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Making the Perfect Record: From Inscription to Impression in Early Magnetic Recording

At least in writing, one of the first magnetic storage media was thread, on which—in September 1888—Oberlin Smith claimed sound could be recorded. Smith imagined thread as a lightweight and affordable means for quantifying the content of a given message, not to mention the time invested in its communication. For instance, in "Some Possible Forms of Phonograph" (published in *Electrical World*), he suggests: "The Lord's Prayer could be written upon a few feet of thread or string, while a young lady receiving a small spool of cotton from her lover would think herself abominably neglected if it was not 'warranted 200 yards long'" (1888, 116). In the case of a ritual communication such as the Lord's Prayer, only a few feet are required. Meanwhile, the complexity of love and its labors warrants at least two hundred yards. And during the late 1880s, those two hundred yards were guaranteed to all consumers of, say, Clark's spools of "Our New Thread" crochet or darning cotton.[1] Since the spools were small and tightly wound, the length of wrapped thread was impossible to determine with a naked eye. Consequently, Clark and other thread companies assured buyers that they were in fact getting the two hundred yards they purchased. Understood this way, Smith's early ideation of audio on thread not only enables a metric for abstracting labor from the messiness of everyday practice (converting the time spent authoring a message into the number of feet on which it is stored). It also demands faith in the medium—a faith that thread would store sounds naturally, authentically, and exactly as they existed prior to their mediation.

Of course, the very idea of an immediate or immaterial sound somehow preceding the recording process was itself a cultural production imbricated with the popular emergence of audio technologies (including Edison's phonograph) during the 1870s and 1880s. If recording

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was invented, then so, too, was the spirit of sound. A speaking spool was at once aura and artifice. That said, Smith's magnetic thread is curious neither as a vehicle for deconstructing the metaphysics of presence nor as an opportunity to interrogate copies as aberrations of their originals.[2] As Jonathan Crary (2001, 4) asserts, critiques of presence are now well rehearsed, and perseverating on them simply ignores larger historical issues related to how the senses are enculturated, organized, and disciplined. Equally familiar to media studies is what Jonathan Sterne (2003, 286) calls the "ontological split between an original and copy," which "only offer[s] a negative theory of sound's reproducibility, where reproduction can reference only that which is not reproduced." As goes the fallacious assumption, copies are always at a loss.[3] A more complex question, then, is how media and their metrics co-construct (rather than merely compensate for) human perception and memory, manufacturing faith in what eyes cannot assess and what ears cannot replay. And to push this inquiry a step further, scholars invested in the materiality of media must unravel how particular procedures of inscription, transfer, and playback facilitate particular forms of record making, including—to return for a moment to love "warranted 200 yards long"—how the physical specifications of magnetic storage shaped the processing of proof and fostered a faith in evidence.

In the following paragraphs, I explore this articulation of early magnetic audio with perception, memory, faith, and record making, examining texts published between the 1870s and 1910s. Oscillating between technical, business, cultural, and literary approaches to media and technologies, my aim is not to privilege one approach over the others. It is to exhibit how they collectively inform a series of historical incongruities, all of which are anchored in a device called the telegraphone. As this essay's object of inquiry, the telegraphone becomes an overdetermined site of a shared investment: noise-free magnetic audio. Put to a variety of uses

and saturated with an array of meanings, it was imagined as a way to individuate people through immersed listening to high-fidelity sounds. It also corresponded with the opportunity to store and consolidate those sounds for later listening: to defer what was once ephemeral. Both of these tendencies were compounded by claims that magnetic recordings were perfect documentations of actuality. For instance, Smith's thread was perceived as immediate precisely because of its magnetic character. It would not "inscribe" or "write" sounds. It would "capture" and "impress" them, affording reliable, indexical relationships without perceivable traces remaining on the storage medium.[4] But regardless of its rhetoric, the telegraphone was a commercial failure. It was never available for widespread consumption. Still, the once-new device helps us better understand how people initially learned to simultaneously ignore, trust, and desire magnetic storage—to examine how faith in magnetic recording emerged between the 1870s and 1910s, well before now-ubiquitous hard drives (not to mention seemingly unlimited cloud storage).[5] Put this way, the story of a failed sound machine offers a prehistory for contemporary computing, invested as it often is in the automagical transubstantiation of magnetic impressions (on platters) into data expressions (on screens and through speakers).[6]

This prehistory matters because it not only contextualizes contemporary computing and today's magnetic media through mechanical age audio cultures. It also sparks some speculation about what artifacts are not at hand, in the archive, or on file—about what does not ultimately go into storage.[7] If, during the development of early magnetic technologies and media, the perfect record would never lie and would never be written, then we must ask how such a record was actively constructed, through what material procedures of impression and playback, and in what relation to transforming notions of proof, evidence, perception, and memory. To be clear, then, this prehistory is an account of making records, not giving or taking them.[8]

Developments in Early Magnetic Recording: No Audible Contact Shall Be Made

In the history of technologies before and after 1888, a drive toward the abstraction and standardization of both information and perception is certainly nothing novel.[9] However, what makes the case of early magnetic recording unique is that Oberlin Smith bundled that abstraction and standardization with a critique of mechanical noise, which abraded cultured ears as it revealed technical flaws. One such flaw was the friction between a needle and groove caused during the playback of mechanically recorded sound inscribed on tinfoil. As magnetic audio historian Mark H. Clark notes in "The Magnetic Recording of Sound," Oberlin Smith visited Thomas Edison's Menlo Park laboratory in early 1878, ten years prior to his publication in *Electrical World* and just after Edison patented the cylinder phonograph (1999c, 7).[10] While examining Edison's new device, Smith was struck by a scratchy noise generated during playback.[11] It was a noise that mechanical recordings simply could not avoid, and it offended Smith's ears.[12] As a response, he proposed magnetic recording, where no audible, physical contact would be made between the storage medium (for example, thread) and the playback mechanism (for example, an electromagnet). In "Some Possible Forms of Phonograph," he explains one use of magnetic recording could be a "*purely electrical . . . recording telephone*," where people would speak into the phone, thereby vibrating a diaphragm that would convert sounds into an electric current (Smith 1888, 116). Varying in a length and intensity relative to the duration and amplitude of what was spoken into the diaphragm, the current—together with a magnetized cord—would pass through a helix. The helix would function as a recording coil, translating the current into "a series of short magnets grouped into alternate swellings and attenuations of magnetism" impressed on the passing cord (116). The cord would be wound

through two parallel reels and put into motion by hand or clockwork. And it would be kept taut by a tension brake or spring pressed against one of the reels.

Smith (1888, 116) hypothesized the results in aesthetic terms: "The cord . . . therefore contains a perfect record of the sound, far more delicate than the indentations in the tin-foil of the mechanical phonograph." Not only would it be cheap and flexible; it could also "talk back" if rewound on a reel and redrawn through the helix at roughly the same speed of recording.[13] Importantly, though, a recording could occur on the receiver's end of the telephone, too. For example, Smith (1888, 116) writes: "our hypothetical young lady might, while listening to the impassioned pleadings of her chosen young man, be preparing the evidence for a future breach-of-promise suit." Comments such as this one correspond with contradictions common to early representations of magnetic audio and the forms of listening it enabled: its noise-free character facilitates fidelity and deceit, immersion and distance, authenticity and disembodiment. By eliminating any audible mediation between a playback mechanism and its source medium, Smith's inscriptionless process would enhance the clarity of communications *and* induce alienating effects.

But thread never caught on. One reason is economic. Even if thread was an affordable and lightweight medium, Smith presumably had no time to develop magnetic storage. Or he did not consider it a worthwhile investment. Like Edison and his work on incandescent light in the 1870s and 1880s, Smith put sound aside in order to pursue endeavors in other sectors, namely metal and coin press machinery.[14] By 1910, his Ferracute Machine Company (located in Bridgeton, New Jersey, just three hundred miles south of Edison's Menlo Park) supplied presses to the US Mint, Eastman Kodak, Chrysler, Cadillac, Ford, and many others. With a list of customers such as these, the press machinery business was obviously far more profitable and in

demand than magnetic storage, especially since Smith's conceptualization of storage was impractical at best. For instance, thread alone cannot store sound. In order for that to occur, a substance such as magnetic fiber must be spun through it, and that spinning process is laborious. True, in his writings on magnetic recording, Smith does list other possible cord substances, including wire and chain. Still, historians are unsure whether he ever invented a system where any medium reproduced audible results.[15] They are, however, quite certain that he never obtained a patent for magnetic recording, a magnetic recording device, or a magnetic storage medium. For Smith, then, ideal sound and noise-free listening remained concepts impressed—at best—on paper in a pop review.

Yet according to *Technical World Magazine* in 1906, Smith's idea was in fact translated into a marketable technology.[16] In "A Spool of Wire Speaks" by E. F. Stearns, audiences could read about "an instrument of most unusual appearance," a "weird instrument," "a box of something less than a cubic foot [with] two spools, five or six inches in diameter, filled with hair-like steel wire" (1906, 410). The device was of most unusual appearance because it resembled a telephone without being one. It was a weird instrument because it served a function people were unaware needed serving. And, as Stearns's title indicates, it was wound with wire, not two hundred yards of Clark's cotton thread. "But," Stearns adds, "the weirdness comes when you listen":

> The demonstrator, say, has set the "speaking" switch, and you have spoken haphazard words into the transmitter; now the switch goes to "hearing," and you listen. And the words come forth—not after the "scratchy" manner of the phonograph, not with the side noises so often incidental to the telephone, but clearly, distinctly, with a pure, clear-cut, flowing quality difficult to describe, but astounding to hear! (411)

All of the technical features that Smith imagines are present here, and they are presented in a magazine chiefly aimed at men already studying, working, and investing in the fields of engineering and applied sciences. In other words, "A Spool of Wire Speaks" is an advertisement in text form. Through hypothetical scenarios, it describes the "weird instrument" as it sells it, stressing several opportunities for technological innovation, like permanently recording otherwise ephemeral telephone conversations, easily editing and erasing dictations on the fly, and answering a phone in the absence of a subscriber. These affordances might be rephrased from the perspective and parlance of a US business operating circa 1906: irrefutable evidence of verbal agreements, the obsolescence of stenographers and associated costs, and increased efficiency through automated messaging and split attention. Indeed, with a machine to hear for them, people could double their labor, listening to a telephone caller in one space while completing additional tasks—like drafting a breach of promise suit—in another.[17] Understood this way, turn-of-the-century communications technologies were not distraction devices. Instead, they increased what people could achieve in a typical day, and they could presumably translate routine sensual labor (e.g., listening) into value-producing activity (e.g., the creation and administration of office records).[18] By extension, businesses could increase the thoroughness and transparency of their file keeping.

Stearns elaborates on these technological and business innovations by creating an everyday character named Mr. Jones, who has to work on the weekend. "It is a Saturday afternoon in summer; save for himself, the office is wholly deserted" (1906, 412). However, Mr. Jones must depart the office in order run some errands uptown. Knowing important people will probably call him, he sets his new storage device on "ready" and leaves. While he is absent from the office, several messages are left, each no longer than three minutes, at which point the device

stops (412). If callers do not complete their message within that time frame—selected solely for the purposes of efficiency, since a two-mile spool of wire could receive up to 17.6 minutes of sound—then they must call back.[19] When he returns to the office, he finds the spool of wire near full. So "Mr. Jones sits back in his chair, starts up the instrument, puts the receivers to his ears and listens to the various voices and messages that have been floating into his office since noon" (412). Comparable to Smith's "hypothetical young lady," he might be multitasking: writing one message and listening to another. Regardless, for reasons explained later in this essay, Stearns's scenario remains largely a fiction in *Technical World Magazine* and elsewhere, at least during its time period. As historian David Morton (2000, 134) notes, it was not until the 1980s that many Americans had an answering machine in their businesses or homes. Nevertheless, something like it did exist in 1906, eighty years before Ferris Bueller took the day off and deferred callers until after the beep.

In fact, the answering machine's predecessor existed as early as 1898. Although there is no evidence that he read Oberlin Smith's work, that year an engineer by the name of Valdemar Poulsen experimented with storing voices on piano wire. These experiments initially occurred in his laboratory at the Copenhagen Telephone Company in Denmark. According to Marvin Camras (1985, 1), a historian and practitioner of magnetic recording, Poulsen would stretch magnetic wire across the diagonal width of a room, from the top corner to its opposite bottom corner. To that wire, he would attach a trolley, which carried an electromagnet, battery, and telephone transmitter. As the trolley rolled down the wire, he would run alongside it, shouting into the transmitter.[20] This process would then be repeated, but with a receiver instead of a transmitter. As the trolley rolled down the wire again, Poulsen would have a friend listen to the playback through an earpiece. The playback could be repeated (ostensibly without deterioration

in audio quality), with people taking turns to individually listen.[21] Better yet, they could then witness Poulsen wiping the record clean with a strong magnet, only to rerecord on the same medium (1). Also mentioned in Smith's early writings, this notion of erasing and rerecording cannot be underemphasized in the histories of magnetic storage. When compared with other, seemingly less-reusable options (such as shellac discs and wax cylinders) on the market, piano wire became an appealing alternative.[22] It was a rewritable medium, and being able to rewrite a record ironically implied increased odds for perfection. A second take (or an edit) gave people a sense of agency, an opportunity to finally capture (but actually reconstruct or make) the essence of a moment heretofore undocumented. And although piano wire is brittle, easy to twist and tangle, and subject to severe fluctuation during playback (especially if hand- or pedal-cranked), its magnetic character was laden with a progressivist bent toward a Hegelian promise of purely synthesized sound and immediate recording.[23] Because of this bent, many of the medium's material limitations (e.g., brittleness and fluctuation)—not to mention many significant aspects of the impression and playback processes—were often overlooked in order to foreground advancements in science, industry, and everyday office life.

Most of those advancements were anchored in remediating the telephone with the phonograph cylinder or gramophone disk.[24] Since Poulsen believed magnetic recording's most important use was storing telephone messages, he directed his research toward what he called the telegraphone (meaning "to write voice at a distance"). In "The Telegraphone," Clark and Henry Nielsen (1995, 15) suggest Poulsen "was frustrated by the inability of telephone users to leave a message when the party they called was not at home." In 1898, Poulsen patented the telegraphone in Denmark, following with applications elsewhere, including one filed in the United States on July 8, 1899, granted on May 29, 1906, and titled, "Apparatus for Effecting the

Storing Up of Speech or Signals."[25] There, his description of the magnetic recording process is incredibly similar to what Smith articulates in "Some Possible Forms of Phonograph." In the patent, Poulsen makes a sum total of forty-three enumerated claims. All of them somehow relate to receiving, recording, storing, or reproducing speech, sounds, signals, and electrical impulses. Also, three of the final four claims seek to patent "a phonogram or sound-record . . . having impressed therein or thereupon magnetic conditions" (1906, 7). Poulsen suggests the phonogram or sound-record could be composed of steel and assume the form of a wire or strip.[26] Importantly, the warrant motivating all of these claims is a critique of the mechanical phonograph:

> As is well known, in the usual phonographs the vibrations of air transmitted to a membrane are caused, by means of suitable mechanical parts, to make indentations in a receptive body, which indentations can cause a membrane to repeat the said vibrations by suitable mechanical means. Mechanical alterations of such bodies, however, give rise to disturbing noises, which apart from the expense of such apparatus is one of the principal reasons why the phonograph has not come more extensively into use. (1906, 1)

Indeed, the affinities with Smith's article (published just eleven years earlier) are uncanny. And they revolve around the aesthetics of recording and playback—around the "disturbing noises" problem. Nonetheless, speculating about how Smith influenced Poulsen, or offering an origin story for magnetic recording, is more than a futile exercise; it also distracts from the traction Poulsen's telegraphone gained in various communities of practice, where the "weird instrument" described by Stearns in a 1906 issue of *Technical World Magazine* quickly became a spectacle.

For instance, the telegraphone received a gold medal at the 1900 Paris World Exhibition. From the perspective of industry and consumer culture, that event was a major gathering on an

international scale. Clark and Nielsen (1995) explain the scene at the telegraphone's demonstration. They note that novelist Émile Zola was present, as was Austro-Hungarian Emperor Franz Joseph, who consented to a recording.[27] They also point out that "Poulsen no doubt sought to emulate Alexander Graham Bell, who had induced Brazilian Emperor Dom Pedro to use his newly-invented telephone twenty-four years before at the American Centennial Exposition in Philadelphia" (1995, 16). Put differently: Poulsen and his research team followed a long legacy of publicly dramatizing the potential of technologies at such exhibitions.[28] Indeed, Poulsen's 1900 demonstration, and Bell's in 1876, are only two instances in a tradition of science fiction–esque performances at fairs between 1850 and 1900.[29] Consider the 1851 Crystal Palace Exposition in London, the ephemeral lavishness of which fascinated Walter Benjamin, namely due to correlations between such lavishness and free trade.[30] There are also Thomas Edison's demonstrations of electric light at the 1881 Paris Exhibition and the phonograph at the 1889 Paris Centennial of the French Revolution. The list goes on, and one persuasive interpretation of these demonstrations is that they foster myths of the lone inventor, [31] often a textbook hero of some entrepreneurial class in US culture.[32] Such myths reduce a set of complex activities (e.g., the labors of production, research, and advertising) to a single product borne by a genius scientist or engineer.[33] They also bolster bootstrap narratives of upward mobility not unlike a Horatio Alger story. Moreover, the mystification of a technology enables what Matthew Kirschenbaum (2008) calls a "medial ideology," or mass attention to the formal qualities of a given medium at the expense of a technology's material particulars.[34] In the case of the telegraphone, the aesthetic appeal of magnetic wire's perfect record overshadowed the physical limitations of the technology's hardware and the labor involved in creating it. In many ways, the telegraphone was vaporware at the turn of the century.[35]

Quite tellingly, appeals to the telegraphone's aesthetic are most vibrant in publications associated with the Franklin Institute, founded in 1824 as a space for fostering expertise in the mechanical arts. As Bruce Sinclair notes, the Institute was ultimately part of a larger national program to not only give citizens (mostly, if not entirely, men) access to a practical education but also blend technical training with the democratizing values of science and technology. Sinclair (1990, 65) writes: "This new approach to technical education . . . depended on literacy and an open cooperative style of work, unlike the secrecy that had dominated the craft activity for so long." In 1826, Thomas P. Jones started a journal for the Institute, merging it with *American Mechanics' Magazine* and calling it *Franklin Journal and American Mechanics' Magazine*. Serving as the journal's editor between 1828 and 1848, he considered the publication a reflection of the Institute's ethos: open instruction, cooperative education, plain writing, and an integration of theory with practice. According to Sinclair, Jones believed that "working people ignorant of first principles wasted time and money on things that would not work. Worse yet, they were misled by mechanical chimeras" (65). Consequently, the journal—later known simply as the *Journal of the Franklin Institute*—condensed the principles of technical education into an efficient form, with articles rarely exceeding eight pages. Jones thought anything beyond that length would most certainly lose the intended audience's attention (69).[36] Although he died in 1848, traces of his framework for the journal lasted far beyond the mid-nineteenth century. Yet the chimeras are certainly there, too. As but one example, consider Charles K. Fankhauser's work in the early 1900s.

At the Franklin Institute on December 16, 1908, Fankhauser presented the telegraphone, speaking little about its material specificities and instead favoring a hyperbolic assessment of its potential applications for occupations involving listening and inscription.[37] In a written version

of the talk, published in the *Journal of the Franklin Institute* in January 1909, he says: "I believe that the next few years will see a telegraphone installed in the office of every doctor, every lawyer, every banker, in the counting room of every trust company, and of every industrial or commercial establishment, large or small" (Fankhauser 1909, 41). He also predicts that the telegraphone will render typewriting and letter writing obsolete, and he dramatizes the range of its reach through a variety of conjectures. In railroading, the device will replace the telegraph; for stock quotations, it will supplant the telephone; in medicine, it will diagnose heart and lung ailments; and it will bring about the demise of stenographers in all realms of dictation.[38] That is, all realms but one: justice. Fankhauser states: "While the human stenographer may never be eliminated in important legal proceedings, it is highly probable that an additional check will be kept in every court room by the installation of a telegraphone which will eliminate all chances of human mistakes" (44).[39] When it comes to standing before the law, a faith in the medium faces its limits. At the turn of the century, even a technocrat is unwilling to reduce justice to pure science, and in the courtroom the telegraphone is relegated from a producer of perfect records to a validation machine. If nothing else, this snippet of Fankhauser's work exemplifies the various ways in which early magnetic recording was actively tied to the construction of human perception and memory. Fankhauser's claim that stenographers will persist amid technological progress corresponds with occupation-specific modes of listening and writing, as well as the memory training and embodied habits associated with them. What's more, it corresponds with the imagined range and robustness of the telegraphone's diverse applications, however speculative they happened to be.

As one may guess, none of Stearns's or Fankhauser's positivist fantasies was fulfilled through the telegraphone. One common explanation is that both Smith's and Poulsen's ideas

were too far ahead of their time. For instance, Clark and Nielsen (1999, 21) point out that "no practical electronic amplifier existed at the time (the vacuum tube was still some years away)." Indeed, electronic amplification was not available until a decade after the 1900 Paris Exhibition, meaning the recording and playback of telegraphonic sound was extremely weak. Camras adds: "If only the telegraphone had given *loud*, clear, reliable sound, it would have met with public acceptance. But the reproduction was weak and spotty" (1985, 6, emphasis added).[40] Without an earpiece, people could not hear the sounds played back by the machine. And even if they could, it would not have been easily integrated into existing telephone networks. That is, in today's parlance, the telegraphone was not built with interoperability in mind. It would not scale. Not only did it lack an amplification device; its parts and associated labor were cost prohibitive. Indeed, the chimerical mystifications of a perfect record eclipsed what could actually be accomplished technologically, and conjectures about the telegraphone's social implications more or less determined how its material particulars were perceived and communicated. Consumers were supposed to simply have faith that the device could eventually achieve what Stearns, Fankhauser, and other investors claimed it would do, and appeals to natural, authentic, and noise-free records did not hurt their cause.

The Telegraphone and Scientific Detective Fiction: Wiping Out the Record

One case study for these chimerical mystifications is the scientific detective fiction of Arthur B. Reeve, who first published in *Cosmopolitan* in December 1910, just ten years after Poulsen's team publicly demonstrated the telegraphone in Paris and roughly three years after the device received mass attention in various magazines and journals.[41] In a preface to *The Silent Bullet* (1910), Reeve would briefly explain what a scientific detective story entailed: "'I am going to apply science to the detection of crime; the same sort of methods by which you trace out the

presence of a chemical, or run an unknown germ to earth.'"[42] Here, his famous protagonist and professor of criminal science, Craig Kennedy, is speaking to Walter Jameson, who is Kennedy's sidekick, a newspaper reporter, and the story's first-person narrator. If this scenario resonates with Arthur Conan Doyle's Sherlock Holmes, then there is certainly no coincidence. Reeve advertised his scientific detectives—such as Kennedy, Guy Garrick, and Constance Dunlap—as the American versions of Holmes, with one key difference: they rely far less on intuition. In a piece from 1919, "When the Criminal Takes to Science," Reeve argues: "The 'science' in Conan Doyle is of the most elemental sort. Here is a grass blade—somebody has stepped on it. Here are some tobacco ashes, let's work them up" (36). Meanwhile, Reeve is invested in a nascent form of forensic science, premised on tracing out the presence (the fingerprint) of bodies at the scene of the crime. Grounded empirically in the physical world, such evidence is—at least according to Reeve—irrefutable and objective.

However, instrumental science needs its neutral devices. And in Reeve's writing the telegraphone is one of them. In fact, throughout his scientific detective stories (including the eighty-two Kennedy stories published by *Cosmopolitan* in the 1910s), Reeve uses fiction as a space for disseminating information about new gadgets. LeRoy Panek (1990, 57) writes: "Arthur B. Reeve, of course, is the fountainhead of the American scientific story." Indeed, "science produced gadgets that made crook-catching easier," and so "Reeve talks of the detectoscope, the telegraphone and the teleautograph" (57).[43] By no surprise, then, Reeve's writing is frequently didactic, comparable to, say, the drabness of a 1980s personal computer manual. For instance, in *The Dream Doctor*, Kennedy rambles about the telegraphone for nearly two pages (1914, 201-02).[44] By way of a demonstration for Jameson, he unpacks the device for his reading audience: "This is the latest improved telegraphone, a little electromagnetic wizard in a box, which we

detectives are now using to take down and 'can' telephone conversations and other records. It is based on an entirely new principle in every way different from the phonograph. It was discovered by an inventor several years ago, while experimenting in telephony" (1914, 201). Aside from the comparison with Edison's noisy machine, Kennedy outlines many of the technical specifications I mention throughout this essay. He continues: "There are no disks or cylinders of wax, as in the phonograph, but two large spools of extremely fine steel wire. The record is not made mechanically on a cylinder, but electromagnetically on this wire" (201). Later, he adds: "There are no cylinders to be shaved; all that is needed to use the wire again is to pass a magnet over it, automatically erasing any previous record that you do not wish to preserve. You can dictate into it, or, with this plug in, you can record a telephone conversation on it" (201). Finally, readers get Jameson's perspective as a listener: "[Kennedy] turned a switch and placed an ear-piece over his head, giving me another connected with it. We listened eagerly. There were no foreign noises in the machine, no grating or thumping sounds, as he controlled the running off of the steel wire by means of a foot-pedal" (202). Such lengthy explanations abound in Reeve's prose. One of their social functions was to educate audiences (especially the middle class) about gadgets unfamiliar to them, and those gestures tend to manifest awkwardly as lectures given by an erudite, loquacious polymath.

Writing style aside, Reeve's scientific realism received both scrutiny and praise. In a July 1913 issue of the *Independent*, he published "In Defense of the Detective Story," wherein he responds to allegations that criminals are inspired by and learn from the "cheap" genre. Halfway through the piece, he recalls the following: "The very first scientific detective story which I wrote was returned to me by one editor of a popular magazine with what I considered the most complimentary letter he ever wrote me, that he 'couldn't publish a story like that—some darn

fool would go out and try to do it'" (Reeve 1913, 93). Such accusations were apparently familiar to Reeve, who counters by resituating the argument, stressing the connections between his realism, social progress, innovation, and the moral good.[45] Through a series of examples, all of which use letters from his readers as evidence, he explains the various ways in which scientific detective stories lay bare the methods of a growing criminal underclass, making those methods common knowledge to otherwise hapless victims. He also suggests that, by reading the genre, people may discover a theretofore unrealized means for revealing the truth. Among these examples are references to the "scientific eavesdroppers" appearing in his fiction (1913, 93). Reeve writes:

> Every mention of the dictagraph, the detectaphone, and similar scientific eavesdroppers has brought eager inquiries. In one case a letter from a South Carolina man said: "I have a case in which I can use such a device in procuring the real truth. It will be the means of restoring the character of a young man who is now a victim of a foul conspiracy." In another case a man who was under indictment in Iowa wanted the author to come to his rescue with such of the scientific paraphernalia as Kennedy uses. "I think," he appealed, "that if you will bring the instruments named, I can get enough evidence to clear myself." (93)

To this list of readers, Reeve adds actual detectives, scientists, and researchers such as Thomas Edison, who also enjoy and learn from detective fiction.[46] Acknowledging this same sentiment twenty-seven years later, well-reputed science fiction publisher Hugo Gernsback introduced a *Scientific Detective Monthly* essay by Reeve with these acclamations: "Mr. Reeve, as the creator of Craig Kennedy, has perhaps done more for the dissemination of science through the medium of detective stories than any other man alive. Mr. Reeve has always kept within the strict bounds

of science" (quoted in Locke 2007, 30).[47] Only a sentence later, Gernsback speculates that, because of Reeve's work, police forces in the United States are integrating new technologies into their departments in order to solve crimes and increase efficiency (30). For Reeve, this tangible correlation between actuality and fiction was—at least for a writer of detective stories—how to differentiate a modern approach from its predecessors, such as fiction by Edgar Allan Poe and Conan Doyle. From his perspective, scientific detective fiction did more than represent rationalist instrumentality. It had a populist, real-world accessibility. It was more applicable to everyday life than Romantic analysis or even Holmesian deduction.[48]

Reeve was so inspired by this quality of accessibility that he became invested in becoming a detective himself. John Locke, who edited a collection of Reeve's work and wrote a short biography on him, notes how many people actually addressed the writer as "Mr. Kennedy" (2007, 131). Reeve was not only seen adorning the covers of magazines featuring the Kennedy stories; he also became actively involved in crime prevention, particularly after his genre expanded into film and radio during the 1910s and 1920s.[49] For instance, in April 1930 he started a radio show named—creatively enough—"Crime Prevention Program," for which he underwent training with the New York City Police. On top of original drama, the program involved guest speakers (including New York Police Commissioner Edward Mulrooney) as well as Reeve's own editorials on crime prevention. Shortly after the radio program commenced, Reeve ambitiously declared the formation of a nationwide "Crime Crusade Foundation." Essentially a media campaign, it would join together crime prevention organizations across the country through a magazine, radio hour, book, and newsreel in order to collectively combat racketeering (Locke 2007, 33-34). The Foundation never gained steam. Still, as Locke describes Reeve's turn from writing for magazines like *Cosmopolitan* to producing with media like radio: "If detective

fiction had been a vessel for imparting science, Reeve was simply changing the broth" (33). Of course, as the "broth" changed, so, too, did the practices and settings through which Reeve exposed those he dogmatically deemed yeggmen and crooks.

Yet—not entirely unlike a speech by Fankhauser, an office scenario by Stearns, or an article in *Electrical World*—Reeve's realism is not without its dramatizations and hyperbole. For example, of the twenty-six times the word *telegraphone* appears in a twelve-volume collection of Kennedy stories published in 1918, only ten of them are used within the context of either a demonstration or an explanation of the device. The other occurrences figure more centrally in the narrative, and a majority of these occurrences are imbricated with now amusing references to truth, eavesdropping, and accuracy.[50] Consider a scene from *Constance Dunlap, Woman Detective*, the twelfth volume in the Kennedy collection.[51] Although Kennedy is not the protagonist in this volume, the style and narrative techniques of the Dunlap stories resonate with the balance of Reeve's short fiction from the 1910s, one likely reason they are included in the collection.[52] For instance, as with Kennedy, Reeve presents Dunlap as a scientific detective who uses forensic gadgets like the telegraphone to unveil criminal plots through trace evidence.[53] In one particular Dunlap story, "The Gamblers," the telegraphone plays an integral role in solving crimes of forgery and blackmail. Participating in what she knows is a fixed poker game, Dunlap waits for several characters to play manipulated cards (with trimmed edges) from the deck. She then declares: "'You are a lot of cheats and swindlers,'" to which one of the players responds with a challenge: "'Prove it'" (Reeve 1912a, 115). And so Dunlap retrieves and demonstrates her telegraphone. From it float preserved voices, as if uncanned from the dead. Reeve writes: "Deliberately she opened the box, disclosing two spools of wire inside. . . . She turned a switch and the wire began to unroll from one spool and wind up on the other again. A voice, or rather

voices, seemed to come from the box itself. It was uncanny" (116-17).[54] The group of cheats and swindlers listen to recordings Dunlap acquired while eavesdropping on the wire and spying on them. They become frantic and instantly paranoid, imagining what truths and private conversations will be revealed. Practically of all them hear their illicit agreements played back at them, with one exclaiming: "My God! it's a plant! . . . I'm ruined. There is no way out!" (118). With the telegraphone recordings in hand, Dunlap needs to say little. The evidence speaks for itself. It proves not only that the poker game was rigged but also that some stock certificates—which were guaranteed to the winner—were forged. For her findings, Dunlap gives the forensic gadget a bit of credit: "I learned all that over the telegraphone. I learned their methods, and, knowing them, even I could not be prevented from winning to-night" (121).

However, by the conclusion of "The Gamblers," no one is formally charged or convicted of their crimes. There is no grand court scene. Instead, Dunlap administers justice by alternative means. With the evidence she has on record, she can easily leverage nearly everyone in the room. And among them is Mr. Drummond, who also happens to be a detective. Feeling some pity for (and thus power over) him, Dunlap decides to let Drummond go. Or, to be exact, she decides to expunge his record. The implications of this forgiving gesture are less interesting than its ultimate expression: "'Drummond,' remarked Constance significantly, as though other secrets might still be contained in the marvelous little mechanical detective, 'Drummond, don't you think, for the sake of your own reputation as a detective, it might be as well to keep this thing quiet?'" (1912, 121). As one may predict, keeping things quiet does not imply merely hiding the evidence. With other secrets potentially impressed on the magnetic medium's nonvolatile memory, it implies complete erasure. Fortunately for Drummond, Dunlap says erasure is afforded by the telegraphone.[55] Reeve describes that process with some flourish: "Deliberately

she passed the magnet over the thin steel wire, wiping out what it had recorded, as if the recording angel were blotting out from the book of life" (122).[56] Dunlap then allows Drummond to test the wire himself to determine whether it is, in fact, blank. It is indeed, and the scientific detective implores him, too, to permanently forget what happened.

When caught on the wire, such is the simultaneity of burden and relief. Although the record may be wiped, the witnesses remain, with Drummond's career still at risk. In the end, perhaps detective Dunlap recognizes that—when compared with the ears of mechanical detectives—shared and internalized memories are not at all easy to forget. The recording angel can only blot but so much, even when the case does not go to court. And as Cornelia Vismann (2008, 146) observes of office and legal cultures during the early twentieth century, "most files no longer contain any secrets. . . . What is secret is neither that which is screened off by barriers nor that which has been put on file, but that which is off the record." Perhaps this "off the record" approach to proof in the age of mechanical reproduction is why, as Fankhauser claims during his Franklin Institute speech, human stenographers trump magnetic mechanisms in the courtroom, reducing telegraphones to validation machines.

An Immediate Medium for Ideal Record Making

Among all of Reeve's scientific detective stories published in the 1910s, this scene from *Dunlap* is one of several anchored in the telegraphone. Given the lack of stylistic and narrative variability in his fiction, the scenes tend to resonate with (or even mimic) each other, all of them involving a set of primary elements imbricating the specifications of magnetic media with listening and memory: the telegraphone as an objective eavesdropper (or a neutral instrument), the threat of magnetic recording to privacy, the promise of magnetic recording in the search for truth and rationality, and the acquisition of trace evidence, which exists noise-free through indexical

relationships with people's voices and their furtive machinations. "I learned their methods," Dunlap declares (1912, 121). "There were no foreign noises in the machine," Jameson observes (1914, 202). "'I am going to apply . . . the same sort of methods by which you trace out the presence of a chemical,'" Kennedy asserts (Reeve 1910, 3). Scholars may read these scenes solely as representations of the telegraphone on the page—how the device is depicted in fiction, how that depiction differs from the actual device, and so on. However, such interpretations risk ignoring how Reeve's scientific detective tales historically functioned within a larger constellation of strategies aimed at creating and fostering popular perceptions across socially disparate communities of practice. That said, a Kennedy or Dunlap story resonates with magazines like *Electrical World*, speeches at the Franklin Institute, the everyday life of Mr. Jones, and even US patent applications precisely because early magnetic recording was not developed in isolation. It was not reserved for the fields of science and engineering alone, and—returning for a moment to Kirschenbaum's notion of a medial ideology—fiction was a way that people learned about magnetic recording and how to perceive (with) it.

Indeed, once-new gadgets such as the telegraphone emerge recursively with other cultural phenomena, including new literary genres (e.g., scientific detective fiction), labor practices (e.g., dictation in the workplace), communication networks (e.g., telephony), consumption habits (e.g., listening to messages on wire), and initiatives in education (e.g., technical instruction in the mechanical arts). The existence of such cultural forces does not suggest they are totalizing, revolutionary, or unicausal. Instead, the implication is that—with devices like the telegraphone operating as an instrumental object across disciplines—those forces are at once abstract and concrete, simultaneously weak and strong (Star and Griesemer 1989, 393). That is, Reeve, Fankhauser, and Poulsen used the telegraphone differently in unique instances; nonetheless,

shared informational needs, listening practices, memory techniques, and ideologies existed across those uses. Perhaps most widespread among them was the belief that magnetic storage would do more than extend the ear or reproduce noise-free audio. It would, to borrow from Jonathan Crary (2001, 42), allow people to express their "autonomous power to actively organize and impose [themselves] on a perceived world" —to make, if you will, records of their own. At the turn of the century, such expressions intersected with a growing distrust in the empirical knowledge afforded by the senses (e.g., Smith's hypothetical young lady drafting a breach of promise suit), a rising demand for individuating and systematizing listening behaviors (e.g., speaking into receivers and listening through earpieces), and the increasing frequency of multitasking (e.g., look here, listen there). As one among many engagements with these tendencies, magnetic recording most obviously promised what Edison's phonograph could not: sound so high in fidelity it would seem immediate and immaterial. Beyond that, it promised a means to treat sound discretely, a way to listen in fragments, to edit, and—as demonstrated by Dunlap—to erase. Yet more importantly, the plasticity of magnetic audio influenced and was influenced by the enculturation of listening and memory.

That very claim should remind media historians that the expression of power over a perceived world is never distributed equally. Even something as banal as listening is saturated with the politics of its time, from the gendered divisions of office labor and the obsolescence of stenography to the instrumentality of a scientific detective, the decline of type, and the dissolution of technology-free leisure time. Whether these ventures were commercially successful or "impactful" is merely one question among many. Throughout the early development of magnetic recording, they were impulses for social, economic, and technological

progress. Moreover, this essay suggests that new technologies frequently serve as vehicles for a variety of often incongruous agendas, failed or not.

To be sure, the telegraphone was embedded in what might be called "speculative determinism," or the articulation of a yet-to-be-disseminated technology with its allegedly inevitable effects. Here, examples include the multiple practices, people, and technologies the device would ostensibly replace or at least dramatically alter: the phonograph, the gramophone, stenography, the book, the typewriter, the typist, the secretary, the police, the detective, the telegraph, listening, reading, and writing, to name a few. Such an articulation—in advance of the telegraphone's widespread consumption—allowed people like Fankhauser and Reeve to shape magnetic recording's commodity character. Part of that character was the appeal of a storage medium that facilitated individual authority over what ultimately went on record. Consider Fankhauser during his Franklin Institute speech, where he asserts that because of the telegraphone an "operator has perfect control of his record, may erase or retrace any part of it at any time by simply pressing the button" (1909, 43). This fetish for control was repeatedly expressed in writings related to the device. For some, it meant the ability to defer calls, consolidate time, and delete evidence. For others, it meant immersed listening on the clock, awkward dictation into a receiver, a loss of privacy, and possible obsolescence in the job market. For all, it meant that, when welded with new media and technologies, perceptual habits and memory techniques could not be neatly parsed from Fordist efficiency.

All of this faith and speculation was possible without a standardized device. No doubt, the case of the telegraphone is all the more curious because fiction related to it circulated more than the physical object itself. Despite the 1900 Paris Exhibition gold medal, exhaustive research by Poulsen's team, and endorsements from a number of known scientists and engineers in related

fields, the telegraphone never achieved a default state—say, a reliable medium with a known storage capacity and consistent playback—intended for a specific group of ideal users (e.g., office workers, police, or detectives). Likely for this reason, as well as its lack of commercial success, it is rarely mentioned in media or literary studies.[57] Still, as this essay shows, the telegraphone did gain some traction, offering us a prehistory for its now ubiquitous successor—the hard drive—and attendant medial ideologies anchored in the immediate transubstantiation of magnetic impressions into seemingly immaterial, data-driven expressions.[58] To be sure, neither the details of this prehistory nor the objects and ideologies associated with them are reducible to technical matters alone. Again, people learned to at once ignore, trust, and desire magnetic recording—to make magnetic records, not just give or take them.

And, as the texts referenced throughout this essay suggest, writings related to the telegraphone are incredibly pedagogical in character, regardless of genre. One obvious reason for this pedagogical tenor is that not many consumers had access to the telegraphone. Another reason is that the device involved a magnetization process unfamiliar to most audiences. And yet another is that, quite early on, numerous people wanted to exhibit expertise in an emerging field, particularly its technical language. For Reeve and Fankhauser, didactic displays not only informed audiences; they also publicly performed authority, something key to the persona of a professor, the reputation of a detective, the success of an innovator, or the pitch of a business agent. As Carolyn Marvin (1985, 49) argues, "control of technical language was a means for experts to establish themselves as arbiters of the domain of technological reality and, from that strength, to seize the larger domain of social reality." Equal to a professional education acquired through a setting like the Franklin Institute was a demonstrable knowledge of how to speak technically, how to use language to model a specific community of practice (49).

Read collectively, almost every publication referenced in this essay contains hyperbole, dramatization, or prose bordering on science fiction.[59] What's more, most of these popular publications privilege the pleasing aesthetics of magnetic audio, stressing its noise-free character, ease of erasure, and amenability to productive listening. In so doing, they tend to eclipse or inaccurately depict the particulars of brittle wire, glitchy playback mechanisms, and isolating earpieces. And yet, curiously enough, most of them explain magnetic recording with precision. For instance, recall Reeve's two-page demonstration in *The Dream Doctor*. It reads like a technology journal or patent of its time. Although such explanations do not always make for an engaging read, they do demystify aspects of magnetic recording for audiences who are unaware of the process. Plus, they trouble assumptions about the content of popular representations—a troubling that would flatter Reeve's realist sensibility. His scientific detective stories construct and enact technologies to perform speculative functions without entirely abandoning the material specificities of their processes. This claim is not to say Reeve never stretches the affordances of those particulars. He certainly does. It is to say that materialist histories can be comprehensive without dichotomizing writings as "popular" (or "cultural") and "expert" (or "technical"). Indeed, when it comes to learning about the stuff of media and technologies, neat distinctions between genres can be misleading.

Ultimately, then, this essay demonstrates how the physical materiality of early magnetic recording was itself enmeshed in popular culture and perception, even if it never generalized or achieved commercial success. Conspiracies on wire and love letters on thread appealed because they represented the impression of evanescent phenomena onto high fidelity, reusable storage media. Fleeting events and ephemeral voices would leave a trace, which could be captured and played back without audible aberrations. Yet the desire for a trace needed inventing, too.

Magnetic storage did not attract attention simply because it was innovative or superior to its phonographic counterparts. It attracted attention because—much like data expressed on contemporary computer screens—it was perceived as an immediate medium for ideal record making.[60]

Yes, ridding a voice of its ephemerality meant the opportunity to listen to it later. It also meant trace evidence or, as exhibited in a story such as Reeve's "The Gamblers," the translation of listening into leverage. In that story, indexical relationships weld canned sounds to bodies, and illicit agreements caught on wire accrue value. For Dunlap, magnetic recording also enables the administration of justice without an official court or a trial by the state. Meanwhile, for someone like Smith, Stearns, or Fankhauser, it is imbricated with measurability and productivity, where perception could be systematized through private acoustic spaces for isolated, immersed listening to dictations warranted, say, two hundred yards long. Of course, listening was all the more authoritative when the content was legitimate and not burlesqued, when two hundred yards of audio sounded as if it were floating into the ears, free from any intervening substance. It helped, too, that such sounds could be remembered with the simple press of a button. But perhaps most importantly, the audio could be easily erased, and the record could be expunged. Otherwise, magnetic recording would be too permanent; it would decrease individual authority over what remained in storage, as proof. That is, the power over how and when to listen demanded the freedom to plausibly deny ever making a record in the first place. Such is faith in a magnetic machine.

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Notes

1. In 1884, Clark Thread Company released "Our New Thread" to the consumer market.
2. Jacques Derrida (1976, 71) describes and then proceeds to thoroughly critique the theological fetish of authenticity and presence. He writes: "All dualisms, all theories of the immortality of the soul or of the spirit, as well as monisms, spiritualist or materialist, dialectical or vulgar, are the unique theme of a metaphysics whose entire history was compelled to strive toward the reduction of the trace. . . . Only infinite being can reduce the difference in presence. . . . The logos as the sublimation of the trace is theological."
3. Sterne (2003, 19–22) points to the work of several sound theorists and practitioners who rely heavily on the negative theory of reproducibility: Pierre Schaeffer (on acousmatic sound), John Corbett (on psychoanalytic frameworks for sound and vision), and R. Murray Schafer (on schizophonia), among others.
4. Engaging the work of Charles Sanders Peirce, Doane (2007, 5) asks: "What is the relation between the index as trace or impression and the index as pointing, *deixis* (Peirce's insistence that the word "this" is the most telling example of the index)?" If only elliptically, this essay responds to her question.
5. For a thoroughly materialist approach to the hard drive and contemporary magnetic recording, see Kirschenbaum (2008). In the first chapter, Kirschenbaum claims, quite importantly, that "computer storage media also have their affordances, but as storage in general has become more capacious and less immediately tangible it is easy to overlook them. . . . Attention to the affordances of various kinds of storage media can reveal much about computing in different contexts, allowing us to reconstruct salient aspects of now-obsolete systems and the human practices that attended them" (32).
6. For instance, according to both Nick Montfort and Matthew Kirschenbaum, a bias (in media studies and elsewhere) for computer screens enables an inattention to the materiality of computational processes and electronic texts. For more, see Montfort (2004) and Kirschenbaum (2008, 31–35). Montfort's term for this bias is *screen essentialism*.
7. For more on speculative (or conjectural) approaches to archives and textual scholarship, see Kraus (2009, para. 64). There, she argues that "conjectural knowledge in the humanities is a manifestation of the inalienable human need to imagine what might have been or could be or almost was."
8. In their research on computation and new media, Wendy Chun and Johanna Drucker make similar observations about the construction—rather than the capture or permanence—of records and data. Chun (2008, 167) writes: "Digital media, which is allegedly more permanent and durable than other media (film stock, paper, and so on), depends on a degeneration actively denied and repressed. This degeneration, which engineers would like to divide into useful and harmful (eraseability versus signal decomposition, information versus noise) belies the promise of digital computers as permanent memory machines. If our memory machines' memories are more permanent, if they enable a permanence that we seem to lack, it is because they are constantly refreshed so that their ephemerality endures, so that they may store the programs that seem to drive our machines." Meanwhile, Drucker (2011, para. 3) observes the following: "Differences in the etymological roots of the terms data and capta make the distinction between constructivist and realist approaches clear. *Capta* is 'taken' actively while *data* is assumed to be a 'given' able to be recorded and observed. From this distinction, a world of differences arises. Humanistic inquiry acknowledges the situated, partial, and constitutive character of knowledge

production, the recognition that knowledge is constructed, *taken*, not simply given as a natural representation of pre-existing fact." In this essay, I extend Drucker's constructivist logic even further and replace "taken" with "making." My argument is also informed by Chun's (2008) enduring ephemeral and her emphasis on degenerating materials and memories—on active forgetting.

9. For prior intersections of thread with standardization and alienated labor, see Babbage (1963, 334) and Plant (1997, 15-16) on computation and Jacquard's loom. Of course, Marx also wrote about spinning and weaving machines, with an occasional response to Babbage. See Chapter 15, "Machinery and Modern Industry," *Capital* (1976, 405-556) and "Division of Labour and Mechanical Workshop. Tool and Machinery" in *Collected Works*, Vol. 33 (Marx and Engels 1992, 387-477).

10. In 1878, Edison's cylinders were wrapped in tinfoil. Wax cylinders came shortly thereafter and were mass-marketed in the 1880s (the decade when Smith published "Some Possible Forms of Phonograph").

11. Smith's response to Edison's phonograph was written in a memorandum dated September 23, 1878, roughly ten years prior to the publication of "Some Possible Forms of Phonograph" in *Electrical World*. The memorandum is reproduced in Clark's "The Magnetic Recording of Sound" (1999c, 8). Why Smith took ten years to publish his hypotheses is difficult to determine. One reason may be that by 1888 he realized he had neither the time nor the resources to dedicate to magnetic recording.

12. Smith was not the only one with a critique. For instance, see the *Telegraphic Journal and Electrical Review* in 1879: "Edison's phonograph, as now constructed, is in several important respects defective. For example, the time of recording the sound on the apparatus is proportioned to the size of the barrel. The necessity of wrapping the barrel with foil does not permit of the conservation of speech, and by reason of its flimsy character only allows of several repetitions" ("A New Phonograph").

13. Redrawing the cord through the helix at exactly the same speed of the recording would be incredibly difficult (if not impossible) to manage if the device was operated by hand.

14. Tim Brooks (2004, 26) writes: "After the exhibition of his first crude tinfoil apparatus in 1878-79, Thomas Edison virtually abandoned the phonograph to work on the electric light. He did not return to work on it until 1886, when the expiration of his major commitments to the electric light, and the hot breath of competition from other inventors working on sound recording, brought him back into the fray."

15. One reason they are unsure is that Smith's lab notes and memoranda were lost in two separate fires.

16. *Technical World Magazine* merged with *Popular Mechanics* in 1923.

17. Here, I am echoing Sterne (2003, 51) in *The Audible Past*, where he stresses how the history of sound reproduction technologies is very much a history of the human ear as a mechanism, beginning in part with the advent of otology (ear medicine) in the late eighteenth century, when the ear (particularly the tympanum) was treated as a discrete, measurable object of scientific inquiry. Later, many sound reproduction technologies, including the phonograph, were represented as "talking machines." Yet, following research in otology and related fields, they were first imagined as hearing machines, especially for the deaf. Alexander Graham Bell's research (subtended by an investment in the eradication of deaf culture) is but one example. Consequently, Sterne argues that "the history of sound reproduction is the history of the transformation of the human body as object of knowledge and practice. Alongside the

problematization of sound, the abstraction of auditory perception and its condensation into a tympanic function defines sound-reproduction technologies as we know them today" (50-51).
18. In *Files*, Cornelia Vismann (2008, 101) describes how the creation and organization of records is central to the work of offices and administration. Near the end of the book's third chapter, she describes files as "the training ground for administrative routine." That is, files are not simply the product or output of administration.
19. Although Stearns (1906, 411) suggests "there are two miles of wire to run through" the telegraphone, his estimation might be hyperbole. Two miles, or 10,560 feet, would have meant 1,056 seconds (or 17.6 minutes). Like Clark's "Our New Thread" cotton, the most common spools of wire were two hundred yards (or six hundred feet) in length, and generally held only a minute of audio (at the rate of ten feet per second).
20. According to Camras (1985), Poulsen also conducted these experiments outside the Copenhagen lab: "In August 1898, Poulsen went on vacation in the country. He did not get much rest or fresh air, for he stayed shut in his room, and repeated 'Yakob, Yakob' into a microphone all day. Poulsen's host and the guests had their doubts about the peculiar young man who was talking to himself. In later years Poulsen explained why he had chosen the word *Yacob*, which is the Danish equivalent of Jacob or Jake in English. This word has two vowels and a very distinctive sound that Poulsen could recognize when it came back faintly through his crude apparatus" (1-2). Put differently, Poulsen had to negotiate with the microphone. The clear-cut recordings it enabled corresponded with the vocal clarity (or discreteness) of the syllables spoken into it.
21. One reason people had to individually listen is that reliable, electronic amplification was not popularized until the 1910s.
22. At the time, piano wire was not the only medium that could be reused. Storage media such as wax cylinders allowed for rerecording. Although it was a time consuming, delicate process, the top layer of wax on most cylinders could be shaved, exposing more wax for additional inscriptions.
23. For more on the Hegelian promise of perfect synthesis in sound reproduction, see Sterne (2003, 285-86).
24. I write "phonograph cylinder or gramophone disk" here because Edison did not demonstrate the phonograph disk until 1911. However, Emile Berliner filed his US patent for the gramophone on April 7, 1887. The word "disk" (as in "hard disk drive"), not "disc" (as in "compact disc"), is used in that patent and elsewhere when referring to Berliner's storage medium.
25. Also in 1899, Poulsen and a group of investors established a corporation in Denmark: Aktieselskabet Telegrafonen Patent Poulsen (or Aktieselskabet Telegrafonen). Ultimately, he received patents for magnetic recording in thirty-eight countries.
26. By "strip," Poulsen implies a strip of uncoated steel.
27. The magnetic recording of Franz Joseph is the oldest one available today. The guest book for the exhibition is available for viewing at the Danish Technical Museum in Helsingor, Denmark.
28. Before and during the Exhibition, Poulsen's research team included P. O. Pedersen, E. S. Hagemann, J. P. Christensen, E. Lübcke, H. Zopke, and Ernst Ruhmer.
29. In fact, the details surrounding Bell, the telephone, and Dom Pedro at the 1876 Exhibition are subject to debate. For instance, see Hounshell (1975), who argues that, despite popular accounts, the telephone was never the central feature of the Exhibition.
30. At several moments in *The Arcades Project*, Benjamin mentions the Crystal Palace Exhibition (or the Great Exhibition). Of most interest to him is the colossal character of the

event, the ephemeral architecture (a palace made of glass) built for it, and the relationship of both with free trade and commodity culture.

31. Or as Marx (1997, 493 n4) poignantly writes in *Capital*: "A critical history of technology would show how little any of the inventions of the eighteenth century are the work of a single individual. As yet such a book does not exist."

32. For more on the textbook hero, see Hounshell (1975, 1), who argues: "Most professional historians of technology recognize . . . textbook accounts as myths and discount their simplistic treatment of what is really a complex story of invention, development, and innovation. They wish the history of technology to be given more prominence in general textbooks, but first to be freed of old myths."

33. Sterne (2003, 181) directly addresses the "male-birth model of technological history," noting how it naturalizes reproduction while also mystifying the conditions of reproduction . Of course, one of the most well-known male-birth narratives in the histories of technology and literature is Mary Shelley's *Frankenstein*.

34. In *Mechanisms*, Kirschenbaum (2008, 36) contextualizes and defines *medial ideology* in the following way: "Jerome McGann has used the phrase 'Romantic ideology' to describe the manner in which modern literary criticism of the Romantic poets has been characterized by 'an uncritical absorption in Romanticism's own self-representations.' I believe electronic textual theory has labored under similar uncritical absorptions of the medium's self- or seemingly self-evident representations. While often precisely Romantic in their celebration of the fragile half-life of the digital, the 'ideology' I want to delineate below is perhaps better thought of as *medial*—that is, one that substitutes popular representations of a medium, socially constructed and culturally activated to perform specific kinds of work, for a more comprehensive treatment of the material particulars of a given technology."

35. Vaporware is a product that is announced or even publicly demonstrated but never actually released to consumers.

36. Jones also advocated for instruction in technology and science over education in the classics.

37. After the talk, a demonstration of the telegraphone (both the wire-based and disk-based versions) was given. Fankhauser was an official agent of the American Telegraphone Company.

38. On the limits of the telegraph, Fankhauser (1909, 41) claims: "Already the telegraph . . . is on the wane; but its complete substitution has heretofore been impossible because of the fact that it is absolutely necessary on important divisions that there should be evidence." On the limits of the telephone: "It has always been a drawback to the general use of the telephone, that the messages transmitted have been wholly evanescent, that it has been impossible to preserve or present an authentic record of conversation over the wire" (40). On the rise of mechanical or commercial stenography: "The field here is growing constantly, as it has been demonstrated that there may be effected not alone an enormous saving in actual money, but in time, and accuracy, that is, with the aid of the talk-machine, the correspondent can dictate from two to three times as many letters as he can through the medium of the stenographer" (43).

39. In an August 1913 issue of the *Independent*, the limits of human stenographers working in similar situations are actually highlighted: "The advantages of [the telegraphone] for international conventions is [*sic*] obvious. It is very hard to get stenographers competent to take down the discussions in four or more languages. The Copenhagen congress was in session forty hours altogether and occupied two adjoining rooms, but all of the papers and discussions were duly recorded on the 250 kilometers of piano wire" ("The Telegraphone").

40. David Morton (2000, 112) also writes that "without any electronic signal amplification, the telegraphone could not adequately record the weak currents of a long-distance transmission."
41. The long title of the story is: "The Case of Helen Bond: The First of a Series of Unusual Detective Stories in Which the Professor of Criminal Science Adopts the New Method of Making the Criminal Discover Himself." At the time, *Cosmopolitan* was known for fiction, often publishing serials such as Herbert George Wells's *War of the Worlds* (1897).
42. *The Silent Bullet* was published as a book in 1912. The stories contained in it were first published in *Cosmopolitan* in 1911. In 1918, the book was republished as the first volume in the twelve-volume set titled, *Craig Kennedy Stories*.
43. On the topic of forensic science and literary history, Ronald Thomas (1999, 6) highlights how "practical forensic devices . . . extended the power of the human senses to render visible and measurable what had previously been undetectable" while also "establishing criminal identity" in detective fiction.
44. *The Dream Doctor* was published as a book in 1914. Many of the stories contained in it were first published in *Cosmopolitan* in 1913. In 1918, the book was republished as the third volume in the twelve-volume set titled, *Craig Kennedy Stories*.
45. On the topic of moral good, Reeve (1913, 93) writes: "More and more the discoveries of the scientists, romantic and thrilling in themselves, are being applied by the forces of law and order in the running down of the criminal. Fiction of this sort is a positive source of good. In the end it will make detectives more and more efficient; will tend to discourage criminals by the sheer weight of unescapable [*sic*] fact. In Europe there has actually grown up a class of scientific professors, a dozen of whom could be named, whose exploits read like fiction. The spread of such knowledge cannot do harm—unless indeed the spread of knowledge itself be harmful."
46. Reeve (1913, 91) writes: "I recall once asking Mr. Edison whether he ever read detective stories. With that magic smile that flits over his face when a question interests him, the great inventor replied, 'That is about all the fiction I do read.' Then he went on, a moment later, glancing about at the appalling mass of scientific books and periodicals in his library, 'I don't think I ever felt so badly over the death of anyone not connected with me as I did when Gaboriau died.'" Émile Gaboriau was one of the earliest writers of modern detective fiction.
47. First circulating in 1930, the pulp magazine, *Scientific Detective Monthly*, was short lived. There were only ten issues (five before the magazine's title was changed to *Amazing Detective Tales*). Reeve's writing was frequently featured in it. He was also the magazine's "Editorial Commissioner." For more, see Locke (2007, 30-31).
48. In the nonfiction essay "What Are the Great Detective Stories and Why?," Reeve (2007, 91) claims: "All science, in fact, is a detective story."
49. During the turn from the 1910s to the 1920s, Reeve's work largely shifted from writing for magazines to writing for film. 1918 was the year of his last story for *Cosmopolitan*.
50. Quite humorously, in *The Exploits of Elaine*, Reeve's characters make several references to the tremendous weight of the device: "We followed him, lugging the telegraphone" (1915, 126), "as I gave a groan of relief, for the telegraphone was getting like lead" (126), and "Kennedy . . . recovered the telegraphone. Together we carried it to the laboratory" (129). Magnetic audio may have been affiliated with noise-free, seemingly immaterial sound; however, the telegraphone was large and clunky at best, raising questions about how easy it was to actually transport or hide.
51. *Constance Dunlap, Woman Detective* was published as a book in 1916. The stories contained in it were first published in *Pearson's Magazine* between 1913 and 1914. In 1918, the book was republished as the twelfth volume in the twelve-volume set titled *Craig Kennedy Stories*.

52. In the Kennedy collection, another volume, *Guy Garrick*, does not feature Kennedy as the protagonist. However, unlike Dunlap, Garrick is simply Kennedy with a different name. The Garrick stories are also scientific detective fictions and were published mostly in 1914. None of them appeared in *Cosmopolitan*.
53. However, unlike Kennedy, Dunlap—the "woman detective"—is not a professor of criminal science. She acquires and performs most of her education informally, beginning with handwriting and forgery analysis in the first story of the Dunlap series.
54. Only a few sentences later, Dunlap describes the telegraphone to the group: "A machine for registering telephone conversations, dictation, anything of the sort you wish. It was invented by Valdemar Poulsen, the Danish Edison. This is one of his new wire machines. The record is made by a new process, localized charges of magnetism on this wire. It is as permanent as the wire itself. There is only one thing that can destroy them—rubbing over the wire with this magnet. Listen" (1912, 52).
55. Of course, as with most media, absolute erasure was difficult to achieve with early magnetic storage. Often, even after a magnet was rubbed over the wire, trace impressions remained.
56. This sentence, not to mention one I reference in the previous paragraph, both begin with "deliberately." Qualifiers such as these are common in Reeve's scientific detective fiction. His modern, methodical detectives rarely make mistakes, and they do not simply stumble upon solutions. For this reason, Locke suggests detectives such as Kennedy are difficult for audiences to like. He writes: "Craig Kennedy is easy to admire, but difficult to like. The human connection is absent. He's a savant who comes down from academia's mountaintop to impart inscrutable wisdom. You want to like him; you want him to become human again after he's exercised that super-efficient intelligence for the good of the law. After reading enough stories of his adventures, you realize you will never know him. And perhaps that's why he passed from the limelight" (49).
57. For example, consider two well-known publications in the fields of media studies, sound studies, and technology studies. Sterne (2003) hardly mentions magnetic recording, and Friedrich Kittler (1999) gives the telegraphone only one page.
58. Of course, in the history of magnetic recording, the hard drive did not immediately succeed the telegraphone. Between the two, magnetic wire, tape, and floppy disks (among others) were popular storage media in the United States and elsewhere.
59. In his analysis of the medial ideology of electronic text, Kirschenbaum (2008, 38) observes the following: "Industry leaders may have grasped the appeal of this ideology even earlier than fiction writers or academicians. In 1982, four Bay-area entrepreneurs cofounded a new company devoted to network enterprise computing. They called it Sun." In the case of early magnetic recording, a similar dynamic emerges, with people in industry first deploying a medial ideology of magnetic audio. Importantly, however, these entrepreneurs used techniques from fiction in their own technical writing and speeches.
60. Lisa Gitelman and Theresa M. Collins (2009, 2) make an observation worth repeating here: "McLuhan's identification of the electric light as a medium can be difficult to map backward to the 1880s, at least insofar as that term—*medium*—did not mean what it would later on. Throughout the nineteenth century a medium was 'an intervening agency or substance.' So, for instance, United States patents that used the plural form, *media*, in the nineteenth century do so with greatest frequency in reference to 'filtering media,' substances which work to filter solutions from more to less cloudy. Beyond filtering, a quick tally of additional uses reveals grinding media, nutrient media; conducting media for heat or for electricity, also insulating

media, absorbent media; mechanical media as in ‘the media of gearwheels,’ clamping and fastening media, rotating media, flexible or elastic media, actuating media such as a hydraulic lift; as well as perforated media, transparent media, resisting and obstructing media.”

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