Shibboleths in the Studio: Informal Demarcation Practices Among Audio Engineers

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"Then said they unto him, Say now Shibboleth: and he said Sibboleth: for he could not frame to pronounce it right. Then they took him, and slew him"

Judges 12:6, King James Bible

1. White Coats and Dummy Faders

In popular and professional imaginations, the white lab coat provides a convenient, if coarse, material index of the scientific status of a field. Medicine, for example, is said to have become a properly scientific endeavor in the late nineteenth century, when physicians began to change out of black suits and into the white coats of the laboratory scientist (Hochberg, 2007). Latour captures the strange material-discursive effect of the white coat, even when taken in its purely metonymic form, to transform humans into technoscientific objects that are even more pliant than *bona-fide* non-humans: "when impressed by white coats, humans transmit objectivation obediently: they literally mimic objectivity, that is, they stop 'objecting' to inquiry" (Latour, 2004, p. 217). What happens when white coats lose their power to impress? In a so-called "post-truth" moment, where the professional boundaries and political affordances of technoscientific expertise are being renegotiated on multiple fronts, we need ways of describing how communities of practice respond to the erosion of their formal modes of professional demarcation (Lynch, 2017; Sismondo, 2017). Useful insights for scientific work might be gained from examining a nearby field where white coats, and their accompanying sense of prestige, have literally and figuratively disappeared.

The field of recording engineering offers one such case. Up until the 1960s, EMI studios (founded in the 1931 and later re-named Abbey Road in 1970) "resembled a hospital, with

orderlies in white coats" (Cleveland 2001, 576). The dress code at IBC studios was "White coats, collars, and ties for the technical department" (Johns 2014, 20). As a formal marker of professional difference, the coat was an effective tool for dividing up technical and artistic roles in a way that was legible to everyone involved. For people who rejected this distinction, such as reggae pioneer Graeme Goodall, the epithet "White Coats" referred to the old guard engineers whose by-the-book techniques had become outdated (Hitchins, 2014). By the late 1960s, then, the material-semiotic distinctions afforded by the white coat had started to become liabilities. As one veteran engineer laments in an online forum thread titled "Why Did Recording Engineers Stop Wearing Lab Coats?", the criteria for what counts as an engineer have been "blurred, tainted, distorted, clipped, and truncated. This is why we can't have nice things" (Gant, 2017).

With the decline of the white coat came the emergence and peculiar sociotechnical mutation of an object known as the "dummy fader"–a mixing knob or control slider that is not connected to anything. Dummy faders appeared in the late 1920s with the advent of sound film projection systems, providing projectionists with a spare auxiliary audio control that could be wired-up if necessary (McCullough, 1929, p. 26). By 1931 the non-functional fader had begun to take on a new social function, namely as a prop for hazing novice projectionists: "We have a Putts[1] here who was surpised when cleaning Faders that the dummy fader didn't have wires in it. How's zat?" wrote one Oaklander to the editor of the trade magazine Loudspeaker (Crowley, 1931, p. 29). Over subsequent decades this practice migrated to the recording studio and it began to be applied to non-engineers as well as colleagues-in-training. Among recording engineers the dummy fader became known as the "artist's fader" or the "producer's fader" as it

[1] In context, this is clearly not a surname but an epithet, i.e. calling the novice a "putz".

was increasingly used to humor and occupy clients who wanted to meddle with the recording process (Avalon, 2005, p. 12). The producer's fader, according to engineer and recording arts professor Alan Kefauver, "makes the producer feel important and gives him something to do with his hands… Often the producer will 'hear' a difference after moving the useless knob, to the great amusement of sound engineers" (Engler, 2004).

Thus we find the disappearance of a formal marker of scientific status and the repurposing of a spare knob as a tool for "faking out" non-engineers. The white coat and the producer's fader provide two reference points in the evolution of audio engineering over the past century or so, a process that many engineers have seen as a decline in their occupation's technoscientific status. In this article I argue that engineers' collective narratives of professional dissolution can be usefully understood as standing in a mutually constitutive relationship with the material and perceptual practices of the recording studio. I develop this argument by first examining in greater detail the changing role of the recording engineer over time and arguing that the decline of explicit markers of professional distinction in recording work has emphasized the role of informal demarcation practices, which I refer to as the "shibboleths" of the studio. I then develop the concept of the shibboleth as an informal demarcation practice in terms of the broader STS literature on social boundaries and material practice, offering two examples from participant observation work conducted in two Los Angeles recording studios.

These primary fieldsites, which I refer to as Studios A and B, are two mid-sized recording complexes in downtown Los Angeles. The head of Studio A, who I call Carl[2], is a Grammy-winning engineer with over a decade of recording experience in genres such as pop, rock, and

[2] All ethnographic informants have been given pseudonyms, in accordance with this project's IRB approval.

hip-hop. Studio B, which is owned by Harold, specializes in heavy metal, noise, and indie rock, while also catering to advertising music production and other more commercially-oriented clients. Other engineers I cite, such as Lucille, Barry, and Seth, are part of Studio A and B's broader network of engineers, and are typically divide their time between multiple different studios in various contractual capacities (e.g., as freelance engineers, vocal producers, or repair technicians.) Where I cite engineers by their full names, these quotes come from published sources, typically trade publications such as Mix Magazine or Sound On Sound.

2. Recording Engineering and its Boundaries

From the invention of sound recording in the late 19th century until roughly the end of the second world war, the recording studio sector was governed by a "laboratory-like regime" (Leyshon, 2009, p. 1319). Because recording equipment had to be custom built, studios were typically extensions of the R&D labs for large vertically integrated companies like EMI, RCA, and Columbia. Generally only artists signed to a particular label could record in that label's studio, and they had little say in how their session would be engineered and by whom. Protectiveness of proprietary technologies and trade secrets meant that engineers would only rarely work in more than one studio over long periods of time. The post-war era, with its flood of inexpensive military surplus technologies (particularly magnetic tape machines seized from the German army) saw a shift in the Anglo-American engineering profession from a craft-union to a more independent and customer service-oriented "entrepreneurial-artistic" identity (Kealy, 1979, 1982).

The entrepreneurial identity reflected the growing competitiveness of the engineering profession. Like many industries, the recording industry began to outsource its R&D by the early

1980s in an effort to increase competition and lower costs (Leyshon, 2009, p. 1324; Mirowski, 2011, p. 17). With the decline of in-house R&D departments, the studios of which they were an extension were increasingly cut loose and expected to fend for themselves in the free market without the benefits of corporate largesse. The introduction of software-supported recording consoles that could save "settings" also made studio clients less dependent upon engineers to set up and run their own sessions (Leyshon, 2009, p. 1324). One consequence was the consolidation of multiple studio roles into a single multi-skilled studio professional (Pras and Guastavino, 2013, p. 616) This de-laboratorization of the studio and the de-specification of the engineer's technical role, along with the artist-ization of the engineer role, produced a persistent strain between artistic and technical roles, manifesting in a "double life" or "balancing act" of self-presentation for the recording engineer (Beer, 2014).

A parallel movement from apprenticeship to formal coursework-based training has required would-be engineers to undertake certification programs (and tuition costs) at for-profit technical schools (Porcello, 2004). This trend towards institutional credentialization has not decreased the importance of on-the-job training, however, as a steady stream of recording school graduates continue to vie for dwindling numbers of studio internships. While these unpaid positions are nominally opportunities for relationship-building and the acquisition of on-the-job skills, interns are in fact rarely entrusted with technical work and are sometimes not even allowed into the studio's control room. As engineer and studio owner Geoff Sanoff explains, for studios, "interns are a way to avoid hiring janitorial and cleaning services" (Crane and Sanoff, 2002). Higher-up the career ladder, jobs have become scarce as a result of the broader decline of the recording industry since the advent of digital file sharing in the late 1990s. This was exacerbated by a contraction in the recording industry following the 2008

financial crisis, after which many large studios went out of business (Olivarez-Giles, 2009). Engineers who managed to remain employed by the remaining studios were largely converted from salaried to contract-based positions. According to the Bureau of Labor Statistics, the number of sound engineering technicians employed in the United States declined by 19 percent between 2008 and 2013 (*Broadcast and Sound Engineering Technicians*, no date).

As job stability for professional engineers has declined, inexpensive computer-based digital audio workstations have made sound recording and production tools more widely affordable to non-professionals. Musicians who would have previously booked studio time and paid an engineer to record their music have increasingly opted to record themselves at home. Professional engineers, meanwhile, have had to keep up with the accelerating cycles of innovation in music production techniques that made home recording possible. By the end of the 1990s, music gear journalism and instrument manufacturing firms had successfully enrolled engineers – hobbyist and professional alike - in intensified habits of gear consumption – making them as much consumers of technology as producers of music (Théberge, 1997). More recently, automated production tools such as Auto-Tune (for vocal pitch correction) and Landr (for audio mastering) have begun to replace the skilled sensory practices of engineers with time-saving algorithmic processes. Digital models of instruments and outboard signal processing gear have begun to rival and, to some ears, replicate or improve upon the sound of more bulky and expensive analog equipment. Companies such as Slate Digital have begun to market these proprietary digital signal processing plug-ins through temporary licensing agreements. Moreover, with cycles of versioning, planned obsolescence, and expiring technical support obligations, the engineer's relation to the means of production has become less tangible and more temporally precarious.

Recording engineers thus find themselves subject to two, often conflicting, professional imperatives. First of all, they need to demonstrate the value of their skilled perceptual and productive labor, as compared to that of non-professional and/or automated options, thereby securing their roles as "obligatory passage-points" of the recording process (Callon and Latour, 1981). Accomplishing this means, in part, staying up-to-date with respect to the very technological trends which are facilitating amateurization and automation in the first place. Second, they need to build and maintain relationships with their clients, almost all of whom are now "amateur engineers" in the sense that they have access to entry-level recording software such as Apple's Garageband. This lowering of the technical barrier to entry requires engineers to undertake a greater degree of emotional labor with respect to their clients (Hochschild, 1983; Wharton, 2009). Harold, for example, describes working with artists as "like a therapy psychology session, in that you're taking these nuances and kind of creating this atmosphere to create, for everything to be fine." Engineer Bob offers a more jaundiced perspective:

> It's just people, you know, and they're buying a product. It's a service industry… do you know how many bars I go to and food joints I go to, I don't even like the food. I can purchase PBR at any bar in LA, the same exact price, you know what I mean? But why do I go to these certain places? Because I like the person doing it, I enjoy them doing it. I like certain bartenders giving me that PBR. You know? It's the same crap. It's just mp3s. At this point it's shitty mp3s we're talking about.

Not even the emotional labor of the engineer-as-service worker is safe from automation, however, at least according to software developer Steven Slate (of the aforementioned Slate Digital). Referring to Landr's automated mastering software in particular, he writes in the pages of Tape-Op magazine:

> [Landr] is a system that attempts to replace an engineer. Artificial intelligence is the new reality. Stop being dismissive and afraid. Yes, mastering is an art. But do you really think that in some years' time, some software process won't be able to analyze emotion? That's what AI is (Hong, 2014).

This tension between technical and emotional roles was, for a long time, specifically addressed in the studio by the role of the "producer," who served as a mediator between production and consumption roles in the recording industry (Hennion, 2013). With shrinking recording budgets, however, the engineer and producer have largely been consolidated into a single studio role. In short, recording engineers have lost many of the formal protections which make them intelligible to themselves and others as a distinct professional category (unions, white coats, durable investments in equipment and training, producers as mediators, etc.)[3] At the same time, the need to distinguish themselves professionally, not least to themselves, has become ever more pressing. How, exactly, do engineers go about performing and managing compromised professional boundaries while also not alienating the various non-engineers (musicians, label management, consumers of music) on whom their livelihoods depend?

They do this, in part, through informal practices of demarcation, moments of partial breakdown in the collaborative relationship, which crystallize the distinction between engineers and non-engineers while producing socially legible sites of role-repair. Because they appear as variations in articulation that enact social distinctions, I refer to these practices as "shibboleths." Shibboleths, in everyday usage, are words, sayings, customs, or ideas that distinguish one group from another. The term originates from a biblical story in which the Gileadites used their enemies' mispronunciation of the word "shibboleth" to distinguish friend from foe. The term also connotes a certain vestigial or informal quality, distinguishing it from an explicit rule. We can develop these colloquial meanings in a more specifically material-semiotic

[3] The exception here is the growth of credentialization and formal recording school programs. A degree in recording, however, is by no means a guarantee (or even necessarily a pre-requisite) for a studio job, as much learning is still done on-the-job. An inflationary logic appears to be at work: as credentialization grows among would-be studio workers, the value of individual credentials *decreases*.

direction by asking how material assemblages and skilled perceptual practices can function as makeshift markers of difference within technoscientific work. Below I discuss two illustrative examples of shibboleths in the studio: wrapping cables and hearing artifacts of the digital vocal "tuning" process. I further explore the potential of shibboleths as topics of sociotechnical investigation in contexts beyond the recording studio, suggesting that they tend to be particularly salient in situations where formal social boundaries have eroded as a result of deprofessionalization and/or technological change. I begin, however, by situating the concept of the shibboleth in terms of existing literatures on boundary maintenance in science and technology studies (STS).

3. Theorizing Collaboration and Consensus (or Lack Thereof)

Two major theorizations within STS of the relationships between objects (taken as material-practical assemblages) and social organization have centered on the concepts of "immutable mobiles" and "boundary objects." Immutable mobiles, as developed in the Actor-Network Theory literature, are things that facilitate collaboration through the construction of consensual knowledge claims across networks, understood as sociotechnical chains of reference (Latour, 1987). The paradigmatic immutable mobile is the laboratory inscription, which is able to circulate across various contexts without changing its basic form or meaning. Susan Leigh Star and James Griesemer introduced the concept of the "boundary object" partially as a critique of the immutable mobile concept, i.e. as a way of looking specifically at how mobiles can be *mutable*. Whereas immutable mobiles forge consensus as a precondition of scientific network-building (reflecting the "consensus model" of collaboration), boundary objects have multiple interpretations across various scales and contexts, thereby facilitating

"collaboration without consensus" (Star and Griesemer, 1989; Star, 2010). Boundary objects are by definition loosely structured, and therefore interpretively flexible, at the intergroup level, becoming more tightly structured in cases of specific application. Each concept has its own set of exemplars: Whereas immutable mobiles may take forms such as inscriptions, specimens, or maps, boundary objects appear, respectively, as standardized forms, repositories, or "terrains with coincident boundaries" (Ibid). Boundary objects and immutable mobiles thus present two distinct ways of talking about processes of *translation*, or the bringing-together of heterogeneous actors in collaborative situations.

In addition to translation or hybridization across boundaries, objects are also implicated in the interruption of collaborative relations. This can occur either through instances of "boundary-work" at the level of specific social groups (Gieryn, 1983) or "purification" at the human/non-human boundary (Latour, 1993). Boundary-work involves the carving out monopolistic fields, expanding of existing disciplinary boundaries, expulsion of transgressors, and protection against external control. Bell Labs engineer John Pierce, for example, is said to have undertakem boundary-work in his efforts to exclude mathematician Norbert Wiener's work on cybernetics from the field of information theory (Kline, 2004, p. 24). Examples of purification work, meanwhile, abound in issues such as global warming, where the debate continues to be framed in terms of who is representing true "nature" and who is representing mere "politics" (even as environmental catastrophes, as particularly consequential examples of natural-cultural "hybridity", repeatedly demonstrate the untenable character of this dichotomy.) Examples of purification work with a more positive political valence, meanwhile, might be found in human rights discourses, wherein claims about the human *per se*, as opposed to the non-human or inhuman, frequently underwrite emancipatory policies.

I want to propose that, as is the case with translational objects (immutable mobiles and boundary objects), the objects implicated in boundary-work and/or purification also need to be distinguished as either functioning characteristically *with* or *without* consensus. We can refer to these, respectively, as "formal markers" (boundary-work/purification through object-consensus) and shibboleths (boundary-work/purification without object-consensus). A formal marker thus carves out domains of collaboration by virtue of its relatively stable appearance and significance across contexts and scales. Examples here include uniforms, badges, memberships, honorifics, or educational certificates. A shibboleth, on the other hand, is a relatively *informal* marker of difference, one which changes its meaning as a function of scale and group-orientation, and thereby striates collaborative and consensual relations simultaneously. **Figure 1** expresses how shibboleths fit into the conceptual matrix of collaboration and consensus with respect to particular relational objects:

Figure 1: A Typology of Objects or Practices of Collaboration

	Facilitating Collaboration: Translation Work via *Inclusive* Objects	**Interrupting Collaboration:** Boundary-Work or Purification via *Exclusive* Objects
***With* Consensus:** Strongly-structured across scales via chains of reference	**Immutable Mobiles:** Inscriptions, Tables, Charts, Maps, Money, Commodities…	**Formal Markers:** Uniforms, Diplomas, Badges, Trade Unions, Honorifics…
***Without* Consensus:** Strongly vs. weakly structured as function of scale and context.	**Boundary Objects:** Repositories, Ideal Types, Terrains with Coincident Boundaries, Forms…	**Shibboleths:** Mispronunciations, Tells, Production artifacts …

A boundary object is loosely structured at the boundary between communities of practice and tightly structured at a local level. In this way, it serves as a flexible joint between otherwise distinctly articulated social worlds while facilitating specific practical applications. A shibboleth, by contrast, is usefully understood as an inversion of this arrangement. With shibboleths, an object or practice at the in-group level might in fact be quite loosely structured,

subject to improvisation, or contested. At the boundaries, however, where the in/out group distinction is actively produced, the same object or practice can become structurally *brittle*, so tightly articulated as to be prone to fracture, an improvised trap set to spring at the slightest encounter with someone or something not in-the-know. It is the perceptual indeterminacy and asymmetry of a shibboleth, its capacity to structure collaborative possibilities while not requiring all parties to agree as to what exactly is going on, that makes it useful for informal demarcation. To echo Star's analogy, the shibboleth is less a "Newtonian" concept than a "quantum" one (Star, 2010, p. 603).

In this way, shibboleths are deeply implicated in what STS scholars have termed the work of "calibration", or the ways in which interdisciplinary collaborations proceed not only through provisional agreement around loosely-structured shared objects, but also through "disciplinary retrenchment, with group members from certain disciplines claiming authority over specific procedures and others deferring to their authority" (Centellas, Smardon and Fifield, 2013, p. 312). Cases of calibration illustrate how the reinforcement of social boundaries, and thus the maintenance of robust disciplinary identities, can facilitate rather than impede collaboration. For example, in their study of interdisciplinary cancer researchers, Centellas *et al* show how the work of staking-out the distinct commitments and sensibilities of collaborating groups (e.g. materials scientists and biologists), can lead to "participation customs" that choreograph participants around disciplinary sticking points in order to facilitate collaboration without consensus.

By crystallizing differences between groups with respect to specific competencies or perceptual habits, shibboleths can help set the stage for acts of calibration to take place. Where the concepts differ from one another is equally important, however, and involves what we

might call the perceptual (a)symmetry of the interaction: Calibration via the articulation of participation customs, in Centellas *et al*'s account, appears as an open and symmetrical negotiation between members of different disciplines. Shibboleths are asymmetrical in the sense that they are construed differently as a function of scale and disciplinary orientation. This protean quality means that shibboleths can play obscured but important roles in the emotional aspects of technoscientific knowledge production (Parker and Hackett, 2014) and the conversion of economic capital into symbolic capital (Burri, 2008).

Two examples, drawn from participant observation work in two Los Angeles Recording studios in 2013, show some of the ways that audio engineers employ shibboleths to informally distinguish themselves professionally from non-professionals as well as non-humans. These examples are 1) coiling electrical audio cables and 2) hearing the artifacts of digital vocal tuning software. Cable wrapping is an example of a "boundary-work" shibboleth in that it is an informal way of distinguishing levels of professional skill. Hearing vocal tuning artifacts is an example of a "purification" shibboleth, in that it is used to distinguish skilled human labor from automated non-human action. These two categories of shibboleth overlap empirically in cases where non-professionals use automated tools to compensate for their lack of experience, but they are nonetheless useful for conceptualizing two important categories of demarcation in which engineers engage. Amateurization and automation of the recording process are mutually reinforcing phenomena, but they offer qualitatively distinct challenges to the professional identity of the recording engineer.

Before turning to examples, a quick note on the supporting fieldwork and how it informs the scope of my argument. I undertook participant observation work as a studio intern during the latter half of 2013, dividing my time between the two studios. While I had prior experience

playing and recording music, my work as an intern was, as implied earlier, far more domestic than technical: I spent my days running errands, cleaning-up the studio, doing paperwork, and occasionally performing simple repairs. It is from this position at the bottom of the studio hierarchy, engaged in varieties of "invisible" (temporary, unskilled, and often unpaid) work, that the subtle techniques of inclusion and exclusion become most apparent. As is the case with most of the "creative" industries, the ability to undertake such work is often itself a function of a more general condition of class privilege. As engineer Jonathan Kreinik puts it, the two most important qualifications for an intern are that they own a car and have parents paying their bills (Crane and Sanoff, 2002). Less explicit, but no less pervasive, are racial and gendered expectations—recording engineers (like most engineers) are overwhelmingly coded as white and male (Keil, 2014; Lanzendorfer, 2017). Lucille, a Grammy-winning freelance engineer, describes for example one project during which it took several days for the client to realize she was actually engineering the session. These barriers to entry are rooted in much broader histories and structures of oppression outside of the studio, important topics that the present argument does not pretend to comprehensively address.

4. A Shibboleth for Boundary-Work: Cable Wrapping

"If you've worked through the problem forwards and backwards, checked your math, consulted your intellectual superiors, and made invocations to the Gods, and still your hardware setup is giving the wrong result, you will find that it's a bad cable" - Welti's Law

The Audio Engineering Society's "Laws For Audio Engineers" (Chinn, 2014)

On my first day in Studio A, Carl asked me to help him tidy up the live room where a band had been recording the evening prior. I picked up an audio cable that had been left on the

ground and began coiling it up like a rope, wrapping it tightly around my elbow and the crook of my thumb. Carl saw what I was doing and stopped me: "that'll get you fired, wrapping a cable like that!" This was not a good start; one of my first efforts on the job had apparently produced a serious *faux pas*. As a result, one of the earliest and most important tasks I undertook in-studio was learning how to wrap cables. This is something of a rite of passage for nearly all studio workers–a local version of knowing the ropes.

The preferred cable wrapping technique, known as the "over-under" method, involves forming loops that alternately pass over or under the gathering hand. This bit of embodied knowledge requires one to feel and work with the "train" of the cable, or the way that it naturally bends as a result of its material composition and history of use. Over-under wrapping builds a self-opposition into the cable that keeps the internal wiring from straining and prevents knots from forming. A properly wrapped cable can be quickly unfurled by "tossing it out" across the room while holding onto one end. The tossed-out cable should lie flat on the ground, which keeps people from tripping on it in the dimly-lit live room. Practicing the over-under technique, in this way, trains both the cable and the person wrapping it. It is a process of skilled sensory and expressive movement (Ingold, 2011), through which the body of the worker is attuned to the cable's previous habits of movement and storage, and the cable is recomposed according to the embodied knowledge of the worker.

Cable wrapping can be understood as a mundane instance of what Rachel Prentice, writing about surgical training simulators, has termed the "mutual articulation" of object and subject (Prentice, 2005, p. 840). The body of the engineer is trained along with that of the cable, and through this repeated training they are both made increasingly legible within the studio context and made more sensitive to future movements within it. Over-under technique

functions as a technical shibboleth, demonstrating one's membership within (or outside of) a community of practice, and thus bears directly on the broader problem of constituting social order within the studio. Once you know the technique it becomes painfully obvious when you encounter someone who is not familiar with it.

Over-under wrapping techniques may undergo involutionary changes in particular cases, elaborating on the basic form according to local tastes and affording yet another degree of resolution as a marker of skill. As Nashville-based engineer Sara Hughes recounts, a failure to recognize local flavors of the method can cause problems for interns and novice engineers:

> He [the studio's resident second engineer] and I repeatedly butted heads over the issue of cable wrapping, because he insisted that all cables had to be coiled right-handed, starting at the female end. I didn't agree: I figured over-under was the same regardless of which hand or which end started. Eventually, he explained that he had a methodology for tossing out [uncoiling by throwing] cables that he felt was impacted by my left-handed wrapping. He felt my refusal to comply adversely affected the efficiency of his setup, and that in turn adversely affected his ability to perfectly complete the session engineer's setup. Even though I didn't agree that it mattered either way, I decided to do it his way, if only to keep the peace. His whole demeanor lifted. Instead of wasting time debating the merits of cable-wrapping, he had the time and the inclination to share seconding tips with me. (Hughes, 2003)

Here the technique's function as a shibboleth is highlighted by how the particularities of its performance – namely the question of handedness and end-outedness – invites a misarticulation for non-initiates. Hughes did not fully realize what the handedness of cable wrapping meant in that situation, and indeed what practical use it was in terms of the effect that it would have on the demeanor of the studio's second engineer. At one level, Hughes is right that a cable wrapped left-handed and male-out[4] is likely to pass the unfurling test just as well as a right-handed female-out coil. For Hughes, however, the practical equivalence of these

[4] For a discussion of the role of gendered imagery and sexual discrimination in recording practices, see (Farmelo, no date; Rodgers, 2011; Keil, 2014).

methods masked its indexical, demarcational difference for the second engineer. Switching to a right-handed female-out technique, thereby "framing to pronounce" the shibboleth correctly, ultimately proved to have practical affordances for Hughes, as it improved her relationship with the second engineer and opened up avenues to promotion.

In Hughes' case, as well as my own, cable-wrapping technique occasioned a moment of correction and socialization to be carried out by someone higher-up on the studio hierarchy, providing a convenient rite of passage for articulating relations of power and authority in an otherwise largely informal (if thoroughly hierarchical) working environment. The technique presents the initiate with a new practical skill as well as a new element in their own repertoire of professional orientation. Once you know what to look for, it is possible to gauge someone's level of experience based on the elegance of their wrapping technique. This is especially useful in sessions where the people involved may or may not have met one another before, since it is rare to begin a session with a formal introduction and assignment of roles. The technique also functions as a kind of "technology of trust" which helps to map moments of uncertainty or malfunction onto social categories (Porter, 1996): cables routinely break during studio work, meaning that they will fail to pass signal or may introduce noise as a result of being mishandled. Complicating matters further is the fact that it is only possible to diagnose which cable is broken by systematically disassembling the signal path – a long and tedious process liable to irritate the client and head engineer alike. When a cable breaks, the person with the aberrant wrapping technique is likely to get the blame. That person is unlikely to be invited back for the next project.

The way that cable-wrapping technique has exceeded its material function and become a practice of social distinction is reflected in a parodic article titled "How to Tell a Loved One

They're Coiling Cables Wrong" (K, 2018) which has been widely shared online among audio engineers and related groups. With mock seriousness, the article offers a step-by-step guide for helping a friend overcome their poor technique. As an inside joke, the article addresses an audience that has experienced the *faux pas* of bad cable wrapping and the awkwardness it presents: the mundane dramatic irony experienced by an engineer watching an evident non-engineer fail to perform a standard technique. The point of the joke is to comment on the fact that engineers tend to take such a seemingly trivial practice so seriously, as well as the tendency of others to (as I had) confidently proceed to do something wrong. It is humorous to insiders precisely because it presents, in caricature, a recognizable experience. Philosopher Henri Bergson observed that laughter characteristically arises from instances of inelasticity in the normal flux of everyday life, and in this way helps to regulate social relations as a sort of embodied critique of rigidity or brittleness. This brittleness manifests at the extremes of the dogmatic as well as the maladroit (Bergson, 1911). Cable-wrapping techniques, as with other shibboleths, is a comic object in that it is a hang-up or a sticking point in this dual sense: it is funny to watch someone wrap a cable incorrectly, but it is also funny to see how seriously it is taken. In both cases, the humor solidifies in-group relations by throwing group boundaries into relief.

5. A Shibboleth for Purification: Hearing Tuning Artifacts

"Given any two arbitrarily similar sounds, there will always be at least one audio engineer who will claim to be able to hear the difference." - Hawley's Law of Differences
The Audio Engineering Society's "Laws For Audio Engineers" (Chinn, 2014)

Audio engineers, like many early 21st century workers, increasingly find their skilled practices displaced by automation. Recent cases of this include the automatic intonation correction software Auto-Tune and the online automated mastering service Landr. These

technologies present a dilemma for engineers. On the one hand, they make engineers' lives easier by providing technological shortcuts for some of the most tedious and time-demanding aspects of the audio production process. On the other hand, they manifestly de-value important parts of the engineer's skill set, making their roles in the production process more dispensible. Technological optimism and professional pessimism are a widely felt combination among engineers. Carl is always eager to talk about the latest raft of Digital Signal Processing plug-ins, but when asked over text message whether he sees a future for recording engineering as an occupation, his answer is "No. Cuz robots."

Between the extremes of luddism – complete rejection of new labor-saving technologies – and complete capitulation to technologies' claims to replicate their skilled practices, engineers like Carl seek to take perceptual and practical ownership of these new technologies. To the extent possible, they seek to own their own means of production, which consists increasingly of software licenses. Legal ownership is not enough, however, since one must also master the perceptual niceities of a particular piece of equipment. We get a sense of the engineer's moral economy of gear through a proverbial expression common among engineers: a talented person can get good sounds out of bad gear, but the best gear won't make an untalented person sound good. One way of demonstrating one's mastery over gear is by becoming attuned to production artifacts – the tell-tale signs that a particular tool has been used in a particular recording. This ability to hear the production is an implicit requirement for one's ability to either use these tools "creatively", i.e. in one's capacity as a skilled (human) laborer, or assert that their own non-automated contributions to these activities are worthwhile.

Online forums frequented by audio engineers thus feature lengthy threads with titles like “Auto Tune: Tell Tale Signs of its Use” and “How Can You Tell if a Voice is Auto-Tuned?” Hearing tuning requires skilled and contextually-informed listening ability, often figured metonymically as having “big” or “golden” ears (Perlman, 2004). This ability can only be acquired by practice, wherein you learn the sound of a particular technique be peforming it repeatedly and learning to recognize its effects on the signal. Lucille recounts a situation where she, her client, and her engineer colleague disagreed about the extent and desirability of tuning on a vocal take:

Lucille: [Tuning] is something I do a lot… I tuned it like where I thought, man there’s like this is like invisible tuning and like it still doesn’t sound like great. It like sounds good but it doesn’t like – it still has the kind of Nirvana singing out of tune sort of thing vibe to it.

Author: When you say invisible tuning what do you mean?

Lucille: Like there’s no artifacts you can’t be like “oh that was like I just heard the tune happen” or like “I can hear that it was manipulated” sort of thing. So I spent like two days on this one vocal… [I made it] artistically out of tune, not annoyingly out of tune. But [the artists] came in on Monday were like “this sounds way too good” and they were like pissed about it. And I was like bypass bypass bypass bypass, back to playlist back to playlist. And then I tried again the next weekend and made it even like more artistically out of tune. And that was like I’d put some things in like better tune, but I’d pull things farther out of tune to try to like make it sound more like a fluid thing. ‘Cause the guy wasn’t a very experienced singer… so it like there wasn’t a lot of artistry to the out of tuneness it was just like out of tune.

Author: Did it ever occur to you to, was it ever an option not to tune at all?

Lucille: No ‘cause it was way too far

Author: But you were pulling stuff out of tune sometimes?

Lucille: Overall it was too far. And it wasn’t like consistent in any way, like he’s sharp so it sounds like he’s still singing well. It was kind of like this [gestures up and down with hands] like he was too sharp and flat on different words. But yeah it took me like three tries and then when we got to mixing [Carl] was like “this is so out of tune… you can’t have the first lyric of the song out of tune.” And I was like,

> "sorry pal that's staying in that way" yeah [laughs] he was like "are you serious? Like the first line?" He was really bargaining with me and I was like, "there's nothing we can do about this that they wont notice."

We can unpack this mediating role of the tuning process, and its perceptible artifacts, in this interaction. Lucille's experience as a skilled vocal tuner leads her to want to correct the singer's "annoyingly out of tune" performance, but in an "invisible" and "artistic" way that would not be betrayed by its artifacts. The singer, to Lucille's surprise, does not find the tuning to be "invisible" at all, but in fact sounds "too good", meaning overly polished and inauthentic. Lucille went back to work on the vocal, opting not to forego tuning but to double-down on it, even pulling some parts further out of tune than they had originally been. This was not enough for her engineer colleague, Carl, however, who pushed for still more tuning on the first line of the song. For Lucille, then, an untuned vocal was not acceptable because she and her colleagues would hear it as a lack of due diligence on her part – a failure to tune something that needed to be tuned. This coupled with the artist's desire for a more naturalistic sound, leads Lucille to the strange situation of trying to tune the vocal enough that her fellow engineer will be able to hear that she fixed it, but the client will not. Clearly the work of tuning in this case crystallzes the emotional investments that engineers and clients bring to their respective roles in the vocal production process. The singer is proud of his voice, warts and all, or, more precisely, he is emotionally committed to an aesthetic that requires his voice to sound unpolished. Lucille is proud of her skill as an engineer, a pride she shares with and reflects upon Carl, and is committed to producing a vocal that is, at the very least, not annoyingly out-of-tune, even if that goal conflicts with the artist's desires. Tuning "invisibly"—i.e. such that only engineers can tell it has been done—serves as a resource for professional distinction among engineers, one that derives its power from the extent that it is both hidden from non-engineers.

Seth, a studio technician and long-time audio engineer, offers an alternative perspective on tuning's relation to his professional identity. "I made a good chunk of money on tuning vocals before I had to say no more," he explains, "I haven't done that for over two years now, 'cause it was getting to the point where I'd go through it and, you know, I'd still do it by listening, but it still just felt like data entry for me." He emphasizes that he always tuned "by listening" as opposed to tuning according to the automatic specifications of the tuning software, a practice he refers to as "going by the numbers."

> I think one of the reasons [clients] liked me was 'cause I didn't just go by the numbers. Because I spent a lot of time training. And I was lucky enough when I moved out here I worked with a lot of old school artists, producers and engineers. And you know they they as Pro-Tools[5] came in I'd be like "oh I can fix that one note." And sometimes they'd be like "is it hard?" I'd say no. Sometimes it was like "no no no that note should be flat. It adds to the song, it adds to the vibe. She sang it like that on purpose." [laughs] You know, and we're not talking way flat, just a little bit. That's one of the dangerous things about Pro-Tools is you can go, zoom way too far in, and lose the whole art end of it.

As with Lucille, Seth emphasizes the creative discretion he brings to the tuning process. Whereas Lucille is performing her tuning for Carl, herself, and other imagined engineer colleagues, Seth roots his tuning abilities in his prior experience with "old-school" mentors, artists, producers, and engineers alike. The difference between tuning by ear and by the numbers was important enough that Seth would refuse to bill for the occasional"by-the-numbers" tuning work he did take on:

> I'm always huge at prefacing – I'm not doing it by the numbers. If there's anything that has to be straight up just let me fix it real quick for free. And there's always a couple. You know – this one I didn't like, this one needs to be tuned better, and I'll just snap it right to the number.

[5] Pro-Tools is the industry standard Digital Audio Workstation (DAW) software for audio engineers, which came into wide use in the 1990s and provided a platform for digital tuning tools like Auto-Tune.

This work of "prefacing" by being up-front about one's tuning philosophy is oriented towards distinguishing Seth's skilled labor from a "snap it right to the number" approach that is practically indistinguishable from automation. Relying on software automation, in Seth's words, involves "sucking all your [his and the singer's] work out of it." Insisting on a more discretionary by-ear approach, by contrast, is a way for Seth to "let the artist be artful." When asked if he can hear tuning in other people's work, Seth nods and laughs. "There are definite times when I'm just like *why* [laughs] But then I listen to someone live and I go 'boy I wish they had tuning.' So you're damned if you do damned if you don't I guess."

Again, this is exactly the dilemma which automation presents to engineers: the need to navigate between the possible technical perfection offered by digital audio technologies and the essential limits of the purely technical as a criterion for skilled engineering work, or the transformation of a means into an end. The instrumental rationality of the tuning algorithm within the pro-tools session, which allows you to zoom-in on a note and nudge it precisely to the technically correct pitch, puts "the whole art end of it" at risk. Though in different ways, both Seth and Lucille fix upon the artifacts of the tuning process in establishing the value of their own skilled work. In both cases it is precisely their ownership of the tuning work as an artistic contribution, its irreducibility to some formal standard, that makes it valuable and emotionally satisfying for them.

In his account of the role of language in developing professional audition among recording engineers, Thomas Porcello has described how engineers learn to negotiate spatial metaphors at various technical and figurative registers (Porcello 2004, 739). A complaint about a "thin" drum sound, for example, might need to be translated into terms of a spectral distribution wherein there are too many high frequencies and not enough mid or low

frequencies. We can extend Porcello's analysis to say that, by developing spatially-oriented perceptual habits, engineers locate *themselves* as perceptually socialized bodies within a particular community of practice and distinct from the equipment that they employ. A purification shibboleth is an informal object that marks out an identifiably human labor process against the activities of an encroaching non-human assemblage. This very informality, as a precarious social accomplishment, is absolutely necessary if the shibboleth is going to continue to serve this demarcating function effectively. Mapped territories are easier to conquer; formalities are easier to automate.

Conclusion: Useful Breaking and Explicating Tacit Knowledge

Inside every large problem is a small problem struggling to get out. – Zentz's Law
The Audio Engineering Society's "Laws For Audio Engineers" (Chinn, 2014)

Since Seth's break from the world of vocal tuning he has mostly spent his time as a technician or "tech", maintaining and repairing studio equipment. His specialty is bringing old gear, which may have been tinkered with or modified over the years, back to "factory spec", or as close to its original technical incarnation as possible. This struck me as paradoxical, since it was exactly the "data entry" quality of vocal tuning that drove him away from the practice. Calibrating equipment to precise technical standards would seem one of the least discretionary tasks he could undertake. He explains this apparent dissonance by way of a distinction between "breaking" and "not working right":

> To me, doing the tech stuff is a lot easier, because there isn't that gray matter. There isn't that communication stuff. For my outside [repair] work, it's 'this is broken – fix It.' Stuff that's broken is much easier to fix than stuff that isn't quite working right, 'cause when something's broken it's broken and it's much easier to find. When something's not quite working right you have to figure out which piece isn't quite working right. Much harder to find.

The interestingly ambiguous phrase “gray matter”, implying both human “brains” and the material “gray areas” that tend to proliferate when they interact, points out the multiple ways that broken things and the types of repair they occasion can be useful. It is better for something to be broken than not working because broken things are easier to understand. This is the sense in which I want to argue that shibboleths are things that break usefully. By providing concrete points of breakdown – between amateurs and professionals, between human and non-human action, and between professional engineers and the amateur-automatic ensembles which threaten their privileged role in the audio production process, shibboleths like cable-wrapping techniques or tuning artifacts provide engineers with valuable resources for transforming sociotechnical situations that “aren’t working right” into ones that are instead “broken” and thus repairable. Another way of expressing this useful brokenness would be “anti-fungibility.” The increasing fungibility (accomplished via the above described processes of commodification, democratization, consumerization, automation, entrepreneurization) of recording engineering work produces a professional role that engineers increasingly experience as “not working”, in the dual sense of industrial malfunction and unemployment. With fewer resources for formal demarcation, engineers rely more heavily on informal markers, things that are useful because only engineers notice how they are broken, in order to orient themselves professionally.

This brings us to “tacit knowledge”, a phrase that may have seemed conspicuously absent from (or, perhaps, tacitly implied by) the above discussions of embodied, collectively held, and relationally constituted skills. One could certainly point to cable-wrapping and artifact-listening as instances of non-explicit practical understandings that enable technical work to proceed. In this way, they can be readily accounted for in terms of tacit knowledge

concept, first articulated by Michael Polanyi and further elaborated by Harry Collins (Polanyi, 1962; Collins, 2010). The shibboleth, as a concept and topic for STS inquiry, offers a more complex relationship with tacit knowledge than being a source of examples, however. As Timothy Thornton has pointed out, the tacit knowledge concept is takes the argumentative form of a theological "*via negativa*," wherein the a thing (e.g., the "divine") is defined by what it is not. One must define tacit knowledge in terms of its antonym; i.e. tacit knowledge is not explicit (or in its "purest" form, according to Collins, practically inexplicable, implying to a "Social Cartesianism" thesis) (Collins, 2010; Thornton, 2013). The trope of tacit knowledge is, in short, a resource for demarcation. From an STS perspective it should be seen as a phenomenon requiring explanation, not an explanation for the phenomenon of scientific knowledge production.

A more adequate sociological definition of tacit knowledge would take into account its function as an "actor's category" in Polanyi's argument for scientific autonomy. For Polanyi, tacit knowledge was a phenomenological argument against external control over scientific inquiry. As Isabelle Stengers recounts, Polanyi "explicitly linked the claim of science's 'extraterritoriality' with the figure of the 'competent' scientist, who alone is capable of evaluating research in his own domain, without for all that being able to give an account of his evaluative criteria" (Stengers, 2000 pp 6). In that context, cases of tacit knowledge (i.e. situated social accomplishments of knowledge practices *as* tacit) are always already shibboleths in that they naturalize the epistemic autonomy of a domain of work by reference to something that escapes formal prediction. Taking tacit knowledge as a form of embodied purification/boundary-work thus affords more concrete analytical insights, particularly when applied to cases of technological change and labor conflict (Lynch, 2013). For example, Susan

Schmidt-Horning's rich historical work on tacit knowledge in-studio yields yet deeper insights when read with an attention to materially embodied boundary-work and purification practices (Horning, 2004, 2013).

Shibboleths may also be increasingly relevant for social studies of science and technology more broadly as science and engineering work is increasingly opened up to automation, non-expert participation, and commodification. Philip Mirowski, in his investigations or the neo-liberalization of technoscientific work, has argued that movements in this direction have tended to employ the discourses of anti-elitism, interdisciplinary collaboration, and public access to scientific knowledge, while in practice restructuring technoscientific work on the model of "platform capitalism" which "deskills the vanishing author, dissolving any coherent notion of 'authorship'… and tends inevitably toward monopoly, in the name of profit" (Mirowski, 2018). This diagnosis implies that the pseudo-democratization of technoscientific work entailed by opening it up to the demands of capital accumulation may well resemble the dismantling of recording engineering by way of the rapid democratization and mass commodification of recording technologies. As embodied skills in various fields of scientific and technical work give way to standardized automation, administration displaces instruction and research, tenure gives way to contract-based labor, and the formal markers of scientific work (credentials, institutional affiliations, etc.) are dismantled in the name of efficiency and profit, we might expect scientists to similarly make use of informal markers to orient themselves and identify one another in a changing world. If boundary objects provide us with a way of talking about partial collaboration across sociotechnical worlds, shibboleths help account for the comedy and pathos of partial resistance in a world undergoing formal dissolution. Carl has been known to use his Grammy's bell as a shot glass.

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