Reactions to Analog Fetishism in Sound Recording Cultures

Andy Kelleher Stuhl

Submitted to the Program in Science, Technology and Society

in Partial Fulfillment of the Requirements for Honors

Stanford University, May 2013

Abstract

Analog fetishism, a highly visible trend in the popular discussion of digital-age sound recording, embodies a technologically deterministic understanding of music and presumes a fundamental split between digital tools and their analog predecessors. This study situates the phenomenon in the context of sonic categories from which musical value systems draw their signifiers and to which digital-age advancements pose a disruption. The case of lo-fi music and home recording is given special consideration as an example of a musical genre-ethic embedding specific relations to recording technologies. A close examination of selected conversations in online sound recording forums, alongside careful consideration of the technologies involved, reveals a strong tendency among recordist communities toward the rejection of technologically deterministic attitudes and toward the reemphasis of performative work as driving musical creation.

Acknowledgements

I would like to express my sincere gratitude to Professor Fred Turner and to Jay Kadis, whose advice, encouragement and inspiration shaped this thesis from the outset. Thank you to Dr. Kyoko Sato, for her excellent guidance throughout the writing process. Additional thanks are due to Professor Jonathan Sterne, for lending his thoughtful perspective as my argument was taking shape, and to Professor Cheryce Von Xylander, for her help in connecting topics in aesthetic philosophy to my early research questions.

Thank you to my wonderful parents and to my compatriots in Columbae, Synergy, and the STS program—without their example, support, and eagerness to hear my ideas, I could not have completed this project.

Table of Contents

Introduction **1**

Chapter One: Socio-Technical Loci and Digital Disruptions **8**

Noise 10

Fidelity 17

Production 25

Conclusion 33

Chapter Two: Case Studies from Sound Recording Web Forums **36**

Lo-fi, Credibility and Contradiction 42

Perspectives on Software in the Studio 51

Production as Performance 59

Conclusions: Locating Value in Music Recording, Looking Ahead **67**

Endnotes and References **73**

Introduction

Larry Crane, editor of the sound recording magazine *Tape Op*, found the film *Sound City* acutely frustrating. The 2013 documentary, produced by rock musician Dave Grohl, centers on the famed Los Angeles recording studio of the same name. Grohl portrays the legacy of the studio, its equipment and the artists and engineers who have worked there; he also seeks to explain why the studio closed its doors in 2011 after forty years of operation. According to Crane, Grohl's film places the blame on digital recording technology. In a brief blog post for *Tape Op* the week of the film's release, Crane offered a sharp criticism: "instead of telling us the real story behind Sound City closing, we're told that what has fucked up the music industry is the evil of Pro Tools, because Pro Tools allows untalented people to make records."[1]

The film's message, as Crane crystalizes it, is a striking example of hard technological determinism—what Robert McGinn defines as a theory of technology's social involvement under which "technological change is viewed as both a necessary and a sufficient condition determining all other social change"[2]. Grohl's telling of recent recording history situates the technological change—digital recording and digital audio workstations such as Pro Tools—as an innovation which forcefully disrupts the existing social conditions of music production. In the context of this disruption, the analog devices which digital tools threaten to replace are depicted as powerfully determinant objects: "One thing that's confusing," Crane notes, "is that Grohl seems to be attributing the arc of his career to the magic in a Neve [sound mixing] console."[3]

Grohl's attribution of apparently magical powers to an analog sound recording technic exemplifies a prevalent trend in twenty-first-century sonic cultures: the fetishization of analog

recording technologies. In transferring responsibility for "the arc of his career" away from the predominantly social influences which shape most careers and granting it instead to a physical object, Grohl displays what Marx identified as commodity-fetishism: "the productions of the human brain appear as independent beings endowed with life, and entering into relation both with one another and the human race."[4] This analog fetishism depends on the same "imputed characteristics" which Paul Théberge, citing William Leiss, sees in the adoption of digital sound tools.[5] Leiss defines imputed characteristics as "those that people believe to be present in things" (guided in this belief by advertising and other social activity under the umbrella of consumerism) and argues that "Commodities are not straight-forward 'objects' but are rather progressively more unstable, temporary collections of objective and imputed characteristics—that is, highly complex material-symbolic entities."[6] The work of recordists engages intimately, as we will see, with recording devices as such entities.

At the same time Théberge sees digital audio tools taking on imputed characteristics, the phenomenon happens perhaps even more strongly in a resistive push toward pre-digital tools and practices. The symbolic functions of analog recording tools, and a major justification for the fetishistic view that they impart value the music in whose recording they are utilized, derive from the audible marks left by the technologies on those recordings. Nowhere is the centrality of these machine-imprints to the values of a musical culture more evident than in the lo-fi (low-fidelity) aesthetic. Developments in consumer recording technology, a decade before digital systems entered professional studios, helped a movement based in home recording flourish. Subsequent genres and creative ethics placed home recording in a central role and prized the subversion of industry standards like sonic fidelity and commercialized distribution. Indeed, lo-fi music

celebrated the idea that untalented—or rather, unconventionally talented—people could make records long before Pro Tools came along; some of it, incidentally, helped lay crucial social infrastructure for Grohl and other musicians.[7] Digital disruptions of these subverted socio-technical categories have presented crises not only for the subcultures themselves but in the more widespread recording practices in which their values have come to be reflected by way of aesthetic and social musical influence.

Even within the conventions of the professional recording industry, the characteristic distortions and limitations of analog tools have in many cases been preferred over digital systems which promise greater flexibility and fidelity. Musican and producer Brian Eno argues in an essay for *Wired* magazine that such constraints allow engineers to engage with recording technologies as instruments, building intuitive relationships with the physical machines they use. The removal of these constraints, in Eno's eyes, deprives the recording process of "personality" and uselessly privileges the multiplicity of options over the needs of artistic production: "Although designers continue to dream of 'transparency' - technologies that just do their job without making their presence felt - both creators and audiences actually like technologies with 'personality.' A personality is something with which you can have a relationship."[8] Eno's rhetoric exemplifies the idea of vivacity frequently ascribed to analog machines by anti-digital voices, amplifying the fetishistic quality of such attitudes which grants human characteristics and agency to analog machines.

Analog nostalgia has long been visible, even measurable, in digital-age popular culture: while sales of CDs have steadily declined since the development of portable MP3 players, sales of vinyl records have experienced a resurgence.[9] Music marketers display an awareness of

analog nostalgia in advertising that touts, for example, the absence of digital tools in a record's production, or emphasizes the authenticity of an artist's sound. Joseph Auner investigates the significance to musical activity of purportedly obsolete technologies in general, citing the digital/ analog divide as one aspect of the trend. "The resurgence of interest in old and out-moded media, sounds, and machines goes far beyond any simple 'retro' aesthetic or nostalgia, but raises issue about how musicians and listeners use music to generate meaning, to locate themselves in a tradition, as well as to produce and transform that tradition."[10] Making reference to Eno's essay and its claim that artists "play with" the listeners' "deep sensitivities to the signatures of different media"[11], Auner argues that "the sounds of old machines can be made to speak in a variety of interpretative frameworks: authenticity vs. artifice, modern vs. postmodern, blackness vs. whiteness, and human vs. mechanical."[12] Here Auner raises authenticity as a key facet of the attachments recordists form to aging technologies.

Authenticity provides a compelling but incomplete answer to the question: what quality of musical recordings do analog fetishists believe these technologies to impart? Allan Moore dissects authenticity in popular and subcultural music, finding that a "first person" version of musical authenticity depends largely on the mediation of the conceived musical piece: "The expression I am discussing here is perceived to be authentic because it is unmediated–because the distance between its (mental) origin and its (physical) manifestation is willfully compressed to nil by those with a motive for so perceiving it."[13] Returning to lo-fi as an example of a recording-technology-centric musical subculture, we see both a confirmation and an inversion of this principle. The audibility of the mediation done by the tools of recording testifies to the absence of mediation by conventional industry practices and thus testifies to the originality of the

recorded musical expression. The playing-back of the recording, in this case, is the physical manifestation of the conceived expression. In this way recording replaces performance under Moore's model, suggesting that the value preserved in authentic transmission is derived from conception rather than performance. Authenticity merely reflects the successful reception of this value; it does not constitute it. This importance of this distinction becomes evident as we track "authenticity" in its use as a sonic descriptor by analog fetishists who twist Moore's process by privileging the technology over the musical conception.

This project sets out to investigate how present-day recording practices engage with the fetishization of analog technologies and to identify what this engagement reveals about the creation of musical value in the age of digital recording's predominance. Amateur and professional recordists frequently contend with analog fetishism on the part of their clients, their collaborators or even themselves. Their reactions reveal a trend of resistance to such fetishism which decries technological determinism and emphasizes musical value as conceived in the performative work of musician and engineer.

In the first chapter, a background is established for present-day analog fetishism, its surrounding context of digital transition, and its significance to sound recording. Three prominent categories of recording as social and technical activity are examined: noise, fidelity and production. The terms themselves, as well as the exchange and contradictions among changing technical and social understandings, reveal points of crisis for sound recording. Digital technologies disrupt socio-technical dynamics in each of these categories, establishing them as loci of tensions between aesthetic-seekers and technological pragmatists.

In the second chapter, terms including “lo-fi” and “authenticity” are used to locate conversations among recordists wherein these tensions are exposed, explicated and resolved. Knowledge transfer and learning-by-doing have guided the practice of sound recording since the invention of the recording studio, and forum-based websites have fostered communities of engineers and enthusiasts who perform these same practices online. Two forums are examined in particular: the Pro Recording Workshop and the Tape Op Message Board. These online community archives present crystalized scenes of real recordists, all with their own attachments and fears toward different technologies, contending with the often-conflicting impetuses of aesthetic goals and digital realities.

Analog fetishism is realized on the side of music’s creation through the belief that pre-digital sound technologies can add value to the recordings they generate. This project examines how that belief effects the work of digital-age recording engineers and what it reveals and changes in the way value is granted to musical recordings. Scholarly investigations of music production following the rise of digital technologies have tended to emphasize new practices enabled by digital-age tools: MIDI composition, software synthesizers, rapid sampling and remix, to list a few examples. This project focuses instead on digital recording as a technology introduced into a pre-existent body of practices and musical genres. While the engineer forums explored do not limit discussion based on musical genre, the majority of participants seem primarily engaged with rock and pop, especially independent and alternative forms—these genres have largely developed with the processes of recording and reproduction in a central position, and as such have allowed a recording-centric culture to emerge around them.

More than the technologically mediated transcription of a musical performance, the findings of this project demonstrate how sound recording is itself a performance and in which engineers work actively to translate a musical vision into a reproducible entity. Analog fetishism, to the frustration of engineers who encounter it, ascribes the vivacity achieved by great engineering to the tools of recording rather than the engineer. Digital sound technologies, while acknowledged as a threat to the aesthetic qualities which have come to distinguish certain cultural values, maintain and in many cases bolster the performative status of recording. In resisting analog fetishism, recordists have emphasized a digital-age value system which ascribes deterministic power to the song rather than to the machine and which reconciles the technology of digital recording with the communication of artistic vision. These values set the stage for new possibilities in digital-era aesthetics, politics and participation as artists move beyond nostalgic conceptions of sound and technology.

Chapter One:
Socio-Technical Loci and Digital Disruptions

Scholars have portrayed the sudden propagation of digital and networked sound technologies in as extreme a light as "what may be the most fundamental change in the history of Western music since the invention of music notation in the ninth century."[14] Timothy Taylor justifies this claim by pointing to the erasure of physicality and degradation from the storage of sound recordings, but also to the possible disappearance of performance from digital-era music: "this music can be realized by a single person with a home studio consisting of a computer and a few electronic musical instruments, and much of it is. No performers are required; indeed, there is no 'performance' in a conventional sense."[15] Taylor's definition of performance excludes the work of this software user and, by implication, requires in performance a temporally distinct activity which is absent from the atemporal sound-building he describes. Prevailing opinions among present-day recordists indicate a broader definition of performance, welcoming the (often atemporal) choices of the producer as performative work. Additionally, live performance of physical instruments remains strongly coupled to certain musical genres, especially those around which recording-centric cultures have developed. These cultures, having arisen prior to the advent of digital technology, acknowledge and contend with digitally enabled practices. Their reactions to "the digital" span resistance, caution, acceptance and innovation.

Arguments toward viewing the advent of digital technologies as a fundamental shift in the nature of music tend to focus largely on computer- or Internet-aided practices such as remix and algorithmic composition. This paper instead focuses specifically on the ongoing reception of

digital tools in recording-centric cultures, mainly with regard to musical genres which have predated the personal computer but in which recording has played an active and visible role. Contention remains as to whether the digital shift deserves recognition as one of the most disruptive events in music history or fits more smoothly into the continuum of gradual electronic advancements. Théberge (whose focus is more on instrumentation than recording) situates digital audio as one of many innovations to effect music in the latter half of the twentieth century but not as a singular jump. This section, in exploring the background of analog recording's connections to aesthetic value, will examine socio-technical categories of musical sound which digital-age paradigms have fundamentally disrupted, while at the same time keeping in close reach the pre-digital fluctuations of the same categories.

Discussions of the digital in theory and the digital in practice veer apart in terms of formats and conditions, with notable consequences to the categories discussed in this section. "The digital" as discussed by theorists like Aden Evens constitutes a bridging characteristic of technologies, while "digital" in other, especially popular contexts, may often imply an ambiguous set of particular tools and formats enabled by work in digital audio. In the latter case, the use of "digital" by an engineer or any commentator denotes an assumption about the chain of software and hardware used to bring a recording to the listener—in particular, "digital" can be a stand-in for MP3 compression, for musical sampling, or even, via the proxy of MP3-enabled portable audio players, for twenty-first century listening habits. For this reason it is particularly useful in arriving at a comprehensive view of digital sound and its cultural treatment to observe from both the perspective of format theorists and from phenomenological angles, exploring the

nature of sound's digital mediation on one hand from its socio-technical shaping and on the other from its theoretical implications.

In order to observe the fetishization of pre-digital recording technologies, we must first understand the ways that cultural and aesthetic relationships have co-evolved with the technologies in question. The concepts of noise, fidelity and production provide particularly active loci. These terms are invoked and understood quite differently in contexts which fall variously along a line from purely technical concern to the vocabulary of cultural listenership. They and the set of ideas to which they attach lie in complex relation to the work of musicians, audio engineers, and listeners. As Evens contends, such polysemy is a "Productive ambiguity" which "connects disparate disciplines" and is thus key to the work of sound studies as a highly interdisciplinary field. The insight-giving benefits of juxtaposing different uses do not derive from simple conflation or confusion, but from a careful study of "phenomenologically verifiable"[16] interactions among meanings. These interactions, and the disparities in understanding among listeners, artists and engineers, form a critical background to the firsthand study of recordist accounts.

Noise

Noise, as a concept based in the technical mediation of signals, bears its own productive ambiguity: according to Bruce Clark, "the productive ambiguity of noise emerged from the consideration that it is too much information—and precisely *unexpected* information"[17] While noise is often conceived as an interfering nuisance opposed to the tasks of communication and sound transmission, we see in cultural treatments of noise a strong confirmation that it encodes

and constitutes information in a way that noiseless signals cannot. In recorded sound, noise makes audible the mechanisms of capture, mediation and playback; while this action is also realized by distortion (covered later under the topic of fidelity), machine noise presents itself as a separate sound altogether from the musical signal, allowing its reception to more immediately characterize the technologies involved in a recording's creation. Noise tangibly reflects the imputed characteristics of recording technologies. Noise has been dramatically suppressed and eliminated in such capacities, however, by digital-age technologies. The continued use of noise by musical artists under its pre-digital significance constitutes a fetishism which informs analog fetishism at large and demonstrates its resultant difficulties.

Noise's role as an audible signifier of certain technologies, as well as its changing status as engineering problem and artistic tool, earns it a careful consideration. "Noise" is a difficult term to pin down, as Jonathan Sterne makes clear in *MP3: The Meaning of a Format*. Sterne presents the signal processing perspective, quoting Harvey Fletcher's definition of "'Unwanted disturbance' in electronics quite broadly…. For him the term signified any 'extraneous sounds which serve only to interfere with proper reception.'" Fletcher's is the electrical engineer's objective understanding of noise as an impediment to the transmitted or stored signal, auditory or otherwise. On the other hand, Sterne notes "A broader subjective and social definition of noise as 'unwanted sound' that at its extreme could be a threat to the social order, often because it was tied to unwanted populations, or to the discomfort of relative elites." While the undesirability of noise seems to be the only uniting feature between the electrical and cultural definitions, a third perspective calls this too into question: "Acousticians had tended to define noise in terms of its frequency characteristics: nonperiodic, irregular, or otherwise not behaving like pitched or

recognized sound."[18] Since musicians, recording engineers, and anyone else involved in the production of recorded music contends with noise in all three of these contexts, instances of "noise" in their discussions must be carefully considered.

In the case of the distinct auditory marks which a recording technology leaves on its products, the acoustic and signal processing notions of noise are the most relevant. (This is not, of course, to say that forms of noise in the scientific sense can avoid a status as noise in a social sense.) Cassette systems create a consistent, high-frequency, relatively low-amplitude form of noise due to the interaction of the recording head with the necessarily non-uniform magnetic particles.[19] This phenomenon, known as tape hiss, is more salient when inexpensive tapes are used. Tape hiss stands out as the most readily identifiable acoustic feature of low-budget cassette recordings. A whole host of other types of interference mark tape recordings as well, with many less easy to categorize as noise or otherwise. Magnetic tape print-through—what engineer John Woram describes as "an audible pre- and post-echo of the signal on the two tape layers that come in contact" with a recorded segment during storage—is one such effect. Thomas Porcello devotes a whole essay to the phenomenological study of print-through, treating it "as a metaphor for cumulative listening experiences engendered in the mediated social spaces of musical encounter." Here the gap is bridged between acoustically defined noise (the unintended echo of print-through) and noise as a socially experienced object. The print-through echo passes the signal processing test as unwanted sound but fails to fit the acoustic description, being a diminished copy of the intended musical content. Its social role originates, for Porcello, in its disruption of "The autonomous status that formalist theories… have granted the musical text." [20]

Noise, by exposing unintentional sounds, challenges the self-standing authority which music recordings are often thought to hold.

Recording mechanism noise is thus analogous to the noise of urban life as Sterne presents it: an underlying but untamable layer of sound which potentially undermines existing systems of power, whether political or experiential. Jacques Attali argues in *Noise: The Political Economy of Music* that music serves as a harbinger of changing social structures, driven in this change by its response to and incorporation of noise. Rather than defining noise in contrast to music, Attali describes music as "The organization of noise," noting that it "reflects the manufacture of society; it constitutes the audible waveband of the vibrations and signs that make up society. An instrument of understanding, it prompts us to decipher a sound form of knowledge."[21] For Attali, noise and music interact in a musical-deterministic, metaphorical model for examining culture. Porcello's likewise metaphorical use of print-through rejects this deterministic approach in its challenge to the autonomous power of a recording's musical content. Attali depicts noise in the era of sound recording as a tool and catalyst which will disrupt music's stage of *repetition*—a commercialized period to which he credits both the birth of a music industry and the destruction of meaning in music, among other things. Here the path of noise for the purposes of this paper parts ways with that of "noise music," but the adoption of noise as the defining element of a genre certainly reflects upon the presence and influence of noise in less deliberately disruptive musical forms. For both Attali and Porcello, noise in either the acoustic or social sense challenges established power structures. Sterne indicates that digital recording technologies and certain events in their pre-development significantly weaken this capability of noise.

While Sterne invokes Attali in his chapter on perceptual coding, his treatment is highly critical. Perceptual coding refers to the science of manipulating sound, whether in recording, architectural design, or elsewhere, so as to take advantage of characteristics in human audio perception. This science is of course central to the digital processes which drive the MP3 format, but it also predates the rise of computer technology. An important corollary to perceptual coding, according to Sterne, is the "domestication of noise." Attali published *Noise* in 1977, "Precisely at the moment when communication engineers began to articulate a paradigm where noise no longer needed to be eliminated or reduced if it could simply be rendered imperceptible to the ear." One task of perceptual coding was to hide noise by causing the intended audio content to render it unnoticeable. In many places, the effort to overcome noise in the electrical sense was replaced by this ability to subdue it through perceptual manipulation. As far as Attali's bold claims about the disruptive power of noise, Sterne contends, "Once you can use signal to hide noise, the game is up. Noise ceases to matter as a perceptual category."[22] Indeed, the print-through noise in Porcello's example is easily overcome by the pseudo-perceptual-coding trick of storing tape wound backward. This practice causes the echo to follow rather than precede its source sound, making it more likely to be drowned out by the intended sounds which follow the original. Still, Porcello notes that the print-through effects on the records he owned where this trick had apparently not been used triggered an experientially disruptive event in his listening.[23] While perceptual coding may thwart the potential of noise when done correctly, it is by no means foolproof.

Of further interest to Sterne, then, are the consequences of "Sound reproduction *after noise*" (emphasis added). In the changed status of noise from electrical nuisance to maskable

sound, Attali's theories on its artistic scuplting seem at least partly redeemed. "No longer did acousticians seek total eradication of noise; now they merely hoped to arrange it. The same could be said for avant-garde composition, sound art, and audio recording. Noise became a source to be utilized in the service of creative expression, and acoustic space became ever more plastic with multitracking and new forms of reverberation that proliferated from the 1960s onward."[24] In Sterne's understanding, advances in perceptual coding not only removed noise as a threat to the process of engineering a recording, but, as with a domesticated animal, brought it into the recording studio as a controllable and even useful presence.

Present differentiations among different types of noise must accordingly address the technological origin and intentionality of the sound. While the deliberate use of chaotic and ambient sound in recordings certainly predates perceptual coding developments, noise enters the picture as a category of technologically derived sounds which defy expectations and modulate perceptual qualities such as sonic spatialization. Reverberated sound, for example, fits at the least an acoustic understanding of noise in its chaotic qualities. As a physical phenomenon, this noise is carefully constrained (for example through the use of sound-absorbent material in recording studios), yet its technologically producible version is used by sound engineers to create auditory illusions of space and distance. The relationships among noise, control, and illusion become increasingly intricate as perceptual coding and digital recording advance. The lo-fi aesthetic, for example, while signified in part by certain types of noise, can be understood in part as a reaction to the illusory capacity of high-budget recording tools.

Even in settings where noise is technologically thwarted, the idea of noise continues on as a signifier of musical and technological subversion. John Mowitt argues that "With the

increasing hegemony of bit-oriented systems, noise even functions to name that which stands opposed to the information system as a whole."[25] The term "noise" thus becomes an object onto which practices resistive to digital sound confer their values. In doing so it becomes a part of analog fetishism and gains the ability to confer notions of vivacity and subversion which analog fetishists seek to preserve. The huge range of instances in which "noise" occurs in popular music cultures testifies to the directed broadening of the term and its associations. The annual Noise Pop Festival in San Francisco, for example, makes no claim of limiting its musical acts by their use of noise or invocation of noise music as a genre; rather, the "indie music, arts and film festival" advertises an attention to musical subcultures in general by emphasizing its local, independent and do-it-yourself-ethos artists.[26]

The transition into a recording culture predominated by digital tools has placed noise at the center of the cultural fetishization of pre-digital technologies. "Digital recording technologies may do just as much to standardize the sound of music—through the proliferation of standards and presets and the tastemaking done by mastering engineers—as to challenge those standards…. *Far too often artists still fetishize noise as transgression or a challenge*"[27] (emphasis added). Here Sterne points out a problem which is quite central to this project: that old conceptions of noise carry over into contexts where new technologies have required their reassessment. Sterne's language implies a value judgment, justified by the concern that these artists operate under an inaccurate view of their socio-technical world. By using a tamed tool under the illusion that it is a dangerous and automatically subversive force, the artist falls prey to a false consciousness which potentially jeopardizes her efforts. The prime example here (and one confirmed by the reported experiences of recording engineers) is the musician who goes out of

his way to record on cassette tape with the impression that this noisier recording medium alone will lend authenticity or credibility to his music. Another musician may just as readily go out of her way to record on cassette tape with the understanding that she is simply choosing the medium's noise as an aesthetic feature, and thus avoid the dangers of the particular fetishization which Sterne criticizes. The distinction is one between noise as a marker for analog fetishism and noise as an instrument to be performed by the artist and engineer.

Fidelity

Greg Hainge (quoted in *Noise Channels*) argues that "The history of the development of different audio formats from wax to vinyl to tape to CD, indeed, seems itself to be driven by a single-minded, stubborn desire to render the communications system or medium entirely transparent (or inaudible, rather) and to eradicate entirely any interference coming from the system or the medium itself so that we can instead focus solely on the pure audio content of our choice."[28] For the adherents of glitch and noise music whom Hainge investigates, a compelling subversion lies in exploiting these purportedly transparent media at the points where error makes them audible. Techno-nostalgia pursues value by looking in the opposite direction: seeking to preserve the audibility of older media. Both tendencies run counter to the goal of fidelity, which in its technical definition is bolstered by the increased transparency of sound media. Music-centric cultures in which fidelity occupies a central space demonstrate how changing relationships to sound media, and analog nostalgia in particular, inflect the values of musicians, recordists and listeners.

The idea of fidelity is central to the process of translating a material-world sound into a reproducible electronic signal; more importantly, it is vital in listeners' technology- and process-aware assessments of recorded music. Like *noise*, the term takes on a range of often clashing meanings as the distance from its purely technical use grows, and once again these points of divergence prove to be valuable locators of socio-technical change and disruption. Fidelity becomes additionally central to the development of audio cultures which emphasize a particular relation to sound technologies: the ideal of high fidelity elevated by self-described audiophiles and marketers of high-end playback systems offers one angle, while the aesthetics and social economy of lo-fi music offer another, dramatically different viewpoint. Taking these cultures as opposing but related extremes in a spectrum of popular music's connections to technology, the origins and effects of musical technophilia become apparent in the reception of recorded music at large. By beginning from a technical exploration of fidelity in analog and digital audio, we can assess how cultural understandings of fidelity emerge from and shape the current phenomenon of analog fetishization.

Fidelity refers in essence to the accuracy with which a reproduced audio signal resembles the sound as it occurred in its original setting. The devices which work to reproduce the sound with more or less fidelity can be thought of as a chain, beginning with microphones and pre-amplifiers, passing through recording and storage mechanisms, and ending with playback systems, amplifiers and speaker drivers. Each component in the chain presents a potential for loss of fidelity through the introduction of noise or distortion. Fidelity is also in this sense the quality of noise's absence, which can be realized in as many different ways as their are acoustic understandings of noise. Distortion, yet another highly context-dependent quantity, is as much an

antithesis to technical fidelity as noise is. Any activity which alters the audio content of a signal can be categorized as distortion, yet in recording practice the term most often denotes specific types of change, most of them undesirable. These types are typically distinguished from distortion in general by their aesthetic reception, providing a reference point for the gap between technical and aesthetic definitions of fidelity.

For popular music recorded in a conventional studio, technical fidelity is rarely the primary objective. Under a strict reading of fidelity, the goal of fidelity-seekers on the recording end would be to capture the sound of live musicians performing simultaneously in the studio using the most transparent tools available, with the goal of precisely reproducing the performance at the point of playback. This would ideally entail microphone placement aimed at simulating the (absent) listener's position in the room and simple two-channel recording with no added effects. This practice runs counter to the way a pop or rock song is recorded in the conventional modern studio: microphones are placed close to the instruments, with musicians arranged in the room so as to cleanly separate the sounds of each into different tracks. Additional sounds are added after the performance in a practice called overdubbing, then mixed along with the recombined instrument sounds to create the illusion that all occurred in the same performance. Electronic effects such as reverberation, compression, and equalization are added to most tracks, and the final, mixed recording is further modified in the process of mastering. The recording process is highly illusory and driven by controlled distortion, which listeners expect and acknowledge. We can infer from the continued discussion of fidelity in popular music discourse that fidelity in this sense is not truly adverse to illusion or distortion on the recording side of the chain; rather, the quality of fidelity changes from an ideal which can only be detracted

into a perceived descriptor which can be enhanced with the successful use of certain types of manipulation.

Porcello identifies this tension between perceived fidelity and recording practice in a sound that is live in feeling while heavily mediated in construction. “The Austin[, Texas] sound exists both at the level of musical genre and at the juncture of the performance practices and sonic characteristics of the music. More than an aesthetic, however, it is also a deeply political stance toward the value of local music practices”—we can understand the Austin sound much in the same way as lo-fi, as a politically directed genre-ethic. In this case, “live performance is the hallmark of this valuation” and the artists and engineers behind the sound must confront the predicament of “how to maintain the sincerity/liveness link despite a recording process that rarely relies fully—or in most cases even predominantly—on live, uninterrupted ensemble performances.”[29] Porcello goes on to describe a similar set of seemingly liveness-removing practices as above, yet ultimately concludes that the particular technological and social mediations enacted by Austin recordists “vigorously guard the social value of liveness, in ways that often render the boundary between ‘mediated’ and ‘live’ indistinct” in that “both can be used to mark a local musical identity resistant to the hegemony of the record industry.”[30] One can easily replace liveness with the overlapping value of fidelity in this calculus, demonstrating that the social ends toward which fidelity works can operate in unison with seemingly contradictory technicalities.

In audiophiles, Marc Perlman finds a culture whose unconditional elevation of fidelity draws liveness into its value system: “They hold quite explicitly not only that the standard by which all audio equipment is judged is accuracy, but that the touchstone of accuracy is the sound

of live music." This culture, characterized by a "faith in the existence of an unconditional sonic truth"[31], treats liveness as the quality which grants musical recordings authority over the technology which mediates their playback.

When listeners refer to the fidelity of a recording, rather than the fidelity of a playback system, the term veers decidedly toward the aesthetic, reflecting the listener's more or less informed determinations about the recording process. This aspect of fidelity is emphasized by electronic and digital technologies in the way they detract emphasis from other parts of the chain. On the one hand, electronically-produced sounds present a complicating element; never having occurred in the materially acoustic domain—that is, as compressions and rarefactions of air propagating toward a microphone—these sounds bypass part of the fidelity-bearing device chain. Digital systems, though, remove another part of the conventional chain, as fidelity cannot in theory be lost in the storage or copying of a signal. A disparity, then, exists between digital and pre-digital conceptions of fidelity. While digital technologies greatly increase the ease of high-fidelity transmission in the purely technical sense, a similar phenomenon to the fetishization of noise despite its quelling by perceptual coding occurs: cultural attachments to fidelity linger, both granting added value to the remaining parts of the chain and conflating the loss of fidelity's relevance with a loss of fidelity itself.

The cultural positioning of fidelity, to which noise and distortion are opponents, helps us understand it as an antithesis to a kind of aura, and thus noise and distortion as the bearers of this aura. The work these qualities perform is the "productive loss" of the aura Benjamin identifies in regard to the mechanically reproduced art work.[32] Fidelity, meanwhile, is closely linked to the presence-granting *tekhne* which mechanical reproduction grants artwork. A truly high-fidelity

system, with as little distortion (intentional or otherwise) introduced, promises to a large extent the same benefit of *tekhne* as Benjamin saw in photography: an increasingly accurate communication of certain realities.[33] Taking as examples two technologically and musically defined cultures which claim opposite bearings on fidelity—lo-fi music and the high-fidelity-oriented audiophile culture—we can see the effects of aura's and *tekhne*'s respective elevation in the reception of music recording.

With fidelity in its relation to lo-fi music, digital's shortening of the mediating chain between source and listener allows us to understand a particular angle of what is lost when the physical, degradable storage medium vanishes. If we understand fidelity as a quantity which can distance copies from the original translates into digital technology as a loss of aura, the prominence of medium-driven aura-making in the shaping of the music itself becomes clear. A vivid example is provided by Bela Koe-Krompecher in Marc Woodworth's book on the Guided by Voices album *Bee Thousand*: a sound in the first track of the record that listeners presumed to be intentionally crafted was actually the result of a faulty cassette machine at Koe-Krompecher's record store damaging the only existing recording of the song.[34] A recorded song's legacy is thus imprinted sonically on it by the machines and events involved in its recording, storage, and reproduction. When storage and reproduction are handed over to digital mechanisms which preclude such imprinting (and which, by the nature of digital files, render the original indistinguishable from reproductions), a key component of the lo-fi value-making system is jeopardized.

Aden Evens claims that the audiophile's definition and elevation of fidelity reflect the social order which situates them as arbiters of the high art status (or more broadly, "music

created by gifted individuals for the pleasure of passive observers"[35]) towards which music strives. The politics of lo-fi and tape culture seek to subvert this order by taking an opposite tack. Tape culture replaced the classically trained genius with the enthusiastic amateur as the originating source of music. Emerging as a community where artists would record to cassettes and trade them with one another by mail, it did away with the passive observer as the music's audience. Even as tape culture grew and lo-fi took hold as a more general musical descriptor, a strong sense remained through the making of fanzines and compilation tapes that members of the genre's audience were also active participants in its propagation. Where the "noise" in "noise music" tends more to reflect compositional or arrangement choices, the "fi" in "lo-fi" reflects instead the subversion of standard recording and reception processes. This distinction does not solely diverge the two genres (noise music and lo-fi) in terms of creative mentality, but also highlights the enclosure of recording and playback as components which should be considered as part of the musical process.

Different attitudes toward fidelity embody fundamentally different relations to sound technologies. Paul Théberge, commenting on fidelity and what others identify as audiophile culture, suggests that "The aesthetics of 'high-fidelity' have reinforced the idea that microphones, amplifiers and speakers are *reproductive* technologies, that they are, by design, transparent in their operation."[36] The idea of certain technologies as reproductive and transparent emphasizes the correlation of high-fidelity values with *tekhne* and stands in opposition to the values of lo-fi. Lo-fi aesthetics depend on the non-transparent imprints left on recordings by the equipment used to produce them as signifiers of the music's origin and legacy.

Digital recording technologies bear strongly upon fidelity, foremost in their introduction of lossless copying. As Timothy Warner notes, analog media store audio as a reproducible signal, while digital media store audio as information from which a signal can be reconstructed—this provides for the fact that while even the most high-end analog systems distort a recording each time it is copied, digital copying (assuming the absence of error or malfunction) introduces no distortion. This change naturally disrupts the lo-fi reliance on machine imprints as signifiers of aura—the anecdote of the damaged Guided by Voices tape would not have happened had the song existed as a digital file rather than a cassette tape. Much as perceptual coding did to noise under Jonathan Sterne's assessment, digital sound technology to a great extent renders fidelity irrelevant. Value systems which center on fidelity, lo-fi and hi-fi alike, are thus placed in a crisis whose most obvious solution is a turn towards pre-digital media.

Despite their differences, both lo-fi and fidelity-centric audiophile culture perform very visibly the task of crystalizing music as artwork, as Evens explores with regard to the latter. This activity occurs with any recorded music, but is exemplified in the cases of these cultures by the extremity of their relationships to fidelity. Accompanying this historical transformation—the object-capture of the musical performance into a technologically manipulable work of art—is a pronounced technophilia. The technologies which enable, through recording and playback, this solidification of music and its further perfection are placed on the same resultant pedestal as the recordings themselves. This attitude is as observable in the mythological status of four-track recorders among lo-fi enthusiasts as it is in the perfectionist equipment-chasing of audiophiles. The present-day recording engineer has in many cases arrived at the intersection of these two technophilias, in large part due to the onset of digital technologies. As consumer-level tools

become more successful in achieving technical fidelity and storage media are removed from the fidelity-altering chain, the social conditions with which lo-fi originated move closer toward the possibility of high-fidelity. Concurrent with this shift is the gradual seep of lo-fi aesthetics into musical venues where hi-fidelity listening is not a foreign practice, to similar effect. As artists and listeners work to reconcile older conceptions of fidelity and its importance with these changes, pre-existing contradictions and problems of technophilia become increasingly exposed. From the artists' and recordists' perspective, the notion of production specific to music recording presents the stage upon which these tensions play out.

Production

Production, as used in the discussion of recorded music, refers in general to the work of making musical recordings, encompassing a range of activity from musical arrangement to direct engineering. Implicit in the referral to this work as production is an understanding of the musical recording as a commercial object, as well as of the recording as the end toward which musical activity in the era of reproducible sound strives. Production encompasses a whole range of practices which depend not only on the reproducibility of recorded sound, but also on the capitalist environment under which music is conceived, performed, recorded, distributed and consumed. The involvement of the recording studio as a site of production depends strongly on the commodity status of recordings, and the practice of home recording creates itself in relation to the recording studio. At the same time home recording began to rise to prominence, digital sound technologies began to disrupt the commodity status of musical recordings, removing a medium from the domain of production and trivializing the work involved in replicating

recorded sound. Digital-age efforts have counteracted this disruption by re-introducing a digital medium, just as analog nostalgia counteracts it by resisting digital technologies entirely; both have done so in ways that locate production and engineering at the center of a crisis in musical value.

For the purposes of the this project, it is most useful to understand production as the technology-enabled construction of the value which musical recordings hold and transmit. While a professional studio recording effort often involves a separate engineer and producer, engineering stands out as the category within production most concerned with technology and most distinct from activity that would be considered part of the musical process outside of a recording context. In an explanation strongly symptomatic of technological fetishism, Albin Zak describes recording engineers as "both craftsmen and shamans, harnessing the power of the machine and deftly manipulating its magical secrets to effect the transformation of the musical moment into a musical text."[37] The nature of the musical moment—to what extent it derives in conception, to what extent in performance, production, recording or reception—is a question on which production practice hinges and to which relation to recording technology matters a great deal. This project will examine the question of musical value's origin in detail, but first turns toward an exploration of production as a socio-technical category of music.

Consumption is, of course, just as dynamic a facet of the commodity-oriented relationship between music and technology as production. While this project focuses on the producers of musical recordings rather than their consumers, the attitudes of the latter are constantly reflected (albeit through layers of distortion) in the efforts and difficulties of the former. Furthermore, many theorists identify technological changes in sound recording as

effecting a dramatic exchange between production and consumption. Taylor argues that "Digital technology is helping to challenge—even, in some instances, break down—the difference between production and consumption. Nowhere is this convergence—or confusion—of production and consumption more evident than in the rise of the MP3."[38] Taylor's claim rests most heavily on types of agency ceded to music consumers by the makers of digital technology, for example the the ability of music fans to easily remix recordings and the advent of user-made playlists as an alternative to album playback. He challenges the aspect of Adorno's model of mass culture under which producers dictate the tastes of consuming masses, finding agency on the part of consumers in examples of technological proliferation.

John Mowitt, writing shortly after the advent of the compact disc and its uncompressed digital audio, argues that digital sound will "integrate, at the level of a technological continuum, the modes of production, reproduction and reception", rendering questions of fidelity to live performance irrelevant and recreating the previously destroyed "conditions for auratic reception"[39]. Mowitt's argument is united with Taylor's, Théberge's and other scholars' by a consensus that digital technologies allow such a convergence of production and consumption. Mowitt's point, in relating the integration of the two activities to Benjamin's notion of aura, raises an interesting counterpoint to a removal of transformative medium which seems evident in the working of digital recordings and their reproducibility.

Consumption practices in the age of sound recording have steered music production most directly (on the engineering end of production, at least) through the recording medium. Mastering—the final step in the production process, in which completed mixes are processed for consistency of the overall sound—has traditionally been heavily medium-dependent, with

different master recordings created of the same album for releases on vinyl and on cassette, for example. In replacing physical media, characterized by certain distortions and limitations, with transparent and lossless storage, digital sound would seem to do away with this necessity. This change has been explicitly promised by high-end digital systems such as the one pushed by Neil Young; rhetoric surrounding the system tends to include descriptions like *Rolling Stone*'s —"intended to present songs as they first sound during studio recording sessions."[40] The magazine's suggestion, perhaps an oversimplification of Young's aim, is that the type of production activity which tailors to the constraints of a medium is adverse to the interests of the naturally fidelity-seeking listener.

The idea in this version ignores a whole host of steps which occur between recording sessions and digital playback: parts are rerecorded, overdubbed, mixed and panned within the stereo field; effects are added for artistic rather than compressive purpose; and mastering includes aesthetic changes without which most accustomed listeners would find recordings difficult or amateurish. This attitude toward digital sound takes an unintentionally extremist stance in opposition to production. Under such a mindset, digital technology promises the disappearance of the medium, where the medium is depicted more as a veil between musician and listener than as the vehicle of transmission. Analog media, particularly vinyl, seem in most such depictions to be exempt from such a disdainful treatment (as seen in Perlman's study on audiophile culture, the "Golden Ear" camp tends to reject engineering-based claims of digital's advantages, claiming that their auditory experience testifies to vinyl's greater fidelity).[41] Partly this exemption is the result of the kind of analog fetishism which arises from crises in fidelity-centric musical value systems, as we've seen; partly it is the popular myth that vinyl and analog

media boast perfect fidelity and are transparent enough to avoid the constraining effects of a medium.

Compressed digital formats like the MP3, against which such proposals for high-end digital systems stake their claim, actually re-introduce the presence of a medium into digital sound. Uncompressed digital audio is an informational system variable in its level of detail by bit depth and sampling rate (the two dimensions of an audio file's resolution, to use the digital image file as an analogy). Perceptual codecs like MP3 once again provide constraints and distortions, through their algorithmic attempts to preserve what will be perceived and discard what will not, in awareness of which methods producers can and must alter their recordings. The codecs tend to run through proprietary, closed-source software, cementing them as media whose characteristic quirks must be felt out and practiced by mastering engineers. Apple's "Mastered for iTunes" campaign marks the most direct reinforcement of this notion from the technology-producing side in recent years. The campaign ostensibly seeks to bolster the perceived quality of the digital music files Apple sells, compressed through the Advanced Audio Codec (AAC), by identifying those recordings which have been specifically mastered for the format according to the company's published guidelines.[42] Mastered for iTunes represents the conscious re-introduction of a practice, already familiar to pre-digital production, as a novel development in digital production; significantly, it locates this development within the recording studio.

John Mowitt involves the commercial recording studio in an argument that the consequences of sound's electronic reproducibility have elevated consumption over production. The nature of this elevation places technologies at the center of music as a cultural activity. "The recording studio," he claims, "is a cultural facility whose existence testifies to the technological

advances that made the present priority of cultural consumption over cultural production possible…. At the very core of the studio reside repetition and reproducibility." Mowitt's assertion rests on the safe assumption that music, understood in the pre-reproducibility past as ritual in its performance, is now listened to via recording far more often than it is performed. This shift reflects back upon performance itself: "In actual recording practice this phenomenon has penetrated musical material to the point where performances themselves are immanently shaped by both the fact and the anticipation of repetition."[43] The shaping to which Mowitt points is the activity and consequence of production. While the recording studio is an environment (and, as Brian Eno proposed in 1979, an instrument) whose purpose and domain is production, it is a consumption-facing object.

Since the professional recording studio as an institution predated the possibility of low-cost home and amateur recording, these practices define themselves in relation or often in opposition to the commercial studio. Cultures such as the trade-by-mail tape music movement invert elements of the commercial production-consumption tradition by using the tools of consumption (cassettes) as tools of production.[44] Théberge focuses on the home studio and its rise toward mainstream use through the lens of professional modes of production bending to developments in consumer-level technologies. He claims that pre-digital amateur studios "did not function as autonomous production centers where a finished product could be turned out for commercial release," but notes a major exception:

> Much of the punk and early new wave music of the late 1970s, and many of the so-called 'alternative' bands of the early '90s as well, made use of consumer recording equipment as the vehicle for a do-it-yourself industry of 'lo-fi,' independent record production. On rare occasions, even big-name performers

> released recordings produced on low-cost equipment, when they felt that the recordings captured the raw spontaneity of a particular performance in a way that could not be reproduced in a commercial studio…. Any apparent losses in sound quality were more than made up for by the cachet of 'authenticity' that the recordings carried with them.[45]

Théberge largely dismisses this facet of home recording, focusing instead on how digital composition tools such as MIDI have subsequently allowed home studios to become full-fledged composition and recording environments for electronic music (a change dependent on the ceding of performance to computer systems). He persuasively demonstrates that professional studios have changed in response and accommodation to this development. His treatment of pre-digital home recording developments, however, underplays the bond which the involved genres helped create between a specific class of recording tools and cultural values—a bond which, as is evident from engineer perspectives, has seeped heavily into studio practice and has become a sticking point in the introduction of digital tools to recording-centric cultures.

In Amy Spencer's documentation of DIY culture, lo-fi appears as a productive ethic under which specific methods of music production attach strongly to cultural values, authenticity being foremost among them. The musical genres in question evidence a shift from performance-based to recording-based subversion as their means of deriving meaning. "For punks, getting up on stage with little rehearsal was admirable. To many post-punk bands it was important to carefully construct a lo-fi sound, which could be just as authentic."[46] Lo-fi is responsible in at least this regard for linking authenticity to music production and thereby to recording technologies. While the term "production" tends to connote professional, label-funded studio recording, it is fully applicable to home and amateur recording. Spencer notes that lo-fi practices have been in many cases a deliberate choice in the production not just of music but of a

musician's cultural standing: "For many musicians at the time, sticking to the 'real' underground was the preferred option. Some were not willing to lose the sense of credibility and the authentic that DIY culture gave and so played the game of becoming successful, but not so successful as to be labeled a 'sell out'."[47] Lo-fi music presents a striking example of how a whole set of cultural decisions are embodied in an aesthetic category best identified simply as a "sound." In the case of lo-fi, the authenticity-bearing "sound" is one characterized by the audibility of the recording tools.

Théberge identifies a key aspect of production and its relation to technology's bearing on musical development with the discussion of this definition-eluding aesthetic category. Théberge claims that "in the age of electronic reproduction, the achievement of a unique 'sound' has become one of the means through which new musical genres are created in the first place." The salient machine-imprints of lo-fi music fall under this category, and the claim is supported by the rise of lo-fi sounds (or their simulations) in genres such as indie rock which have drawn heavily on DIY traditions as influence and instantiation. Digital tools, as Théberge points out, become "the perfect vehicle for a music industry based simultaneously in fashion and nostalgia" by aiding both the creation of new sounds and the emulation of old ones. The nostalgia for old sounds, then, is coupled with a conflicted but intense attachment to the technologies which supposedly and in reality produce them. The vocabulary used by musicians to identify qualities of sound in this genre-level aesthetic sense reveals that "even musicians who reject digital technology" are "betraying their preoccupation with technologically reproduced sound"[48]. In the greater scheme of Théberge's argument—that musicians increasingly act as consumers of

technology in a way that structures their musical production—these attitudes toward "sound" and technology fuel analog fetishism on the part of musicians and producers alike.

Conclusion

Noise, fidelity and production present three capacities in which technical and cultural understandings collide in the creation of value in musical recordings. In all three cases, contradictions among various meanings and intentions characterize the terms and reveal possibilities for subversion. Digital recording fundamentally disrupts each quantity in different ways, creating crises for cultures which have come to depend on these types of subversion. Lo-fi music, especially when held up in contrast to other musical cultures with explicit relations to technology, provides sharp examples of these forms of subversion and makes particularly evident the potential for a deprivation of cultural meaning as a result of digital developments. Through these lenses we can come to understand a more rational origin for strong attachments to analog tools; furthermore, a context is established in which analog fetishism emerges as an ongoing reaction and resistance to such disruptions whose effects on the work of recordists are prevalent and fundamental.

Noise demonstrates a category of sound which has simultaneously been suppressed by signal processing technologies and elevated in cultural status. The distinction between noise and signal, derived from engineering, is reflected both in the generation of music and in theories such as Attali's which examine music's bearing upon social structures. The presence of noise in recordings stands out as the most salient way in which recording tools can leave their audible, characteristic marks on music. Perceptual coding and digital recording have succeeded, in many

cases, in eradicating noise as a technical obstacle. Artistic conceptions of noise have not always taken this development into account, though, leading to a fetishization of noise and the potential for a false consciousness on the part of the musician in regard to the technical constraints under which he or she works. We can therefore understand noise as a specific object which undergoes digital disruption and analog fetishism.

Fidelity, understood in one aspect as the absence of noise and distortion, forms a link between technology-centric musical cultures and the specific sonic qualities that reflect the values these cultures prize in recording. Lo-fi and audiophile cultures present sharply differing examples of such technological attachments. While their attitudes toward fidelity in a sonic sense seem perfectly opposed to one another, they share a strong concern with transmitting a fidelity of musical "vision." Recording technologies are idealized on the one hand by audiophiles as transparent, reflecting as accurately as possible the sound of the live performance, and on the other by lo-fi adherents as proof of the social history embodied in the recording. In its removal of noise and distortion sources, digital recording technology renders recording-oriented notions of fidelity irrelevant, creating crises for both value systems. Analog fetishism can be approached as a response to this dilemma, locating fidelity at the center of its socio-technical concern.

Production, in contrast to the previous categories, refers more to a mode of musical activity than to a sonic descriptor. Like noise and fidelity, however, its usages fall diversely and often ambiguously across a spectrum of technical and social understandings. In examining production we can observe the most concrete ways in which digital-age changes have effected music, recording, and the commodity-oriented landscape in which the two meet. Among these developments are a removal and re-introduction (via file compression) of a characteristic-bearing

medium that must be tailored to in production. The increased consideration of a "sound" in production provides another angle from which to approach lo-fi music and the nostalgia driven by audible machine-imprints. Finding production central to questions of creating and locating value in music recording, we turn toward the perspectives of the recordists themselves.

Chapter Two:
Case Studies from Sound Recording Web Forums

Online communities present a vital resource to this project in their capture of the problem-solving and opinion-airing which inform the real recording practices of their members. Crucially, these forums are situated within the long trajectory of knowledge-sharing among sound engineers, presenting an Internet-age venue for the pre-Internet and pre-digital modes of the craft's development. Susan Schmidt Horning explored how the role of the professional recording engineer has evolved alongside advancements in recording technologies, finding that "recording practice has retained craft skills and informal knowledge systems despite the steady growth of, and increasing dependence upon, complex technological systems."[49] Horning maintains that tacit knowledge and mentor-protegee modes of learning have retained a central place in the way recording engineers acquire their aesthetic and technical expertise. In these online communities, tacit knowledge occurs through collective problem solving and through the case-by-case transmission of proven solutions to new contexts. While for the most part abandoning the mentor-protégée model as a static relation between two individuals, these communities display a kind of collective apprenticeship in which a forum's senior engineers accumulate the trust and stated respect of less versed users through the reliability of their solutions and the cultural value of their related experiences.

In their commingling of technical advice, opinion and anecdotes, online recording communities resemble those surrounding much earlier waves of advances in media technologies. These similarities help situate the recording engineer—a role often dramatically different from

the contemporary engineer as perceived in general—in relation to the electrical engineer as first conceived and to the role of expertise in the social negotiation of media technologies. Carolyn Marvin finds that different types of electricity-focused communities in the late eighteenth century helped grant textuality to electrical work and defined notions of experts in the developing field. Alongside the technical, primary material of early electrical trade literature, Marvin identifies "a secondary content of social news, editorial comments, and short anecdotal articles that provided a less earnestly self-conscious arena of discussion." Even present-day sound engineering occupies a similarly uncertain zone in relation to established forms of engineering as electrical work did in the era Marvin describes; and the same secondary content dynamic vibrantly characterizes the communities which surround the craft. While technical concerns justify the group communication and form its central thread, a good deal of the content takes the form of anecdote and opinion, speaking additionally to the importance of recording as an aesthetic practice. The informality of these online communities tends to foster vocalization of the contemporary issues most important to the development of the craft, again analogously to electrical engineering literature: "The casual tone and location of this material, at the interstices of the strait-laced technical and professional documents which announced that electricians were busily engaged in their calling, made it ideal for expressions of the concerns closest to their hearts."[50]

The social operation of such communities revolves around the textualities they maintain and the way they construct themselves in relation to the technical skills they foster. Textual authority is central, as Marvin presents it, to the functioning of such communities, and observation of recording communities confirms this claim via the strong emphasis on the textual

authority of recordings. A strong tendency exists among participants to defer to the recorded song as authoritative proof of a practice's merit, and an argument is rarely launched or rebutted without an appeal to specific recordings as examples. With the development of electrical textuality and the status of the electrical engineer, insider/outsider dynamics arise. Marvin depicts a rise of technical literacy as social currency alongside the propagation of electrical communication technologies, citing examples in which insider communities used ignorance of electrical technologies to deride outsiders and stigmatize non-empowered groups (e.g. women and non-whites).[51] The demographic makeup of the recording communities examined below appears to resemble that of the early electrical insiders (predominantly white and male), but derision and stigmatization are directed in notably different ways: stereotypes emerge of recordists, musicians or listeners who deserve derision for their misunderstanding of technologies and practices, but this study observed no coupling to social status outside the musical sphere.

As in many creative fields, cheap and widely propagated technologies have enabled in part a gradual blurring of traditional boundaries between amateur and professional modes of sound recording. One product of intermingled professional and hobbyist approaches to recording has been a similarity in knowledge sharing among and between the two camps. Moderated web forums have proven to be a key venue of this activity. As opposed to other online tools such as collaborative documents or instructional videos, web forums allow engineers to build knowledge by posing and addressing a vast series of specific challenges. The forums in question maintain the interpersonal, specialized activity of tacit knowledge while bringing it into a publicly visible setting. This movement of interpersonal learning into a more public light is naturally a further

benefit to hobbyists without a professional training background. It also aids the quick propagation and evaluation of new or unconventional ideas about recording.

For the purposes of this study, the archives of two web forum sites—the Pro Recording Workshop and the Tape Op Message Board—were sampled as representations of opinions held among professional engineers and recording enthusiasts. The sampling was keyword-driven with terms identified as indicators of potential crises in sound engineering perspectives, both during literature review and during the forum analysis itself. This set of terms, including "authenticity," "lo-fi" and "analog," was used to select conversations which centered on issues directly pertaining to disparities between digital and analog tools and the negotiation of musical or sonic authenticity. Findings from the analysis of these conversations and their related materials were grouped by the focuses of their arguments or contentions, as the material which connects a given conversation to the research questions of this study often emerges from the refinement of a central problem later in a discussion thread rather than immediately from its initiating post.

The Pro Recording Workshop (PRW) group of forums, started in early 2011 on the forum hosting site Lefora, is the venue for a professionally oriented community that had developed on the ProSoundWeb forums prior to its reorganization[52]. Most of PRW's moderators and active contributors identify themselves by real name, and many are established and well-known recording engineers at the professional level—the forum's creator is Terry Manning, and William Wittman and John Agnello host the Music Production section of the site. Forums within PRW include, among others, the highly populated "Whatever Works" forum where engineers share challenges and solutions, a forum on music production with concerns outside of strict engineering, and a home recording forum. With some fifteen hundred members and a smaller

number regularly active, PRW functions as a low-anonymity online community in addition to a knowledge-sharing site.

A more longstanding vital site in the sharing of knowledge and opinions between recording enthusiasts is the online message board hosted by Tape Op. *Tape Op* is a magazine in print since 1996 and focusing on creative approaches to sound recording. Initially "a hand-stapled 'zine in the punk rock, Do-It-Yourself tradition," *Tape Op* retains a much greater emphasis on home recording and low-cost solutions than other publications in the field.[53] This egalitarian tone and a body of combination reader-contributors have translated into a fruitful online community. With over seventeen thousand registered users, the message board is more than ten times as populated than the PRW, yet it shares in the phenomenon that the most active users identify themselves by name and engage with one another as an online community. While anonymous users and off-the-cuff responses are more common in the Tape Op Message Board than in the PRW, the prominence of home recording and musician perspectives is greater, and the color of opinions and interchange often sharper.

Both the content and rhetoric of these web forum posts provide crucial, encapsulated insights into the ongoing efforts of sound engineers to reconcile digital-age phenomena with cultural norms about recording and production. Sound engineers, as revealed in their voiced concerns and frustrations, often find themselves positioned at the specific point where the conceptions and expectations of popular or artistic culture clash with the technical dimension of the tools which capture and manipulate audio signals. The Tape Op and PRW forums offer unique access points to a present iteration of the long-existent tradition of communal knowledge transfer and problem solving among these engineers. By walking through engineer discussions

and carefully unpacking the socio-technical backgrounds that inform either side of contested issues, we can identify a more fundamental set of patterns and problems. Among these are a deep uneasiness surrounding the role of engineering and production as mediating activities. Another finding is a surprisingly strong tendency of forum contributors, despite their roles as engineers, to assign much more deterministic agency to musicians and musical artifacts than to machines or producers.

As prominent as the technical knowledge transfer in these forums is the awareness of cultural disparities between musicians, listeners and engineers. The field of problems which are tackled communally in the discussions frequently includes the experiences of engineers struggling to fulfill a musician client's requests or to understand the meaning and rationale behind a particular sonic descriptor. In terms of analog nostalgia and notions of authenticity, these threads far more often reveal critical awareness of the phenomena than the phenomena themselves. Receptions of nostalgia- or authenticity-driven concerns reliably range from sympathetic to harshly cynical, providing a vivid picture of the challenge these trends present for anyone involved in the creation of musical recordings.

This chapter is divided based on three prominent themes which emerged from the source analysis. In the first part, engineer encounters with the lo-fi aesthetic are examined, offering indications of shared and divergent attitudes among engineers regarding the desire for cultural credibility that is seen to motivate musicians who seek the aesthetic in their work. The second part focuses on how software is viewed as a presence in the recording environment, exposing discomforts both with appeals to analog nostalgia in the marketing of software and with digital tools like Auto-Tune that lack analog predecessors. A third section focuses on how production-

based qualities are reflected in recordings. The problems of defining "overproduction" and of reconciling idealized production practices with the creation of sonic aesthetics reveal production as both a layer of technological mediation and as a performance in itself.

Lo-fi, Credibility and Contradiction

In the PRW forums, the term "lo-fi" appears more often as a descriptor of a desired sound than of an undesirable quality. In one thread under PRW's music production forum, users asked engineer Brad Wood questions about his recording of the first albums by the indie rock musician Liz Phair. One user inquired, "How did the lo-fi-ness of the debut come about? Did you deliberately hold that up as an aesthetic, or did it just seem like the best way to capture what was going on for the artist at the time? That sort of thing is very fashionable right now but was much less so than. Did you have any fear (as I often do today) of the record being perceived as 'poorly engineered' when you chose from the lo-fi sonic palette?" This user's definition of lo-fi treats it as an aesthetic category of sound qualities. His concerns over fashionability situate the topic squarely in the field of artistic choice, though by describing a threat to perceived quality of *engineering* rather than of *production* he ties these concerns to technical work. Later in the thread he specifies that what he means by "lo-fi" is a "lack of slickness or artifice" which he considers "much harder to achieve than the polish that many people seem to expect from a 'recording studio' experience." For him, the sounds in question are characterized by immediacy and adherence to the musical artist's real character or presence.

Oddly enough, this definition drifts strongly toward *high* fidelity in a literal sense. While the user understands the "fi" in question to refer to conventional norms of studio enhancement, in

the technical sense fidelity is maximized by lack of interference with the captured sound, whether via mechanism noise or studio manipulation. Wood's reply reflects this confusion over the term when he states, "I don't for a second think that [Phair's first record] Exile In Guyville is lo-fidelity in any way. The microphones we used were/are the best the available… and the recording format was a robust analog."[54] Wood's definition of lo-fi is strongly grounded in a technical understanding of fidelity, determined largely by the precision of the equipment and media used; the questioning user's definition tends much more toward the aesthetic. Their exchange highlights sharply two divergence aspects of fidelity and their applicability to music production.

Of course, the question is not simply whether nominally lo-fi sounds are desired among recording enthusiasts, but how and why they are sought out. As for *how*, in a post labeled "Lo Fi > Hi Fi," the moderator of the PRW Home Studio forum requested help reproducing a "lo-fi" effect which appears in a particular song.[55] The range of solutions suggested by users involved both analog media and digital tools, often in combination. Most commenters suggested playing the original digital recording through a particular device and using a microphone to record the output back to the computer. The devices included built-in computer speakers, a CD or cassette tape player with "crappy speakers," an iPhone, a communicating pair of cell phones, a battery-operated miniature guitar amplifier, and an old tube-based radio receiver. Among these, the tape cassette player and tube-based receiver are pre-digital devices commonly favored by analog nostalgists. The digital devices in this group, notably, share the characteristic that the hobbyist engineer would likely already own them. In this sense the use of the digital devices would seem closer in step with an originating principle of lo-fi recording: the enabling of easy sound capture

through readily available tools. While some devices suggested employ digital technologies, all of the above recording strategies involve bringing digitally stored sound into a physical space and then back into digital representation. Any audible playback of digital sound involves a conversion to analog signal, and speakers, microphones, and the physical space itself can be considered analog devices under a moderately liberal definition. Whether the involvement of specific pre-digital media and electronics is needed to achieve an authentically "lo-fi" or "analog" sound seems in this case up for debate.

The first commenter on the "Lo-Fi > Hi-Fi" post was unique in recommending only a plugin[56] as a solution. The suggested plugin is called Vinyl and made by the software firm iZotope. The company promotes it as "The ultimate lo-fi weapon" and explains that the program uses a set of sophisticated digital technologies to "create authentic 'vinyl' simulation, as if the audio was a record being played on a record player."[57] As with many plugins, the controls in Vinyl are represented as knobs, faders and switches on a physical device. Users can manipulate parameters including the mechanical and electrical noise a turntable might produce, as well as the wear, dust, scratching and warping that might impact the sound of a record. Distinct relationships among lo-fi, authenticity, analog media, and noise emerge clearly from the software and its promotional material. As in the forum post's original context, "lo-fi" features as a strongly positive descriptor. One gets the sense from "ultimate lo-fi weapon" that the plugin itself is not being described as lo-fi, but rather that lo-fi represents a sonic and material state to be fought for. The contradiction in achieving a lo-fi sound by way of digitally modeling a high fidelity analog medium (the vinyl record) is mitigated by the centrality of noise and damage—the material distortions of the medium, not the medium itself—as the sources of a lo-fi sound.

Authenticity, meanwhile, is tacked on as a key reason that artists should desire both a lo-fi sound and a simulation of the analog medium.

While engineers often discuss lo-fi and analog sound aesthetics as desirable ends, many are also sharply aware of what they consider irrational attachments to analog technologies. One forum thread titled "Analog tape madness" began with a user complaining that a group he was working with seemed to adhere to "the quasi-religious 'Analog is better' school" but had sent him improperly recorded tapes. Other users quickly joined in expressing their frustration with the uninformed attitudes toward analog machines they had encountered in their work, as well as their frustration with some of the analog technologies themselves. One commenter stated, "People (musicians) often assume that analog will provide them with a sound that the engineer couldn't provide for in the first place, as if 'analog' was synon[y]mous with 'better engineering.'" This user's particular frustration results from a transfer of agency away from him, the engineer, toward the fetishized technology.

A sense emerges from the thread in general that many engineers have worked with musicians who place higher value in the capacities of a particular device or medium than in the ability of the engineers who operate these machines. Another user wrote that "I know analog can sound amazing. Great analog sounds amazing…. But I almost wish the creaky old A-80s and other cranky sounding machines would just all break so I can concentrate on making music sound as great on playback as it does in input."[58] These engineers portray a socio-technical environment in which relationships are formed towards analog technologies out of an incomplete mythology—a mythology in the sense that the devices are said to grant authenticity to the recordings they produce, and incomplete in the sense that many of these musicians have not been

informed about the imperfections and limitations of analog recording. Such relationships are in some cases so strong as to obstruct the operating dynamic among musician, engineer, and machine.

As in the PRW forums, many of the Tape Op Message Board discussions which touch on conceptions of lo-fi and analog fetishism begin with specific inquiries from frustrated engineers. One thread from 2005 started with a user addressing a question to "the guys here who play in bands" — "the artist Im working with is unhappy because in his words 'you did too good of a job'. Im not quite sure how to approach the situation but its brought up bigger questions about where people's aspirations are really at. If you guys are wearing your lo-fi ethic on your sleeve, are you afraid of a good sounding recording ruining your street cred?" Again, we see the engineer's understanding of technical quality and fidelity clashing with the musician's aesthetic aims. The vocabulary that describes these different ends is central to but not responsible for the disconnect. The key confusion, as the same user states more powerfully later on, is not over the terminology of lo-fi but over the disparity between its aesthetic claims and its technical realization: "Is lo-fi something you get because all you could afford was not the most expensive gear so you went with it and like it, or is it something you go out of your way to achieve?"[59] This question could be restated numerous ways—is it truly lo-fi if you go out of your way to create that effect?

Also embodied in this user's question and the ensuing discussion is an awareness of the "lo-fi ethic," as he puts it. While unclear on the term's true meaning and the feasibility of its realization in the studio, most contributors seem attuned to lo-fi as both an aesthetic and social object. Few genres are commonly attached to an "ethic" in conversation about music, with punk

being a prominent exception. A more common use, and one that bridges the sentiments of punk and lo-fi, is the DIY ethic which Amy Spencer illuminates. DIY spans a much broader range of activity than music recording, promoting a general attitude of self-reliance and inventiveness as an alternative to pre-fabricated and consumerist solutions. Where the DIY ethic's demands on sound recording are rather self-explanatory and limited to the production side, the overlapping ideology of lo-fi plays out more ambiguously in both process and product. In this case, the musician desires lo-fi only as a quality of the product without apparent concern for the process by which it is achieved.

Opinions which categorize lo-fi as a musical fad reflect this same conclusion. The "too good of a job" discussion quickly turned divisive—many users sympathized with the musician's request, and others expressed indignation at the idea that an engineer should need to make a recording sound "worse." One particularly vehement member of the latter camp, who felt that a "recording is either good or it isn't," said that he had "always hated that fake credibility lo-fi thing almost as much as I hate the idea that being a shitty musician gives you punk credibility" and that the case seemed to him "like an example of half-assed trend chasing." This user's strongly cynical approach to the problem of lo-fi's separated process and product brings the factor of credibility and a more explicitly social angle into the foreground. In this reading of the musician's request, social factors in the reception of the music, which he feels should be decoupled from the production, take precedence over the production itself. The musician is thought, in order to have his music taken seriously, to be concerned with creating the appearance of certain production qualities, hence "fake credibility." The musician allegedly aims to deceive listeners into assuming certain facts about the music's and the recording's creation. The listeners,

he expects, have created a strong association between this rough quality and the stories which surround significant works in the genre.

Credibility joins a collection of properties a recording can be seen to hold or to attempt, authenticity and sincerity being close neighbors. In the above commenter's perspective, we can note that credibility holds an attachment to whichever genre-ethic the musician and listener operate under. What passes for punk credibility may not pass for lo-fi credibility, or for that matter blues, folk or banghra credibility; otherwise the distinction would be inappropriate. An ethic such as lo-fi or punk thus defines through some mechanism a set of qualifications by which musicians can give credence to the social claims they make (about their own lives and attitudes) by participating in the genre. Credibility, like authenticity, appears to depend on the understood social position of the performer. Both deal, to some extent, in the accuracy of the performer's representation of his or her culture. Credibility connotes an additional sense that the performer deserves the expressive outlet which the music and its genre provide.

Credibility as stated here (that is, as something to be achieved in the recording studio) may be better understood in opposition to non-credibility—that is, as a set of aesthetic qualities which aim to preclude the impression that the music is disingenuously created. Its qualities are thus the negations of qualities perceived in the undesirable, contrived version. Under a punk definition of credibility, if we bear with the anti-lo-fi forum contributor above, conventional standards of musicianship make up the qualities against which the ethic reacts. The resultant punk aesthetic grants value, then, to the sound of an untrained and unpracticed musician. In the eyes of critics such as this forum user, this value system gives rise to reverse-reasoned attempts to satisfy the aesthetic qualities and thereby imply the socio-political values which originally

gave rise to them, without actually upholding these values. In the case of punk, our hypothetical trend-chaser would believe that a lack of conventional musicianship alone could lend his music the disruptive, anti-establishment thrill that characterizes punk music. In the case of lo-fi, the ethic tends to derive its values not just from subverting ideas about what a musician should be, but by subverting the entire process of producing and propagating a musical recording. The qualities it must avoid, then, are those which characterize the typical product of a professional recording studio: a cleanly separated and familiar vocabulary of instrument sounds, a low noise floor, and electronically added effects such as reverb and compression, for example.

Credibility becomes a matter of canonized sounds and styles, which translate into production desires. By imitating the sound of certain culturally iconized musical artifacts, the musician hopes the listener will confer upon his music any number of qualities associated with the making of these canonized works: independence, originality, and opposition to corporate or systemic norms are all likely candidates under the lo-fi ethic. But credibility is largely an object that exists in interaction between musicians and listener, with the musical recording as a platform for their exchange. For music fans accustomed to home-engineered recordings and culturally attuned to the workings of the music industry, highly produced recordings—that is, recordings relatively free of noise and marked by heavy use of electrically (or digitally) added effects—may rouse suspicion. This possibility sets production as a concept at odds with credibility.

Production is, in a popularly conceived sense, often seen as an antithesis to credibility—as proof that a musician's output needed sculpting by outside hands. Listeners and journalists often tend to depict engineering and production as a central stage for the corporate co-opting of an anti-conventional genre, be it punk or lo-fi, etc. Since the creation of any musical recording is

a production effort, this sentiment places musicians and engineers in a difficult tension enabled by awareness of listener expectations and the requirements of credibility. Forum discussions, such as those cited here, which involve artists striving towards a perfectly imperfect sound, are prime examples of this tension and its resulting contradictions. The musician who desires a lo-fi sound from his recording engineer, again under the "trend-chasing" reading, feels he must actively preclude the sonic signifiers which might diminish his credibility. Whether the musician is in this case actively trying to disguise his social position, which in reality may be outside that expected by the genre, or simply aiming to recreate that genre's canonized sounds, is impossible to determine. The perspective which labels such a desire as a "fake credibility" effort would say the former, and the perspective which calls foul on "trend-chasing" would say the latter. In this case, both perspectives are voiced at once by the same critic; and in reality, one can expect that both considerations are at least partially true for the majority of recording musicians.

The picture becomes additionally complicated with the inclusion of technology shifts such as that, generally, between analog and digital systems. When socio-technical changes disrupt the causal link between the values of a musical ethic and its aesthetic markers, would-be participants in that ethic are placed in a difficult situation. Many might face the choice between "faking" the aesthetic and retaining a more socially rooted sense of credibility by avoiding deliberate alteration in the production of their recordings wherever possible. The examples drawn upon here indicate musicians tend to take the former route, preferring to wait for the genre-ethic's set of characteristic sounds to catch up with the sonic imprints (or absence thereof) of a new set of tools and production capacities. Techno-nostalgia, then, is built into the process by which new tools enter the picture and by which musicians engage with these ongoing changes.

Perspectives on the digital tools themselves, however, reveal ways in which the shift from entirely analog to digitally driven systems presents a disruptive, non-continuous event in this movement.

Perspectives on Software in the Studio

Marketers of recording products are keenly aware and active in the propagation of analog nostalgia, and sound engineer perspectives reflect a good deal of discomfort with this trend. In a 2012 post titled "Are 'vintage' type compressors relevant in today's music?" a Tape Op forum user notes that "Everywhere I go, I hear 'vintage' this and 'warmth' that and 'classic' that...Every plugin maker seems to be emulating the greats of yesteryear."[60] Yesteryear's great compressors are electrical hardware devices which perform dynamic range compression—the narrowing of the difference in amplitude between the loudest sounds and quietest sounds in a recording. Dynamic range compression serves a number of potential purposes, as Jay Kadis notes: "This can be for musical effect, to make a sound stand out more in a complex mix, or for the purposes of noise reduction in noisy recorders or transmission systems."[61] This compression is easily achieved by signal processing software, which can adjust the amplitude across a digital audio file according to any number of rules. Hardware compressors, without the ability to analyze any more audio than is currently passing through them, have certain characteristics by necessity—for example, a compressor's attack refers to the quickness it responds to a loud sound's onset by reducing the amplitude of the signal which follows. The hardware-emulating plugins to which this user points include these parameters, and their makers advertise them as conferring the same desirable characteristics onto recorded music as the hardware versions purportedly would.

This user questions whether the stated value of the hardware compressor emulator plugins holds any merit or whether the trend is "really just a marketing ploy to sell units," adding, "Can't we do better with our current technology?" This user's frustration is in large part a direct reaction to analog nostalgia. His phrasing speaks to a prevalent unease among engineers who use such software tools and feel that replicating the constraints of older hardware devices may be a backwards-facing and limiting mode of design. Computer programs, in being able to examine any part of a recorded sound at any given point, are freed from the time-dependent constraints of analog devices. Compression plug-ins, from a purely technical standpoint, can do a much better job of compression's stated task. Features such as look-ahead become possible, in which a digital compressor can lower the amplitude of a signal in advance of a loud sound rather than allowing a small portion to pass through unmodulated. In practice, however, compressor plug-ins retain the parameters (attack, release, knee, etc.) necessitated by hardware compression.

Some responders in the "vintage compressors" thread were quick to caution against the subjectivity of the question, while also defending the value of hardware compressors. The first reply began with "No, we can do if *differently* with our current technology" and noted that "Software is great at some stuff…. Hardware is great at other stuff". Between these statements was a defense of hardware: "I also enjoy the visceral experience of adjusting a real knob on a piece of hardware to just... there, not a quantum approximation of 'there.'" While ignoring the original question as to the usefulness of emulating hardware devices in software, this reply touches on a central rationale for analog preference among technicians: the difference between discrete and continuous values. The replacement of continuous analog signals and controls discretely quantizing versions essentially defines digital audio; however, modern digital

recording systems offer such tiny value intervals as to overcome any perceptible effects of digital quantization. In the case of signals, this is done through standardizing sampling rates high enough that all frequencies perceptible by the human auditory are reproduced; for interface controls, designers might in theory limit a simulated analog control to broadly rounded steps but in practice can easily spare the computing resources needed to give the control sub-perceptible finesse.

This fact is presumably understood by the above forum user when he specifies that he enjoys the experience of precisely adjusting an analog control to obtain a value which feels correct. He is not claiming to be able to perceive the difference between the value he selects on an analog control and the minutely rounded value digitally emulated control would produce. Rather, he finds that the knowledge of the digital rounding detracts from his experience as an engineer. Arguments from music listeners in favor of analog formats over digital often reflect a similar concern: that while no audibly perceptible difference exists due to the magnitude of the digital medium's sampling rate, the experience of listening is impinged upon by awareness that, at some level, the digital signal goes through processes of estimation and representation which are absent in the analog format. This experientially rationalized take on analog nostalgia is voiced more colorfully by the second responder, who claims "There is a certain alchemy that occurs when you run a signal through gizmos a certain way". The visible fact of hardware, in concert with the engineer's intuitive level of familiarity with the hardware's signal processing methods, creates an experience which in contrast to the use of digital tools takes on a magical quality for some engineers. Here we see a sharpened reflection of the imputed properties which

in analog nostalgists evidence commodity fetishism; the experience of using the machine rather than the machine itself bears magical value.

Opposing opinions in the same thread defended the use of plugins, arguing for determinable quality of sound rather than quality of experience. The first response to explicitly address the question of authenticity in the compressor plugins discussion approaches authenticity as a technical and quantifiable value: “I figure that if the plug-in, or program within your multi-effects processor gets you 95% of the sound of the original... then really, are you working at a level where you need more authenticity than that? Isn't the whole point just to get a good sound?” This user points out that these software plugins emulate specific hardware devices not in order to achieve the stated goal of compression more effectively than otherwise possible, but rather to recreate the unintended sonic imprints left by the original machines. He notes that “the reality of the outboard gear that attempted to control levels in the analog domain is that the process of controlling that level brought with it all sorts of artifacts. Some of those artifacts sound ‘pleasing’ and others don’t.” His claim, which resonates across a broad range of recording technologies and their attachments among users and listeners, holds that imperfections or limitations in the equipment create “coloration” which becomes desirable. Emergent from this argument is an interesting position on fidelity: from a technical standpoint, coloration is in effect the carefully selected introduction of noise and distortion to a signal, which opposes its fidelity to the sound source. Responding to the original post’s observation of words like “warmth” and “vintage” recurring constantly in the marketing of emulator plugins, this user explains that “if the manufacturer said of their hardware or software items, ‘we add distortion’ or ‘we make unfaithful recordings’ then it would take a lot more explaining. Instead we use fun terms for the coloration

of sound that nobody can really agree on. Ask a dozen people what it means to sound ‘warm’ and you'll get about 20 different answers.”

The process by which those specific machine distortions are selected as desirable—and by which such euphemisms for distortion as “warmth” become signifiers of authenticity—is understood to depend heavily on the music whose production relied on the devices. Another user posited that “over a few decades of use and abuse by pop engineers, those compression artifacts developed into a vocabulary for modern music. So when someone like the OP [original poster] here asks if ‘vintage’ sounds are still relevant, the answer is hell yes, because whether you know it or not, that's part of the vocabulary of pop you grew up hearing.” In this argument, the success of the music is responsible for the propagation of the equipment used to record it, not the other way around; that is, the user does not claim, as he easily could, that the use of certain compressors with now sought-after coloration helped certain pieces of music become popular. Despite the basis of the Tape Op forum community in engineering and production, this latter perspective is absent from this particular thread, with other users supporting the more music-deterministic explanation. Another responder, adding his opinion that software makers have not yet been able to adequately emulate desired hardware compressors, says that the plugins “don't do what big old pieces of analog outboard do, and people are very attached to that sound. I imagine that over the next few decades (actually it's pretty clear to me that it's already happening) people are going to grow more attached to the sound of digital audio manipulation and it will become less and less of an issue.”

Where authenticity is seen as an aim or selling point in software tools which emulate hardware pieces, digital tools which do not have analog predecessors tend to attract distinctly

sharper worries regarding authenticity. The poster child for this concern, carrying the discussion into a much broader pop cultural sphere, has recently been automatic pitch-correction software. Commonly referred to by the name of the leading product in the field, Auto-Tune, this software uses algorithmic signal processing to detect and adjust the pitches of individual notes in a vocal recording so as to make the recorded singer more in key. The bulk of Auto-Tune's infamy outside of audio engineering circles stems from its sudden entry into pop music as a deliberately audible effect. "Auto-Tune" in the popular sense more accurately refers to a use where pitches and the transitions between them are made so dramatically rigid that the voice takes on a robotic quality.[62] While discussion of Auto-Tune in engineer forums is assumed to refer to the tool in its originally intended (corrective rather than distorting) use, popular conceptions visibly bear upon many engineers' negative sentiments toward the tool. The variety of feelings toward pitch correction software, however, reveal stronger patterns of unease and acceptance toward tools likeas Auto-Tune that are exclusive to the domain of digital recording.

Many of the sentiments expressed by engineers around pitch correction reflect a discomfort with challenged standards of musicianship. One thread in Tape Op's Computer World forum began with an engineer admitting that his view on pitch correction software had shifted all the way from his being "an outspoken opponent of pitch correction plug-ins" to viewing the tool as something "I don't think I would mix without"[63]. He explains that he had "always felt (as a singer myself) that if you can't sing it, you shouldn't" but that a recent recording experience had convinced him of the tool's usefulness. This experience centered on a vocalist in whom the engineer appeared to place prior confidence but who, due to her pregnancy, experienced minor pitch troubles which the Auto-Tune plug-in was able to correct. In this case, the singer had

already earned her credibility as a musician in the engineer's eyes, past the point where pitch correction software might have, in his understanding, allowed an unworthy singer to pass as competent. Another user seconded this notion, arguing that "When you KNOW a singer is good, but is having a hard problem overcoming an illness, or, in this case, pregnancy, it is only your 'moral' duty as an engineer to facilitate the situation for her." The prevailing opinion in this thread holds that pitch-correction is a perfectly acceptable tool if and only if the musical authenticity of the vocalist is established prior to its use.

The explicit connection to authenticity in the Auto-Tune thread arrives from a user who argues for the aesthetic appeal of out-of-tune vocals. Responding to the type of cautioning against value assignments that graces most Tape Op threads ("the 'it's not the tool, it's how the tool is used' concept", as another user in the thread puts it), this user retorts, "maybe it's just because I'm 18 and still give a va[gu]e shit about authenticity." Rather than making him more comfortable with the conventional tools and practices of the digital era, this user's youth provides grounds for him to claim a sharpened attachment to authenticity in music production. The sentiment holds closely to punk attitudes about youth and credibility, thereby strongly attaching this use of "authenticity" in the technical fidelity sense to the artistic genre-ethic definition. He goes on to specify that "Theres not so much an inauthenticity about auto-tuned vocals so much as an authenticity about un-auto-tuned vocals." By reframing his argument as a positive rather than negative bias, the user is in part defending his argument against claims that he has wrongly attached a negative value to the tool, Auto-Tune. In addition, he reveals an important nuance in the mechanism by which, in his eyes, musical authenticity is produced. In challenge to the idea that authenticity or credibility emerges from the absence of certain high-

production signifiers, the audible imperfections of an out-of-tune singer here actively denote authenticity.

The rhetoric of disdain and caution which generally surrounds pitch correction in the thread stems from the concern that "it is a tool used to make bad performances appear good," an activity which several participants consider inherently problematic. Their fear points again toward a music-deterministic understanding of production, as well as toward a view of digital-domain tools as functionally deceptive and, in this capacity, anti-authenticity. Under this view, a good musical performance is a source of authenticity and the work of digitally aided production challenges traditional modes of verifying that authenticity in the produced recording. Why digital tools or pitch correction in particular render production a threat to authenticity is unclear from the discussion. Several users note that the use of reverb and space echo, effects available from older, analog electronic devices, can also improve the perceived quality of a less-than-perfect vocalist. While some suggest that these tools might have faced similar suspicion at the time of their entry into the standard recording studio gear set, the users in the thread stop short of demonstrating a fundamental quality of digital pitch correction which separates it from these analog tools. The deterministic power of musical performance agreed upon in the discussion of software tools presumably holds just as true in pre-digital settings; when this power is misattributed to digital technologies, which the recordists in these discussions frequently see happening, the fault cannot lie solely in the technologies themselves but in the fetishization of their predecessors.

Production as Performance

The musical-deterministic tendency of engineers in the online forum communities corresponds to a portrayal of music production as an effort which strives to communicate the integral qualities of the original musical performance but simultaneously threatens them. Production here refers to the process, of which engineering is a component, by which a song is turned from an idea into a recording. Pop culture depictions of record producers tend to focus on the financial and selective aspects of a producer's work; members of the PRW and Tape Op forums, many of whom fill overlapping roles as musicians, producers and engineers, tend to portray production as the loosely bounded layer of artistic choices closest to the actual technical work of engineering. With the vagueness of production's definition comes a natural anxiety over the interpretation of its criticism; this uneasiness is fueled, however, by deeper concerns about authenticity and the interference of technical machines and processes in the capture of artistic expression as recording.

A PRW post titled "What is 'Overproducing'?" highlights uncertainties over not only the definitions of *production* and its modified forms but also over the fundamental nature of production as a reductive versus additive project. The post asks, "Is overproducing making sure every single word in a vocal is perfectly in tune? Are we supposed to stop at 80%? Is it taking away too many distortions or mistakes? Is overproducing when a record gets changed to the point where the 'feel' gets put in 2nd place to technical perfection?"[64] This first voicing of the user's confusion exposes a problematic temptation, when manipulating music with technical tools, to view music as itself a technical and quantifiable object. Engineering, production, and music performance each bear their own level of technicality, and the poster's deliberately

oversimplified suggestion addresses the problem of trying to apply a quantitative approach from one category to what should be a more qualitative object from another. Digital tools, built on more strictly quantizing technologies than analog devices, strengthen the fear that technical principles forcefully imprint their technicality on music production and so diminish its artistic aspects.

The more prominent concern raised, though, centered on whether certain production techniques, exemplified once again by the stridently digital-domain Auto-Tune software, contradict the goal of communicating an artistic intention. The poster questions, "doesn't [using Auto-Tune] interfere with the original direct expression of the artist? - or is it just enhancing what the artist can envision (if they imagine that performance as perfect as possible)... so the autotuning is only the realization of imagination? I wonder if that qualifies as overproducing." The question is still constrained by the idea that a line can be drawn between appropriate production and overproduction. Where this threshold should stand depends, in his eyes, on the interfering capacity of production. Two quantities are held up as potentially compromised or enhanced: the "direct expression of the artist"—that is, the performance—and the artist's imagined recording—that is, the song as a conceived object. One understanding of production would hold that its responsibility is to aid the transformation of the former into the latter. This song-centric view is reflected by one user's definition of overproduction as "a sonic imprint resulting from production techniques/tools that gets between the listeners and the song. It upstages the song rather than supports it." In this model, both performance and production exist as detractive processes through which the imagined song must pass in order to become a recording.[65] Such an understanding of performance calls into question the rationality of

performing in the first place rather than synthesizing and arranging sounds with the precision and control that software systems allow.

To explain the continued work put into performance in the studio, then, we either need to decry the practice as irrational, argue that software tools have not yet met their potential in this regard, or identify performance as a value-giving process which confers qualities upon an imagined song that it could not otherwise gain. The same consideration can be given to production as a process which mediates song and performance into recording—as work which is not only potentially detractive but also additive. The uncertainty in the PRW and Tape Op communities surrounding these aspects of production, juxtaposed with the paucity of suggestions that performance might detract from value, ties into discomforts surrounding new tools and practices. A contributing factor, of course, is a focus in these message boards on the responsibilities of engineers and producers which tends to treat the intentions of the artist as material formed prior to the recording process—an online community of performing musicians might similarly identify over-performance as a concern. Still, the debate as to the meaning of "overproduction" and the origin of an overproduced sound highlights the degree to which song- and performance-centric views treat production as inherently opposed to musical authenticity.

The emergent focus of the above conversation was in correlating "overproduced" as a common descriptor of musical sound with specific production practices. The first two responses posited that the qualities identified as overproduction actually reflect a lack of production work —that "'underproducing' often gets mistaken for 'overproducing.'" This first response proposed a source of overproduced sound in a producer's tendency to "get myopic and lose the plot. (Advocate for arrangements that are too dense for what the music requires, push technical

perfection when rawer expression would fit the bill, etc)." This statement allots value in the song as conceived pre-performance (the bearer of "plot" and arbiter of appropriate arrangements in itself) as well as in the expression-giving performance. As above, technical perfection plays the opponent of performance's expressive qualities in the imposition of technical paradigms on music's qualitative side. Such practices, the user claims, are "usually a betrayal of underproduction (i.e. inadequate focus or effort) as it often speaks to divided attention, lack of understanding of the vision/needs of the music through background or research, an inability to put one's ego aside and commit fully to the good of the music, doing things habitually/ procedurally instead of in-the-moment". Production, then, figures as an effort to steer an artistic expression through technological systems in such a way as to avoid their compromising effects. Poor production relies on automatic processes, the producer performing the same operations on an input regardless of its artistic context (as a machine would), and using a machine-like logic to categorically select and add flourishes to the recording.

The correlation between overproduced sound and excessively additive production methods (a "kitchen sink record") is echoed strongly throughout the discussion thread; as one user notes, the overproduced sound is often more a result of arrangement than production (though the practice of overdubbing complicates the distinction between the two). The second responder cites Arif Mardin's work on a Norah Jones record as an example of effective and strongly reductive production. According to him, Mardin's method relied on stripping away passages of certain instruments and other parts altogether in order to end up with "An iconic way to present an artist." The user concedes that additive "wall of carefully organized details" methods, exemplified by producer Mutt Lange, can also result in strong production; his emphasis

shifts to the attentiveness and labor in bringing a focused artistic vision to realization, rather than on reductive methods as an exclusive means to that end. The problem of digital quantization surfaces again, with the specific example of rhythmic alignment: referring to highly proficient musicians who introduce intentional nuances or tensions in their rhythm, he notes that "one could be doing a lot of damage by moving things toward grid-lines." A defining mark of good production, in this user's opinion, arises from the selectivity with which corrective tools are applied, reflecting a close understanding between the producer and performing musician.

The same user addresses production from an additional angle, saying that in his own work he must "constantly watch myself to make sure I'm not taking the 'life' out of something while 'improving' it. This voicing touches most directly on the notion that music as conceived and performed bears a quality approximate to vitality, to which technology poses a threat via passing its constraints through the producer. The user qualifies his claims with a typical nod to aesthetic subjectivity, noting that "it's just sonic entertainment... Some people are entertained by 'authenticity', and they love the rough edges. There is no pleasing them if you accidentally get better at your craft. You will no longer be 'cool'." While the version of "authenticity" cited rather derisively here is categorized as an aesthetic appeal to specific tastes, the "life" preserved by effective production seems itself a form of authenticity. The difference between the two usages stems from the prevalence of "authenticity" seen in a context of technological and aesthetic fetishism, which as we've seen presents a headache for engineers. As with the discussion of a musician feeling the engineer had done too good a job and deprived his recording of this type of authenticity, the realization of this lo-fi aesthetic is seen to run counter to the inherent goals of production and engineering. Yet a shared quality is evident between the "life"

producers seek to preserve and the "authenticity" elevated by lo-fi purists, in their mutual reverence for the expressive value which originates with the musician and performance.

The key difference seems to stem from the divergent ways this value is mediated by the recordist and by the recording technology. The lo-fi mentality seeks out the imprints of recording tools, while the purely technically-minded studio engineer typically seeks to render them inaudible. The two approaches are united, however, in a practiced reverence for expressive fidelity. Overproduction, by the definition reached in the PRW discussion, is in fact more of an opposite to lo-fi than fidelity itself is. In successfully realized lo-fi recordings, the distortions introduced by the recording technology provide a perceptive barrier which the musical expression must overcome in order to be heard, and in doing so provide too a testament to the power of the expression. In this way lo-fi sacrifices technical fidelity for expressive fidelity—an exchange that is utterly central to its ethos. The reverse sacrifice occurs in overproduction, with technology imprinting itself indirectly and inaudibly, via the producer's imitation of machine logic, on a recording in such a way as to diminish the expression's vitality. The pitfalls of analog fetishism resemble those of overproduction in that both originate in a misguided concession of agency to technology: the conception, on one hand, that low-fidelity tools create the type of expressive power prized in lo-fi music or, on the other, that studio production should follow the type of rules which govern studio technologies.

This picture of production evidences that engineering a recording is as much a performance as the musical performance on whose capture it centers. To successfully preserve the vivacious quality of performed music which is threatened on either side by analog fetishism and overproduction, the engineer must be attuned to the musical moment in the same way that

instrumentalists attune to the conceived moment in realizing it as sound. Such a sentiment harkens back to Brian Eno's depiction of the recording studio as an instrument whose ideal qualities foster an intuitive dynamic between engineer and equipment. While Eno complains that the transparency-chasing, anti-limitation philosophies behind digital tool design have resulted in devices which detract from this relation, the testimony of engineers reveals the performative nature of good production to hold true even with the use of digital tools. In doing so, these accounts confirm that the temporality which some scholars see digital sound as removing from recording is in fact preserved, as production leans upon the musical moment which leans necessarily on music's temporality. Additionally, we see Eno's complaints to be more a matter of design choices than inherent properties of the digital versus the analog.

The treatment of production as performance opposes technologically deterministic attitudes toward music creation, with analog fetishism foremost among them. Analog fetishism ascribes the vivacity found in great recordings to the tools of their recording, leaving engineering as a layer between musician and medium that is necessary but solely detractive in its effect on the music. Recordists, reacting against such views, tend to portray engineering and production in general as value-additive work that is just as essential to realizing the conceived song as the song's musical performance. An additive approach to production is still subject to the dangers of technological paradigms imposing themselves on the performative work of engineering; the sound of overproduced recordings is traced to an overly mechanical, quantitative approach to production. Reactions to analog fetishism, inasmuch as they contend socially with the propagation of a new and more quantizing paradigm, amplify such concerns. In doing so, these

reactions shed light on the way recordists see value originating among musical conception, performance and recording.

Conclusions:
Locating Value in Music Recording, Looking Ahead

Whether in their frustrations toward aesthetic credibility-seekers, their hesitations in adopting certain software tools, or their feelings on the nature of good production, the recordists contributing to the PRW and Tape Op communities reveal a collective response to analog fetishism that credits musical conception and performance over the tools of recording. While many of these recordists embrace the possibilities of a lo-fi aesthetic, they also see authenticity-obsessed artists transferring agency away from their collaborative efforts and into analog devices, fundamentally interfering with the work of the sound engineer to communicate musical value into a recording. Attachments to specific machines and media emerge from the incomplete translation of a genre-ethic into new settings, often placing standards of artistic credibility at odds with the creative role of the engineer and producer. Lo-fi culture, offering the most vivid example of a technology-oriented and popularly drawn upon genre-ethic, becomes in some cases synonymous for fetishistic attitudes; yet in the decoupling of lo-fi's political ethic from such clashes, we can see its expression-centric value system embodied even in professional studio recording and a reconciliation between lo-fi principles and digital practices.

Perspectives on software tools in the recording studio help to specify the ways recordists protect the social value of the musical performance and, despite their own attachments to pre-digital tools, fend off fetishism. Analog nostalgia is experientially rationalized by some engineers, who are careful to distinguish that their awareness of digital processes, rather than the technology itself, can detract from their work in engaging the recording tools. A unique type of

discomfort is evident in discussions of software tools such as Auto-Tune which lack analog precedents—the uncertainty some engineers face over whether such tools threaten musical value is at least partially resolved by establishing an artist's competent live performance as a prerequisite for using corrective software on their recordings. Though the qualities of digital-domain tools which cause them to require such proof of eligibility remain indistinct, the topic of corrective effects opens insights into continuity across the analog-to-digital shift in terms of production practices. A musical-deterministic model of sonic trend-setting emerges in opposition to technological-deterministic views, proposing that canonical recordings cement the status of tools and production practices, not the other way around.

The PRW and Tape Op communities express a good deal of concern over not just production techniques but also the nature of good production and its role in the transmission of musical value into recordings. Digital tools are seen to intensify a pre-existing temptation for producers to approach qualitative aspects of the creative process from an overly quantitative standpoint, mimicking the rational logic and strict quantization which underpins digital technology at large. The treatment of production as value-additive correlates to this pitfall, which leads to an "overproduced" sound—the ineffective producer in this scenario adds whatever techniques and effects she believes to improve a generic recording's sound, resulting in an overwrought style ill-suited to the song. The forum contributors tend to portray great production as instead a reductive, sculpting process that adds a second type of performative value to the original recording by curating the performed sounds which will make it through to the final mix. This process is therefore sonically and artistically reductive but value-additive. The distinction justifies the continued cooperation of both types of performance in the face of new, digitally

enabled modes of sound design; it establishes the work of sound engineering as a layer of performance which mediates the value-originating musical performance, to which it is secondary but also essential.

Musical value is termed differently in the many contexts which receive and transform it: *vivacity*, *authenticity*, and *vision* might crop up variously in discussions of production, noise and fidelity, for example, but all point back toward the same fundamental quality in music whose successful transference is the goal of sound recording. In the way qualities like vivacity and authenticity are conferred upon cassette recorders and hardware compressors, we see both proof of analog fetishism and the frustration it poses to the recordist. Yet the technological determinism enacted by analog fetishists is not merely an opinion as to where credit should be given for the quality of a recording; it is an argument for the predominance of technical innovation in shaping musical creativity at large. The recording communities studied here stake the opposite claim: great performances create great recordings, which cement the cultural status of the technologies (both tool and technique) that went into its making, and in turn they drive the technological attachments of musical trends. Performance, here, is understood to include the work of the engineer and producer; still, the expressively powerful live performance from the musician herself emerges as an unquestionable prerequisite to great recording. This relinquishing of credit on the part of the recording engineers is perhaps the most surprising consequence of the performance-determinism finding, and speaks to the prevailing self-conception of these engineers as conduits for, rather than originators of, musical value.

The tendency toward elevation of performative value shows one way in which, rather than erasing performance from music as some scholars have claimed, digital sound technologies

enable the reemphasis of performance. In a case study on an the students of an audio technology program, Jan Marontate finds evidence of new ways in which "digital technologies and their attendant creative practices have allowed for the reemergence of musical works as practices rather than objects."[66] Marontate's work identifies digital intertextuality as lending new performative possibilities to the field of recorded music; a re-emphasis of performance in response to techno-nostalgia provides another, less readily apparent avenue toward the same end. Additionally, Marontate claims that "digital recording technologies have also expanded options for participation in creative processes. Listeners and creators (e.g., musician, sound technicians) have the potential to become active agents in mediation and dissemination processes."[67] While the politics of lo-fi and cassette culture accomplished a similar, pre-digital participatory expansion, analog fetishism must be overcome as an obstacle to the translation of their politics to digital settings. The collective recordist reactions described here aid this task, furthering the convergence of consumption and production that many scholars identify as a hallmark of digital music creation, and doing so without discarding the practice of performance-based studio recording. By prompting the decoupling of technological attachment from democratic creative ethos, analog fetishism inadvertently paves the way for Attali's predicted stage of musical composition, to which such participatory convergence is key.

The performance-determinism espoused by recordists in reaction to analog fetishism lends support to Attali's lofty theories of music as a self-sustaining force and defends them against accusations of technological determinism. It provides a justification for the maintenance of studio performance amid the new possibility of fine-tuned, atemporal digital arrangements. By pointing toward a system in which musical creativity, helped along by recording, fuels its own

development rather than bending to technological innovation, the model offers a glimpse at how digital-age value systems might preserve performance and recording in the movement toward Attali's era of composition in which "music… emerges as an activity that is an end in itself, that creates its own code at the same time as the work."[68] With regard to the transition into this stage, Taylor writes, "Failing to theorize the technological aspect of these stages means that Attali slips into a deterministic model of technology in his book, as if each of these new sociotechnical systems simply produced new musics rather than being caught up in complex webs of music, technology, society, and history"[69]. The prevailing attitudes toward sound technologies held by the people who engage most directly with them indicate that Attali has not, in fact, erred by leaving out the technological specifics, since the canonization of new sounds is credited to the songs rather than to the tools of recording.

The mechanism of this canonization—the process by which new patterns of sonic coloration emerge, come into favor, and inform attachments to technologies—deserves further and more historical examination. This study, having focused narrowly on two recording communities, is limited in its social, musical and historical breadth along the boundaries that demarcate these communities and their archives. There is a great deal of ethnographic work to be done in more clearly mapping out the changing technological attachments of different genre-ethics and non-traditional recording practices as they contend with the analog-to-digital shift.

The findings of this study expose an on-the-whole optimistic view from recordists as to the future of their craft. While analog fetishism has challenged and frustrated the roles of recording engineers, the overall picture shows performative value not only winning out but rising to the forefront of musical value's discussion. Music's participatory widening since the advent of

digital sound has not been confined to the performance-replacing practices which sound studies scholars have cited most frequently. As recordist communities show in their reactions to analog fetishism, pre-existing models of recording continue to center their value systems around physical performance while incorporating new politics, adapting aesthetic trends, and broadening their possibilities for participation.

Endnotes and References

---

[1] Larry Crane, “Sound City, Dave Grohl, and the Changing Business of Recording Music,” *Tape Log* (blog), *Tape Op*, February 23, 2013, http://www.tapeop.com/blog/2013/03/22/sound-city-dave-grohl-and-changing-business-record/.

[2] Robert E. McGinn, *Science, Technology and Society* (New Jersey: Prentice Hall, 1991), 94.

[3] Crane.

[4] Karl Marx, *Capital, Volume One* in *The Marx-Engels Reader*, trans. Samuel Moore and Edward Aveling, ed. Robert C. Tucker (London: W.W. Norton & Company, 1978), 321.

[5] Paul Théberge, *Any Sound You Can Imagine: Making Music / Consuming Technology* (Middletown, CT: Wesleyan University Press, 1997), 140.

[6] William Leiss, *The Limits to Satisfaction: An Essay on the Problem of Needs and* Commodities (Toronto: University of Toronto Press, 1976), 82.

[7] Michael Azerrad, *Our Band Could Be Your Life: Scenes from the American Rock Underground 1981-1991* (Boston: Little, Brown, 2001).

[8] Brian Eno, “The Revenge of the Intuitive,” *Wired*, January 1999, http://www.wired.com/wired/archive/7.01/eno.html.

[9] Jonathan Sterne, *MP3: The Meaning of a Format* (Durham: Duke University Press, 2012), 184.

[10] Joseph Auner, “Making Old Machines Speak: Images of Technology in Recent Music,” *Echo: A Music-Centered Journal* 2, no. 2 (2000): 2, http://www.echo.ucla.edu/Volume2-Issue2/auner/auner.pdf

[11] Eno.

[12] Auner, 2.

[13] Allan Moore, “Authenticity as authentication,” *Popular Music*, 21, (2002): 213, doi:10.1017/S0261143002002131

[14] Timothy Taylor, *Strange Sounds: Music, Technology & Culture*, (New York: Routledge, 2001), 3.

[15] Taylor, 4.

[16] Aden Evens, *Sound Ideas: Music, Machines, and Experience* (Minneapolis: University of Minnesota Press, 2005), xii.

[17] Bruce Clark, “Information” in *Critical Terms for Media Studies*, ed. W.J.T. Mitchell and Mark Hansen (Chicago: University of Chicago Press, 2010).

[18] Sterne, 108

[19] Jay Kadis, *The Science of Sound Recording*, (Boston: Focal Press, 2012), 129.

[20] Thomas G. Porcello, “Tails Out: Social Phenomenology and the Ethnographic Representation of Technology in Music Making,” in *Music and Technoculture* (Middletown, CT: Wesleyan University Press, 2003), 264-265.

[21] Jacques Attali, *Noise: The Political Economy of Music*, trans. Brian Massumi (Minneapolis: University of Minnesota Press, 1985), 4.

[22] Sterne, 124.

[23] Porcello, "Tails Out," 265.

[24] Sterne, 124.

[25] John Mowitt, "The Sound of Music in the Era of its Electronic Reproducibility," in *Music and Society: The Politics of Composition, Performance and Reception*, ed. Richard Leppert and Susan McClary (Cambridge: Cambridge University Press, 1987), 194.

[26] "Noise Pop Festival," accessed March 21, 2013, http://www.noisepop.com/about/

[27] Sterne, 125.

[28] Greg Hainge, "Of Glitch and Men: The Place of the Human in the Successful Integration of Failure and Noise in the Digital Realm," *Communication Theory* 17, no. 1 (2007): 28, doi:10.1111/j.1468-2885.2007.00286.x

[29] Thomas Porcello, "Music Mediated as Live in Austin: Sound, Technology and Recording Practice," in *Wired for Sound: Engineering and Technologies in Sonic Cultures*, ed. Paul D. Greene and Thomas Porcello (Middletown, CT: Wesleyan University Press, 2005), 104-105.

[30] Porcello, "Music Mediated as Live in Austin," 114.

[31] Marc Perlman, "Golden Ears and Meter Readers: The Contest for Epistemic Authority in Audiophilia," *Social Studies of Science* 34, no. 5 (2004), doi:10.1177/0306312704047613, 789.

[32] Warwick Mules, "Aura As Productive Loss," *Transformations* 1, no. 15 (2007): http://www.transformationsjournal.org/journal/issue_15/article_05.shtml#10.

[33] Walter Benjamin, "The Work of Art in the Age of Mechanical Reproduction," in *Illuminations: Essays and Reflections*, ed. Hannah Arendt (New York: Schocken Books, 2007), 217-252.

[34] Marc Woodworth, "Bee Thousand," in *33⅓ Greatest Hits, Volume 2*," ed. David Barker (New York: Continuum, 2007), 301-302.

[35] Evens, 8.

[36] Paul Théberge, "'Plugged In': Technology and Popular Music," in *The Cambridge Companion to Pop and Rock*, ed. Simon Frith, Will Straw and John Street (Cambridge: Cambridge University Press, 2001), 4.

[37] Albin Zak, *The Poetics of Rock: Cutting Tracks, Making Records* (Berkely: University of California Press, 2001), 165.

[38] Taylor, 16.

[39] Mowitt, 193.

[40] Patrick Flanary, "Neil Young Expands Pono Digital-to-Analog Music Service," *Rolling Stone*, September 27, 2012, http://www.rollingstone.com/music/news/neil-young-expands-pono-digital-to-analog-music-service-20120927.

[41] Perlman, 793-794.

[42] Chris Foresman, “Mastered for iTunes: How Audio Engineers Tweak Music for the iPod Age,” *Ars Technica*, February 22, 2012, http://arstechnica.com/apple/2012/02/mastered-for-itunes-how-audio-engineers-tweak-tunes-for-the-ipod-age/.

[43] Mowitt, 175.

[44] John Oswald, “Cassetricity,” in *Cassette Mythos*, ed. Robin James (New York: Autonomedia, 1992), 2.

[45] Théberge, *Any Sound You Can Imagine*, 232.

[46] Amy Spencer, *DIY: The Rise of Lo-Fi Culture* (London: Marion Boyars, 2005), 261.

[47] Spencer, 275.

[48] Théberge, *Any Sound You Can Imagine*, 213.

[49] Susan Schmidt Horning, “Engineering the Performance: Recording Engineers, Tacit Knowledge and the Art of Controlling Sound,” *Social Studies of Science* 34, no. 5 (2004), doi:10.1177/0306312704047536, 704.

[50] Carolyn Marvin, *When Old Technologies Were New: Thinking About Communications in the Late Nineteenth Century* (Oxford: Oxford University Press, 1988), 11.

[51] Marvin, 17.

[52] Jay Kadis, email message to author, February 6, 2013.

[53] Jonathan Sterne, “Tape Op Magazine,” *Bad Subjects*, May 4, 2000, http://bad.eserver.org/reviews/2000/2000-5-4-1.07PM.html.

[54] “Hey Brad Wood -- Care to Talk About Liz Phair Recording?,” *Professional Recording Workshop*, January 29, 2011, http://prorecordingworkshop.lefora.com/2011/01/29/hey-brad-wood-care-to-talk-about-liz-phair-recordi/.

[55] “Lo Fi > Hi Fi,” *Professional Recording Workshop*, June 1, 2012, http://prorecordingworkshop.lefora.com/2012/06/01/lo-fi-hi-fi/.

[56] A plugin, in audio engineering terminology, is typically a small piece of software which can be used within a digital audio workstation’s environment to render a particular effect.

[57] “iZotope Vinyl,” iZotope, Inc., accessed January 2013, http://www.izotope.com/products/audio/vinyl/.

[58] “Analog Tape Madness,” *Professional Recording Workshop*, December 16, 2011, http://prorecordingworkshop.lefora.com/2011/12/16/analog-tape-madness/.

[59] “Just Curious…,” *Tape Op Message Board*, February 12, 2005, http://messageboard.tapeop.com/viewtopic.php?t=27657.

[60] “Are ‘Vintage’ Type Compressors Relevant in Today’s Music?,” *Tape Op Message Board*, June 20, 2010, http://messageboard.tapeop.com/viewtopic.php?p=655739.

[61] Jay Kadis, “Dynamic Range Processing and Digital Effects” (lecture notes, Stanford University, Stanford, CA, 2008), https://ccrma.stanford.edu/courses/192b/192b_Lecture_1_06.pdf, 1.

[62] Sasha Frere-Jones, “The Gerbil’s Revenge,” *The New Yorker*, June 9, 2008, http://www.newyorker.com/arts/critics/musical/2008/06/09/080609crmu_music_frerejones.

[63] "Auto-Tune… I've Changed My Mind…," *Tape Op Message Board*, May 8, 2008, http://messageboard.tapeop.com/viewtopic.php?t=55079.

[64] "What Is 'Overproducing'?," *Professional Recording Workshop*, August 19, 2012, http://prorecordingworkshop.lefora.com/2012/08/19/what-is-overproducing/.

[65] This model, which in some cases is enacted by musicians, points to the completion of recorded sound's supplanting of performance as the end outlet for musical expression—which in turn suggests that the next truly disruptive event in music's technological history will be the ability to directly record imagined sounds, erasing production entirely.

[66] Jan Marontate, "Digital Recording and the Reconfiguration of Music as Performance," *American Behavioral Scientist* 48, No. 11, July 2005, doi:10.1177/0002764205277647, 1422.

[67] Marontate, 1434.

[68] Attali, 135.

[69] Taylor, 5.