of this acoustic infrastructure: how it can maintain a monumental future threat despite failing to warn of present dangers.

Testing the Public

When the EAS and its neighboring systems have appeared in the news in recent years, the occasion has most often been either a national test or a false-positive failure. An instance of the latter unfolded in January of 2018 in the Wireless Emergency Alert component of the Integrated Public Alert and Warning System (IPAWS)--the umbrella system that now includes the EAS (Federal Emergency Management Agency, 2016)--when an operator mistook a testing procedure for a real emergency and sent an alert to all compatible cellphones in Hawaii that a ballistic

missile was expected to hit the state (Kang, 2018). Less dramatic headlines attended a test of the same cellphone alert system in October of that year (Zraick, 2018) in coordination with another national EAS test (“Nationwide Test,” 2018), though the “Presidential” label of the alert that arrived on personal mobile devices across the country carried a troubling valence in connection to a falsehood-spreading executive with openly authoritarian aspirations. Since the Canadian government has steered its own emergency warning systems toward interoperability with IPAWS (Timm, 2017), the same network of networks took part in the flurry of confusion, critique, and stern backlash to critique that attended a late-night Amber alert sparked in Southern Ontario in early 2019 (Van Der Zwan, 2019). Spotlighting the ultimately inscrutable face of this sprawling infrastructure, these incidents evidence the friction that occurs in the mismatch between the local emergencies where it is deployed and the prospect of global or national crisis that guides its design. With similar inscrutability pervading personal media devices and the software platforms they open onto, these moments accentuate a distinctly medial anxiety:

It is the relative control of the unseen administration of broadcasting and computing systems that creates user distrust. The circulation of a computer virus, the expansion of an inbox due to unwanted e-mail from seemingly anonymous sources, the moments when the Emergency Alert System tests its ability to take over the operation of a station--these bring the user to the potential for disaster. This sense implicates both the medium and the object that transmits and receives the medium (Miller, 2003, p. 185).

The EAS did not invent the distinct dread that its messages bring suddenly to mind for listeners. Rather, it has developed under the same national projects wherein, as Joseph Masco (2014)

describes, government publications and civilian defense exercises in the Cold War worked to distribute imaginaries of crisis and destruction in the service of normalizing such dread. The legacy of the EAS shows it as taking part in this distribution, but also as itself an imaginary *of* distribution, where the listening subject is alerted not just to the ever-looming national threat but also to their place within a signal chain for vital information. These arresting activations of the system blur the distinction between what Lisa Parks (2015) terms “infrastructural imaginaries--ways of thinking about what infrastructures are, where they are located, who controls them, and what they do--” and the infrastructures themselves (p. 355). Hardly a relic resuscitated from a previous century, the “locally self-organizing, systemically self-amplifying threat of large-scale disruption” remains an active production through which a distinctly post-9/11 American governmentality now operates (Massumi, 2009, p. 153). The imaginary that charts this threat and offers the EAS as an infrastructure that can answer it insists upon the national or extra-national scale of the coming crisis.

Top-level EAS tests capture press attention in the same stroke by which they capture the whole hierarchical span of the system across the country. In contrast, local use looks to a “patchwork of testing regimes” that activate isolated sections of the branching EAS structure at its statewide and smaller levels on a weekly and monthly basis. Authorities and broadcasters activate the EAS at these levels for a secondary tier of events--“severe weather threats, child abductions, and other local emergencies”--that misalign with the system’s designed-for scenario of singular, nation-scale calamity. The FCC explains that “non-Presidential EAS alerts do not require that EAS Participants open a live audio feed from the alerting source, but rather deliver alerts with prerecorded messages that can be delivered at the discretion of the EAS Participant, rendering

non-Presidential alerts (and their related testing procedures) inappropriate for the test of a national alert” (Federal Communications Commission, 2013, p. 7). With the 2011 national test, FEMA and the FCC endeavored to realign their anticipated and rehearsed scenarios by engaging the full signal chain of the system. They included the listening public in this signal chain. “The Test plays a key role in determining if the public is able to receive timely and critical emergency information as part of a larger effort to assess national preparedness for all hazards” (Federal Emergency Management Agency, 2011, p. 1). The public here figures as an appendage of the test, which inspects neither a particular threat nor a technical point in the system. In this administrative vision, the nation’s decoder/receiver boxes and its media audiences join together in a grid of potential responsiveness.

A YouTube record of the 2011 national test shows a radio listener taking part in that signal chain. Sitting in his truck with the radio turned up, the video’s narrator half-heartedly teases the possibility of some connection between the planned test and an ongoing storm, a meteor fly-by, and an apocalypse rumor. Then, just as the scheduled time for the test has past, the music from his car radio is cut off by a dissonant pair of tones. A voice recording, layered over the synthetic sound, is too distorted to make out. The man listens for a bit, then switches the radio to another channel. Finding only silence there, he keeps moving through frequencies in the FM band, catching snippets of the same tones and voice at varying levels of loudness and distortion. Finally, he reaches a station as it plays three unaccompanied bursts of the tone pair and cuts back into the middle of another song. “I guess that was it. It didn’t say it was a test or anything--just a series of beeps,” the narrator reflects. “Obviously they’ve got some problems to work out with it. We’ll see what happens” (AtlanticTR, 2011). With regard to communicating actionable

information to the listener, the system and its coordinated test seem to have failed. Still, the video ends on a note of anticipation; the event has held the future open toward possibilities of repair and of catastrophe.

In the absence of stable criteria for what it measured, it is hard to call the 2011 test a success or a failure. The FCC, for its part, concluded that this “first-ever Nationwide EAS Test was a success in that it demonstrated that the national EAS would generally perform as designed, if activated” (Federal Communications Commission, 2013, p. 19). At the same time, the agency acknowledged that poor audio quality and equipment failures had left considerable gaps in the test message’s propagation. Despite its justification beforehand as focused on public reception, the national test exercise withdrew to more technical criteria at the stage of evaluation. Having set up a web interface for EAS participants (meaning broadcast station operators) to report back on their reception of the test, the FCC “received and analyzed test result data from over 16,000 EAS Participants, and held discussions with EAS Participants, FEMA and other EAS stakeholders to analyze the test’s results” (Federal Communications Commission, 2013, p. 3). Radio listeners entered as the endpoints of the branching signal diagram, but this membership in the network of response did not grant them “stakeholder” status when it came to assessing the system’s performance. Any audio that reaches the public has completed the circuit, the FCC’s evaluation implies--even if in becoming sound, that audio blends together into a uniformly cryptic dissonance.

Friction and failure in a never-utilized information infrastructure--here, the specific mechanism that would materialize out of seized media channels when “all EAS Participants are broadcasting

the audio message from the President across the entire nation” (Federal Communications Commission, 2013, p. 8)--produce different effects from those of breakdowns in the infrastructures that circulate energy and physical resources. Infrastructure studies have invested in the sudden and total blockage as a methodological opening: “Studying moments when infrastructures cease to work as they normally do is perhaps the most powerful way of really penetrating and problematizing those very normalities of flow and circulation” (Graham, 2010, p. 3). When breakdowns themselves become routine, though, the disposition requires more nuance. “Perhaps,” Stephen Graham and Nigel Thrift (2007) propose, “we should have been looking at breakdown and failure as no longer atypical and therefore only worth addressing if they result in catastrophe and, instead, at breakdown and failure as the means by which societies learn and learn to re-produce” (p. 5). Graham and Thrift push back against two jointly over-valored figures in social science: on the one hand, catastrophic failures, and on the other, the “black boxing” effects of untroubled functionality to which these breakdowns are exceptions. They shift focus toward the work that goes into producing that impression of smoothness. A maintenance-oriented outlook on infrastructure throws the relationship of normality and disturbance into a confused constancy of erosion and repair (Jackson, 2014). As a practice of maintenance within such a pattern, the EAS’s routine test messages constitute the system at the same time that they perform its historical, ongoing presence, for and through the listening public.

From survivable communication to media decay: the EAS and American radio

Paul Baran’s 1964 proposal for a “distributed communications system,” which laid a groundwork for the packet-switching technique that underpins the internet, has garnered renewed attention as media historians trace an American Cold War paranoia through to today’s cloud

technologies (Hu, 2015). Baran argued that a “grid or mesh” of signal-relaying nodes would form a superior alternative to a centralized design under a central criterion: survivability (Baran, 1964). Nuclear detonation did not only loom as an emergency that would necessitate rapidly warning people dispersed across a huge area; this eventuality, along with solar and meteorological eruptions, posed a major threat to communication infrastructures themselves. Most importantly, for the Canadian and American defense projects that Edward Jones-Imhotep studies in *The Unreliable Nation: Hostile Nature and Technological Failure in the Cold War* (2017), the ionospheric disturbance from these events could block military radio communication. Through these projects, though, the other category of disruption against which survivability endeavored--inevitable internal failures within a complex system--came to not just motivate but characterize national relationships to technology. In this section I trace how the EAS took shape out of these same Cold War motivations and how, through the same process by which it entrenched radio as a national infrastructure against and under military threat, the EAS helped imbue both itself and broadcast media with fundamental unreliability.

The American federal government first formalized an emergency function for civilian radio transmitters in the 1950s with CONELRAD (Control of Electromagnetic Radiation). The program expressed needs specific to radio and to its material properties: by requiring stations to all adjust their broadcast transmitters to the same frequency, the military could disrupt the ability of enemy pilots to infer their position over the country from the combination of signals their radio receivers picked up; and by relaying emergency information through the broadcasters to listeners who knew to tune to that single frequency, civil authorities could give instructions to the public through a distributed chain whose redundant, electromagnetic, and acoustic links would

make it very difficult for an invading force to fully disrupt (Brinson, 2009). The Emergency Broadcasting System (EBS), launched in 1963, expanded the CONELRAD charter to address non-military hazards like weather. It also introduced the design whereby FEMA could send a Presidential alert through a dedicated phone-line connection to “Primary Entry Point” stations (Federal Communications Commission, 2013, p. 8). Following the same survivability logic as Baran’s design, the system ensured that an alert broadcast from a PEP station would then reach others over the air, enlisting stations in a branching, wireless propagation system.

Thinking through the “meshiness” that links Baran’s network visions, amateur radio communities, and activist-led local data networks, Rory Solomon (2020) points out that ham radio operators conceive of their practice as an important potential emergency resource. That these elements--emergency communication, terrestrial radio, and distributed network models--continue to converge outside of a governmental purview should remind us that emergency broadcasting as an infrastructure had no pre-determined correspondence with national defense. Much as Susan Douglas (1989) has argued of radio itself in the 1920s, the institutional design that won out for emergency broadcasting in the United States had to be entrenched through coordinated pressure among corporate and regulatory actors. In the EBS, this coordination required reconciling the distributed shape of a survivable system with the militaristic demand for centralized control. PEP stations, selected for their high licensed transmitting power, became the physical juncture points between the centralized and distributed axes of this design. Accordingly, these stations were the first to show that national emergency communication would architecturally and geographically transform broadcast media rather than merely insert receiver boxes into their stations. PEP stations received backup power and structural reinforcement for

their transmitter sites, typically located in the outskirts of urban centers, to increase the likelihood that FEMA's direct lines would remain intact amid bombing.

These transmitter sites changed from antenna sheds into barbed-wire-enclosed, windowless structures that evoked the urban telecommunications exchange building and its "rhetorical figure within a military-industrial imaginarium of danger" (Godel, 2015, p. 36). Since the national security apparatus pulled transmitter sites out into the hills outside a city while the working lives of announcers and programmers kept broadcast studios closer to its center, the ongoing division of radio labor into talent versus engineering roles redoubled in a geographic register. Division, in turn, aided efforts to render each of these roles and sites more automatable. Re-entering a city as a ubiquitous part of its soundscape, the signals processed in this "architecture for machines" contributed through their sonic prominence to a "sense of security and preparedness" that infrastructural nodes in other urban media fostered (Mattern, 2017, p. 24); and whenever an EBS test took over that signal, the sense would be made explicit.

When the EAS earned government approval in 1994 as a set of incremental refinements to the EBS, its designers articulated the system's older motivating character (survivability) to a newer one: automation. Where the EBS design had followed a distributed propagation concept similar to the internet's packet-switching system, EAS messages could behave even more like data packets in that they directed their own propagation. Encoded information in each message's header portion now preceded the alert audio, communicating to receiver machines through predesignated codes that would "define who originated the emergency message, the nature of the emergency, the location of the emergency, and the valid time period of the emergency" (Federal

Communications Commission, 1994, p. 1814). These new features offered greater precision as to where and when an alert would air, but they also delivered a timely assurance that the alerts would complete their journeys regardless of whether or not a human operator was in the room with each box they reached. Commercial stations, particularly in the ownership consolidation race that would accelerate after the 1996 Telecommunications Act, increasingly relied on techniques of automation and remote control in order to reduce personnel expenses. Corporate networks responded enthusiastically to the proposed EAS (Wilson, 2007, p. 253). Citing strong support for “the use of automation in the new system” among broadcasters who had submitted comments, the FCC reasoned that automated and remote-controlled modes for EAS equipment would do away with the “costly, time consuming, and... often ineffective” need for a “full-time person on duty to determine the content and nature of EBS messages” (Federal Communications Commission, 1994, pp. 1821-1822). By promising to become automatable, the EAS assisted in a larger project that automated away station maintenance roles and aided centralization.

In separate “companion” proceedings to their rulings on the new EAS, the FCC also requested comments and revised rules regarding the unattended operation of broadcast stations (Federal Communications Commission, 1994, p. 1823). Up until 1995, radio broadcasters in the United States needed to ensure, in most cases, that anytime their station’s transmitter was powered on, a licensed employee would stay on site to monitor it. Asserting that technological advancements had rendered the provision against unattended operation unnecessary, the FCC sought to lift what it now described as an undue burden on broadcasters. The old EBS and the new EAS entered this deregulatory push in a flourish of circular logic: the manual operation requirements of the EBS stood in the way of unattended operation and thus needed to be upgraded; unattended operation,

made feasible by the redesign, would encourage EAS equipment upgrades and thus should be pursued as a public good. Paraphrasing comments from equipment manufacturers and broadcasters who noted that “the current EBS cannot be reliably automated,” the FCC suggested that “it would be appropriate to link unattended operation with implementation of the EAS” and that this “linkage [w]as an excellent opportunity to encourage the rapid implementation of the EAS.” The rule-making document all but explicitly signaled trouble to come, noting in one breath that the EAS was “specifically designed for unattended operation” and in the next that “various concerns over the EAS technology have arisen in recent months” leading to “uncertainty in the implementation date for the EAS.” Reasserting that an automatable EAS promised a “no risk benefit to both the licensees and the public” that outweighed its technical prematurity, the agency moved forward with allowing unattended operation (Federal Communications Commission, 1995, p. 11481).

A decade later, the same FCC bureau would acknowledge that the 1995 proceedings transformed radio in unintended ways. In a 2007 notice, the agency sought “comment on whether it is appropriate to review the rules that have facilitated the development of automated broadcast operations.” By this point, broadcasters had “broadly embraced this new technical flexibility” with many stations now operating “for extended periods without station personnel at or near transmission facilities.” Noting that the 1995 commissioners had cited EAS automation in their reasoning, the 2007 notice pointed to a particular instance of breakdown in suggesting that the assurances of automated broadcasting might need rethinking: it noted a failure in emergency communication following a 2002 train derailment in Minot, North Dakota. (Federal Communications Commission, 2007, p. 48). Eric Klinenberg (2007) recounts the Minot disaster,

in which caustic fumes from the Canadian Pacific Railway's freight cargo blanketed the town, at the start of his book that indicts deregulated and centralized broadcast media for eroding media's public service functions. During the chemical spill, which caused one death and many injuries, some residents tuned to local radio and television channels for information. Despite these listeners taking up their scripted place in the signal chain, no information arrived--neither through the automated EAS, which state-level emergency officials neglected to activate in time, nor from the city's remotely owned and operated stations.

Government materials around the EAS continue to stress how the system forms a "survivable communications network" (Federal Emergency Management Agency, 2011, p. 3), reinvigorating America's mid-century threat scenarios and their germinal relation to distributed infrastructure designs. IPAWS and its pan-medial ambitions would seem to resound Tung-Hui Hu's (2015) point that "war circuits are indistinguishable from civilian circuits, because, in a time of emergency, everything will be part of a war circuit" (p. 16). In fact, the EAS prods us to invert this formulation insofar as the "time of emergency" is far less defined than the mechanism by which military communication can conscript other media. The insistent unreliability and systemic inscrutability that media audiences experience from the system are qualities that Hu and other media historians have used to characterize a continuum from Cold War technologies to present-day platforms. These qualities are bound up not just in military but also in corporatist efforts to at once distribute and centralize communication. More importantly, they persist across media eras in a process that might be better analogized to acoustic interference--as different signals co-mingle, they mask, distort, or interrupt one another--than to sequential layering. By

pulling temporality and sound to the foreground, we can better grasp how the EAS punctuates radio and to what consequence.

A system of suspension

The EAS is an infrastructure whose design has been compromised such that failure precedes rather than follows from the emergency. In this sense it is *anticipatory* not just in its designed function but in that its principal effect, in place of fulfilling that function, is to confer anticipation--the sense of the generic yet prepared-for catastrophic event and its relation to futurity (Anderson, 2010)--on the public it addresses. This reading of the EAS reveals that test signals not only constitute the structure through which they travel; they also perform its affective work of directing the listener's anticipation. The EAS thus inverts the infrastructural trait of becoming "visible upon breakdown" (Star, 1999, p. 382): where an infrastructure characteristically "recedes into the invisibility of routine" (Barney, 2018, p. 80), the EAS test's attention-grabbing tones make arrestingly audible the normal operation of the system, while its failures to provide warning amid actual emergencies like that in Minot take the form of only retro-audible silences.

The mechanics of this inversion come into sharper detail through Karen Pinkus's (2017) development of the *grid* within a new materialist lexicon. Pinkus points out that "the assemblage that is the grid comprises various actants that cooperate under normal circumstances but may fail to do so under an emergency scenario" (p. 331). The elements that together constitute the EAS within radio include audio encoding standards, encoder and decoder devices, dispatchers, broadcast engineers, and the audio signals themselves. Further out in the grid, through the

IPAWS architecture, it reaches more elements in television, cable, and mobile telephony. A centralized system of scheduling, testing, and reporting facilitates cooperation among this ensemble. Yet Pinkus draws our attention to the fact that the same eventuality around which the EAS is defined is the circumstance in which these cooperative links may be expected to break down. The top-down design of the EAS envisions a future calamity so total that it bypasses the need to distinguish a particular emergency against a particular normality. In practical life, this need cannot be bypassed (Rubenstein, 2015). The threshold of articulating an effective “emergency claim” determines who can act to utilize or influence emergency media (Ellcessor, 2019, pp. 4490-4491). For the sub-national levels of the EAS where its only non-test activations have so far occurred, technical and organizational misalignments let the symbolic emergency disrupt the system well before the physical emergency could.

Codes and categories become the stuff of communicative blockage amid the EAS’s conflicting inclinations toward hierarchical control and business-friendly flexibility. A variety of problems within the functioning message flow conglomerate into delays, dilution, and confusion that often defeat the purpose of warning. Responders must communicate against the grain of hierarchical design: “[e]mergency management officials in the county where an incident occurs have to ask their state counterparts to issue an alert,” adding turbulence to a message’s flow through the EAS before it even begins. Differences in encoding standards among devices in the EAS network then reduce the specificity of a warning, with older decoders generating “a ‘civil emergency message’ for everything from a terrorist attack to an Amber Alert for a missing child because the equipment can’t distinguish the codes.” These factors can compound into a total sense of suspended purpose, as expressed by a TV station’s news director: “The notices come in so late

and are so vague, she says, ‘I cannot remember a time when an EAS alert has sparked us into action or told me something I didn’t know’” (Potter, 2005). These breakdowns in classification, a core level of information infrastructures, demonstrate the design’s neglect for the “articulation work” needed to sort out the emergency from the routine and to handle unplanned-for contingencies (Bowker & Star, 1999, p. 310). Stemming from this fundamental neglect, postponement and diversion emerge as qualities of the EAS infrastructure rather than just events within it.

Where the opening tones of a test or warning message might produce an effect of *suspense* for the radio listener, much like a swell of dissonant string instruments in a horror film soundtrack, the larger temporality that these messages and their misfires produce is what Akhil Gupta terms *suspension*. Suspension holds open the possibility space of the dysfunctional infrastructure and makes palpable the multiple futures it thereby produces. As with Brian Larkin’s (2013) attention to the poetics of incomplete--or never designed for completion--infrastructures, Gupta uses suspension to unseat a binary between failed and functioning infrastructure and considers what infrastructures might *do* outside of or in place of their stated purpose. In the case of the EAS, suspension coalesces the myriad delays and dilutions of signal flow that, without ever culminating in a total failure, lead people to experience the system as forever awaiting its realization. Here we can see the EAS “shaping the present through a politics of anticipation.” The silences of localized failure and the shrill beeps and monotone syllables of routine testing all command attention toward (and within) the system, yet they insist that its true operation will be something other than the test. These patterns converge in their production of the eventuality--the singular national emergency--that will activate the system at the top of its hierarchy and

commence the designed-for flow in earnest. EAS tests punctuate the quotidian flows of broadcast media and attune listeners to this eventuality, the shape of which at any given point depends on the political present and the particular threats that anchor its vision of the future. The tests thus give rhythm to the way that “the future configures the present” (Gupta, 2018, p. 63), stitching the future threat and the security of its anticipation into the material presence of the tested media infrastructure.

The acoustic emergency

The internal structure of an EAS signal affirms its dual status as both the channel-making agent and the content passing through that channel. As the National Association of Broadcasters’ Engineering Handbook describes, “An EAS message consists of four elements, in the following order: digital header code (repeated three times); two-tone attention signal; audio, video, or text message describing the actual alert; and digital end-of-message code (repeated three times).” The waveforms in the message’s header code and end-of-message code relay the state-changing information to the receiving station’s EAS hardware device, opening and closing it.

Except for the actual audio message itself, the header is the portion of the EAS message that contains the most information. The two-tone attention signal is not intended to serve any purpose other than to audibly alert the audience that an EAS message is about to be broadcast, and the end-of-message code is simply... used to indicate that the alert is over and that the EAS equipment should reset itself to its normal, non-alert state (Wilson, 2007, pp. 250-251)

At the same time that the machine-addressing and audience-addressing portions of the message are separated into discrete components, these pieces align in the way they aim toward a state

change in both hardware device and listener. The attention signal, placed in between the digitally encoded header and the voice recording, performs this alignment at an acoustic and affective level.

Priming the audience for the incoming spoken announcement, the attention signal transitions between the header code's instruction to the machine and the verbal interior of the message. This part of the message likewise tethers the older and newer parts of the system around its acoustic logics: "The two-tone attention signal is created by simultaneously transmitting the 853 Hz and 960 Hz tones, the same two-tone signal that was used in the old EBS." A two-tone signal approach also serves as the basis for the method of digital encoding in the outer portions, which were introduced in the transition from EBS to EAS: "The header codes and the end-of-message codes in an EAS message are composed of a series of digital bytes and are transmitted using the 1562.5 Hz and 2083.3 Hz tones" (Wilson, 2007, p. 251). All four tones fall squarely within the audible range of the frequency spectrum. With its rapid alternation between tones as a way of transmitting a digital bit sequence (National Weather Service, 2011), the header code as heard sound stands apart from the attention signal's continuous tone pair only through a higher pitch and more varying texture. Except to a listener specifically acquainted with the EAS and its message format, the progression from header to attention tone marks a change predominantly in the timbre of the sound, not in the kind or purpose of the signal. The similarity is not a coincidence but rather a sonic reunion of the two signals' shared underpinning logic.

The EAS message's couplet of header code and attention signal blends acoustic and symbolic representation in its simultaneous conferral of an emergency state onto machine and listener. The

dissonant tone pairs, like the church bell sounds that “called the Western man to the borders of reason, of war, and of his earthly finiteness” (Siegert, 2013, p. 118), produce anharmonic sounds that “signal a state of emergency in the symbolic order because they are this state of emergency in the acoustical real” (Siegert, 2013, p. 110). A purely harmonic sound contains only frequencies that are integral multiples of a common factor--this tone is the sound’s fundamental frequency and is heard as its pitch. An anharmonic sound is still heard as having a stable pitch, even though this fundamental frequency is missing from its component tones. Mobilizing a Western affective rubric for harmonic versus anharmonic sounds, the attention signal thus aims to jump out from the auditory context it has interrupted--broadcast radio’s flow of speech and music sounds--in order to call the listener to responsiveness. With most stations’ encoder/decoder machines today running in automated mode (Kepner, 2010), the EAS performs this acoustic operation upon the listener as much in its tests as in its warning messages, as the listener has no way of knowing whether a message is a warning or a test until the attention signal concludes and a voice recording plays.¹ The beginning of the message, by design, captures listeners’ attention and holds them in suspense. The technical action of the signal follows this model as it acts upon the decoder device.

In the audio sequence of the EAS message format, the attention tone follows the header code; but in the system’s development, the header code arrived later. The header’s two alternating tones for binary information representation, along with the interior format that the digital contents of the header follow, come from the Single Area Message Encoding (SAME) protocol (Moore, 2010). The National Oceanic and Atmospheric Administration developed SAME in the 1980s as a way to increase the precision with which the National Weather Service could geographically

direct emergency dispatches in their flow toward specialized consumer weather radios (National Weather Service, 2011). The EAS formally incorporated SAME in the transition from the EBS, facilitating a newly interoperable and automatic juncture between these two emergency communication networks (Moore, 2010). As with the transition from EBS to EAS, SAME was itself developed atop an existing system: the NOAA Weather Radio, which activated its receivers and called their owners to attention through a Weather Alarm Tone--eight to ten seconds of 1050 Hz (National Weather Service, 2011, p. A-2).

The method for encoding digital information as sound in the EAS, in other words, first took shape in a semantic and signal context already populated by an attention tone. The encoding method addresses the decoder machine as the alarm tone addresses the human listener, switching their state to one of full attention and readiness to follow instructions. In this merger, reinforced by the ongoing aural similarity of the attention and header signals, the EAS treats machine listeners as human-like and its human listeners as machinic. The EAS orients this obedient listening subject through the subject's vital need for information under the threat of national crisis; and it does so most saliently by holding the fulfillment of that need in suspension. The same political and temporal property of suspension characterizes the EAS both at the narrow timescale of its messages' audition and at the long timescale that the system's messages and failures together construct.

Conclusion

In adapting recent media studies frameworks to center acoustic rather than visual or spatial materiality, this study has used emergency broadcasting's distinct alert sounds as a means to

begin unraveling its effects upon adjoining infrastructures. The EAS is present in radio as these sounds, as cable lines, and as hardware devices--but it is also present as an ongoing tool for the (anti-)regulatory actors who continually renegotiate radio's form and function as a medium. At the same time that it conferred the form and status of survivable network on radio and other media, the EAS and its predecessor systems made way for the centralization that has often deprived these media of their expected utility under actual emergencies. In explicating that mechanism, I hope to have provided caution for policymakers in Canada and elsewhere who have looked to adapt parts of the American model for cross-media emergency warnings against its re-centralizing pitfalls. I have also aimed to shed further light on a condition in the United States where deep-set complacency about infrastructural stability is at ever greater odds with the eroded institutions that its publics encounter: "across the global North, one cannot be faulted for feeling a creeping sense of decay spreading across many infrastructural environments" (Boyer, 2018, p. 224). The EAS, in the long-term rhythms composed by its audible test signals and its inaudible failures, produces such an environment and the feeling of its disrepair.

The EAS does not simply lurk in American broadcast media's past or underneath a newer scaffolding as an insidious conduit for military power. It is certainly part of the Cold War socio-technical story that such figurations have crucially revealed, but it is also an ongoing point of negotiation and interoperation among disparate media designs, eras, and power-brokers. Emergency alerts remind us that, no matter how far CONELRAD has receded into the past, many of our communicative circuits can be seized by state power. The anxiety of that fact, though, can help disguise a more nuanced reality: that the state power in question, in the interest of easing corporate centralization, has more readily loosened the couplings in that seizure

apparatus than it has made use of them. Alert signals help sustain a notion of emergency as a temporally bounded state of exception, but the larger decay of emergency communication capabilities in America rejects this notion. What I have found instructive about the EAS is that, even at the historical timescale, it demands to be heard in order to be understood; indeed, because a listening public forms part of its signal chain, it only fully materializes as a network in the action of its being heard. To approach an infrastructure through and as sound, as the EAS requires, is to shift analysis inward from the architecture that surrounds media signals and into the material, temporal, political action of signals themselves.

Notes

1. Listeners would typically only know the status--test or warning--of a message prior to hearing its content in the case that a DJ or announcer, working in a broadcast studio where the EAS encoder/decoder has been set to manual rather than automatic mode, chooses to tell their listeners about the test or warning in advance of manually triggering the playthrough of the message. This scenario depends on elements of training, in-person staffing, and device settings that are all, according to Kepner (2010), exceptions to the present norms in the American radio industry. Centralized and automated practices in this way determine the affective operation of the EAS, not just its technical successes and failures.

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