Doing Sound: An Ethnography of Fidelity, Temporality and Labor Among Live Sound Engineers

Whitney Slaten

Submitted in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy
in the Graduate School of Arts and Sciences

COLUMBIA UNIVERSITY

2018

ABSTRACT

Doing Sound: An Ethnography of Fidelity, Temporality and Labor Among Live Sound Engineers

Whitney Slaten

This dissertation ethnographically represents the work of three live sound engineers and the profession of live sound reinforcement engineering in the New York City metropolitan area. In addition to amplifying music to intelligible sound levels, these engineers also amplify music in ways that engage the sonic norms associated with the pertinent musical genres of jazz, rock and music theater. These sonic norms often overdetermine audience members' expectations for sound quality at concerts. In particular, these engineers also work to sonically and visually mask themselves and their equipment. Engineers use the term “transparency” to describe this mode of labor and the relative success of sound reproduction technologies. As a concept within the realm of sound reproduction technologies, transparency describes methods of reproducing sounds without coloring or obscuring the original quality. Transparency closely relates to “fidelity,” a concept that became prominent throughout the late nineteenth, twentieth, and twenty-first centuries to describe the success of sound reproduction equipment in making the quality of reproduced sound faithful to its original. The ethnography opens by framing the creative labor of live sound engineering through a process of “fidelity.” I argue that fidelity dynamically oscillates as struggle and satisfaction in live sound engineers’ theory of labor and resonates with their phenomenological encounters with sounds and social positions as laborers at concerts. In the first chapter, I describe my own live sound engineering at Jazzmobile in Harlem. The following chapter analyzes the freelance engineering of Randy Taber, who engineers rock and music

theater concerts throughout New York City. The third chapter investigates Justin Rathbun's engineering at Broadway's Richard Rodgers theater production of "Porgy and Bess." Much of engineering scholarship privileges the recording studio as the primary site of technological mediation in the production of music. However, this dissertation ethnographically asserts that similar politics and facilities of technological mediation shape live performances of music. In addition, I argue that the shifting temporal conditions of live music production reveal the dynamism of the sound engineers' personhood on the shop floors of the live music stage.

Table of Contents

Acknowledgments

The intellectual and artistic support of the past and present members of The Columbia University Center for Ethnomusicology, The Columbia University Department of Music, The Columbia University Center for Jazz Studies, and the Columbia University Graduate School of Arts and Sciences brought this research from an idea to a dissertation. I am ever thankful to each of you. The live sound engineers who were interlocutors for this project were generous with no bounds and I am indebted to them. My dissertation committee members John Szwed, George Lewis, Walter Frisch, Christopher Washburne, and Aaron Fox gave feedback of praise and critique that I will be thinking about for a long time to come. I have special gratitude to Aaron Fox, my advisor, who saw the significance of a live sound engineering studies project and encouraged me from the beginning. The fellow graduate students who were with me on the journey, as well as my students at Columbia, William Paterson University, Seton Hall University, and The New School gave me collegiality and inspiration. The steadfast love of my family and friends sustained me, and, above all, the loving support of my wife, Marti. From the bottom of my heart, thanks to you all.

Dedicated to Marti and Wesley…

Preface

My earliest memories of live sound engineering begin where I grew up, on Grant Avenue in Scotch Plains, New Jersey in the 1980s. My parents and I lived in a Cape Cod-style house with a yard that seemed like an enormous space to me. In the summer months, I played outside in that yard while my mother gardened, tending to a variety of herbs, vegetables, and Jersey tomatoes while at the same time yearning for the ability to grow the fruits and vegetables of her native Jamaica.

After a sojourn in Toronto, my mother had married my father and moved to Scotch Plains. As a newcomer to the racial politics of the United States, this wife and mother, who identifies as an Asian-Euro-Afro-Jamaican, kept largely to herself and her family; she remained in close contact with her sister (who had also married a local man and lived in a nearby New Jersey town), her mother in Toronto, and other family members in Florida and Jamaica. Her sense of both belonging to and longing for Jamaican culture was strengthened when she became a culinary historian of Caribbean cuisine; she eventually wrote a cookbook, appeared on television, and lectured at universities, including The New School, on the food cultures of this region.[1]

My father, an African-American man somewhat older than my mother, was born and raised in the Vailsburg neighborhood of Newark, where his parents were active in the family church; our family's affiliation with Bethany Baptist Church dates back to its founding in 1871, when newly emancipated black families began moving from places like Richmond and

[1]Sybil Slaten has made numerous appearances on television and radio shows including UPN 9 with Matt Lauer, WABC-TV, the Lifetime Channel, WOR RADIO's "Food Talk" with Arthur Schwarts and "Dining Around" with Gene Burns. Sybil is the creator and host of "Caribbean Kitchen," a series of cooking videos and has written a cookbook of Caribbean recipes.

Culpepper, Virginia to Newark in a precursor to the Great Migration. My grandparents were formally-trained classical musicians: after studying keyboard performance at the Department of Music at Columbia University in 1928, my grandfather and my grandmother, a classical soprano, performed concerts of spirituals throughout the area. My father, though not a performer, continued on his parents' musical path, studying electronic circuitry at RCA and working in recording studios in Manhattan before eventually opening his own studio in the late 1970s. In addition to recording countless advertising jingles, he regularly engineered recordings for artists such as Judy Collins and Fleetwood Mac. At the time that he and my mother married in 1980, my father was beginning to see a decline in the independent recording studio business, and he decided to shift his focus to sound system installation and live sound engineering. To this end, in 1971 he formed Audio International Inc., a company which rents and installs live sound reinforcement equipment.[2]

In the 1980s, both my parents worked for Audio International, and so did I. My mother managed the home office, while my father designed sound reinforcement systems, wrote quotations, installed equipment, and operated sound systems that he rented at different shows throughout the area. From the age of six years old, I accompanied him at these shows and helped my father run cables, erect microphone stands, and test microphones. In those early years, our client list was diverse, including local gospel-based church concerts and tent revivals; Indian

---

[2] As a studio recording engineer, Warren Slaten's credits include Bing Crosby, Fleetwood Mac, Tito Puente, and Judy Collins, among others. He worked at Robert Swanson Productions, an advertising and "Jingle" studio. After five years, he was offered a fifty per cent partnership and expanded the studios, *Tempo Sound*, including a second studio and a record mastering facility. Later, Slaten joined *Mastertone Studios* where he was chief studio engineer working on a wide variety of projects for the record industry and further advancing his knowledge of record mastering. When the owners retired, he purchased the studio business and maintained it for several years. During the operation of *Mastertone,* he was approached to design and build recording studios for some of his customers and others that spawned Audio International. His specialty was mixing consoles that he designed and built and then shipped to the final destination. Today the company accepts the challenge of bringing affordable presentation technology to houses of worship.

classical concerts; jazz society festivals; symphony concerts; West African drumming performances by Babatunde Olatunji; concert performances of spirituals by groups like the North Jersey Philharmonic Glee Club; and musical theater fundraising concerts for a number of Hasidic Jewish girls' high schools in Brooklyn.

Engineering Shows with Audio International

The Hasidic fundraising shows took place during the winter. On a typical Saturday afternoon, my mother would prepare sandwiches and a thermos of hot tea for my father, all the while speaking to my auntie on the white kitchen wall phone in heavy Jamaican patois. I would bring the food to the Chevrolet Astro cargo van, into which my father and his assistant would be frantically loading gear from the garage. After loading, Dad would take the driver's seat, his assistant would sit in the passenger's seat, and I would sit on a microphone case in the back.

We would begin the drive from Scotch Plains to Brooklyn, passing through Clark, Linden, and Elizabeth, New Jersey, onto the Goethals Bridge to Staten Island, and from there to Brooklyn by the Verrazano Bridge. The back of the van smelled like audio equipment: a hard-to-describe smell of oxidizing steel, chipping chrome, and the carpet-like material that covered my father's large Gollehon loudspeaker cabinets. WBGO, the local jazz radio station, was amplified through the van's modest speakers, and those sounds commingled with the bumps in the road and the clatter of the contents of the van. The street scenes changed during the drive from Scotch Plains to Brooklyn: the tree-line thinned and the houses became smaller, until sights of the open air and the Hudson and Atlantic waterways were replaced by a cityscape with dim-looking streets and buildings. Finally, we would arrive at Franklin Delano Roosevelt High School in Borough

Park, Brooklyn—a neighborhood covered heavily with graffiti and patrolled by the Guardian Angels, the vigilante citizens' crime-fighting group.

We were at the school to provide audio support at musical performances that were fundraisers for private Hasidic girls' schools. These private parochial schools, such as Bais Yaakov Machon Academy, Beth Jacob of Boro Park, Bais Yaakov High School, Prospect Park Yeshiva, and Yeshiva of Brooklyn, rented the public school auditorium in order to accommodate the large audiences—often more than 1,000 people, all of them female—that would turn out over several weekends from January through March. The plays performed were based on stories about the Jewish people and their history of oppression, with a moral message of maintaining adherence to orthodoxy.

Following centuries of tradition, the Rabbonim, a council of rabbis that govern specific sects of the Hasidic community, forbade Jewish men and women from mixing in public spaces. In line with this decree, men were not permitted in the auditorium during the rehearsals or the shows. However, the physical co-presence of someone to conduct live sound amplification was necessary. By permission of the Rabbonim, therefore, my father, his assistant, and I—as non-Jewish, African-American men—were the only males in an auditorium of more than a thousand women. Although many of the men on the custodial staff at the school were not Jewish, they were white, and seemingly for that reason, they were consistently asked to leave the auditorium. During some performance seasons, my father brought along a white assistant from Ohio, and his presence would similarly provoke a request to leave the space. (Strangely, when we used another employee, a black man from Jamaica, our presence was tolerated.) I asked my father whether it was our technological skill or our blackness (which made us recognizably non-Jewish) that

appeared to make Audio International the company of choice for the majority of this production work in Brooklyn. He would never say.

Labor Conditions

While our skill, our blackness, and/or our obvious non-Jewishness permitted us to work at these shows in the presence of Orthodox Jewish women and girls, we were expected to place the audio mixing console, which would normally be positioned in the front of house, in the back —directly at the foot of the stage, near the lip of the orchestra pit—where the Hasidic school's teachers, principal, and rebbetzin (rabbi's wife) sat. This position—too close to the direct sounds of the performers on stage, and too far from the amplified reproductions of those sounds through the main loudspeaker system that—made it difficult for my father to mix.

My father always acceded to this arrangement, and would consistently set up in this location before anyone arrived. In addition, he would extend his adherence to his employer's expectation that we not offend propriety by frequently telling me, a then six-year-old, not to look at the performers on stage, especially when they were dancing or performing a pantomime. Instead, I would curl up inside a speaker cable bin beneath the mixing console near my dad's feet and play with a few toys that I brought, listen to my Walkman, or fall asleep while the show went on and the dust from the old public school stage cascaded down over my head. As a youngster, I was responsible for erecting microphone stands, placing microphones, and running microphone cables from the stage directly to the nearby mixing console inputs. At the end of the show, I would put these things away.

As a young child I had mixed feelings about doing sound. I grew to hate doing it. Though I liked the idea of going to work with my father, after the age of about twelve I felt that the shows subjected us to oppression. Certain clients treated us better than others; Toby Einhorn and Havi Klein, drama teachers at Machon Bais Yaccov of Borough Park, stand out in my memory. In fact, Einhorn and Klein produced the best dramas among all of our clients, with set designs that rivaled Broadway productions. Their acting pedagogy was serious, and they were very thoughtful about crafting background music soundtrack recordings with my father, often months before the performances. They were among the few clients who took my father's expertise seriously, to the extent that they would ask his opinion about other elements of the production besides sound.

As a teenager, I became proficient with videography and multi-camera event recording, and Toby Einhorn began involving my work in her productions. While working with Einhorn, my knowledge of media representations of characters and the affect associated with close-ups and framings grew exponentially. I never knew what became of those video productions, as the Rabbonim forbade women in the community from watching television, but it was a great opportunity for me, and I remain very thankful to her for that, as well as for making my family's experience in that context acceptable in ways that would preserve our dignity.

On the other hand, there were clients I never cared for, especially within the tense immediacy of live production. Some of them would get in my father's face, yelling and making demands, as he, ever gracious, affirmed them in the most non-violent way. In spite of the stress of these hectic shows, they taught me lifetime's worth of skills in live sound amplification and

beyond. However, while I always admired my father, I never wanted my adulthood to involve laboring in such conditions, which were so different from those of Toby Einhorn's shows.

My Love and Hate for Live Sound Work

With the exception of Toby Einhorn's shows and the elementary school shows of Sara Rothman, a music teacher, the memory of the Hasidic girls' shows have continued to traumatize me. To this day, on every job that I've worked as a live sound engineer, I've been assailed by conflicting emotions brought up by my memories of being yelled at, the need to hide, and the physical pain of manual labor and long hours. These feelings have reemerged every time I have done live sound since. I relive those daydreams and nightmares before every show, and I work through those memories, and the procrastination they encourage, before every show.

My relationship to live sound engineering remains complicated. It was a wonderful way to make music and make musicians heard. I have learned social practices and the production of culture in my live sound work, while commemorating my positive childhood experiences with Audio International. However, my work in live sound engineering – the primary focus of this dissertation -- continues to trigger my traumatic memories of the industrial ideology of hidden sound reproduction labor that I learned during my formative years. I continue to feel the need to hide. I also continue to experience the stress of being responsible for a show's success: if I fail at live sound engineering, the audience would only hear whispers, faint plucks or strums, distant hollow drum resonances, and sticks hitting cymbals.

And were that to happen, I would rupture the modern ideal of technological transparency, and the audience, musicians, and organizers would blame me for ruining the show. Arriving at

venues continues to pose a challenge in being able to set up the equipment on time, all the while hoping that all of it will function properly. In many instances where I have been hired to do live sound production, the instrumentation of the performing ensemble, which determines my set-up configuration, is information difficult to acquire in advance. I am also faced with the challenge of constantly assuring musicians – who are often mistrustful of engineers -- that I will faithfully amplify their sounds, in the face of their mistrust forged by an accumulation of negative experiences with live sound engineers. Finally, though I always hope to get paid on time, this does not always happen. This mix of emotions, including my traumatic memories over the course of more than thirty years of live sound engineering, inform a significant stress that I struggle to manage, hours and minutes before I reluctantly leave my house to do sound again.

Introduction

Theorizing Live Sound Engineering

As a professional live sound engineer, I have come of age during an epochal shift in the technology and practice of live sound engineering, itself part of a larger shift in musical and technological practice, and as in other domains of contemporary musical practice, associated with emergent modes of intellectual, emotional, and embodied labor. My central project in this dissertation draws on that experience to produce an ethnographic description of contemporary professional engineering practice under conditions of transition from older modes of live sound engineering into new modes.

My focus is on the labor process of professional live sound engineers, and on their experience as workers and artists as they encounter, resist, and help shape an accelerating contemporary transformation of that process, both for themselves and for the musicians and listeners whose experience they mediate. Live sound engineers—often called "soundmen" in common professional musical discourse, with the gendered implication being significant, and male engineers dominating the profession—have a longstanding and uniquely important place in the mediation of musical culture generally, which has however rarely been studied in critical terms. Live sound engineers "enact amplification" as their contribution to the labor of producing live music, in ways that assert musical choices, aesthetics and creativity and that are directly implicated in the intelligibility and experience of music for artists and audiences. In addition to amplifying music to intelligible sound levels for audiences, live sound engineers also amplify music in ways that assert their often-hidden sonic artistry, all the while working to sonically and visually mask themselves and their equipment from the consciousness of artists and audiences.

My goal in this dissertation is to render audible, visible, and intelligible the work of live sound engineers, as they engage in a form of labor that happens every night, in live music venues all over the world, from outdoor block parties to massive arena concerts to cramped dive bars to Carnegie Hall. Live sound engineering, I argue, is fundamental to modern musical experience and is equally fundamental to the ways musicians, producers, and marketers of music conceive of music—popular, classical, or folk alike—as a commercial and professional artistic field of practice. Remarkably, however, this constitutive dimension of modern musical experience, which yields immediately, obviously, and richly to the critical theorization of "mediation" advanced by ethnomusicologists, popular music scholars, and historians and anthropologists of sound over the past twenty years, has yet to receive an extended ethnographic treatment in those literatures. It is an important goal of the present work to ask how that lacuna could be the case, as well as to provide an ethnographic demonstration of the importance of live sound engineering to any modern ethnomusicological understanding of "music" as a social phenomenon.

I will argue in this work that, just as live sound engineers assert their professionalism through "hiding in plain sight," their cultivated "hiddenness"—their absent presence—has also kept them from receiving the robust scholarly attention their importance clearly merits. Many—perhaps most—of the participants in live music making, across genres and cultures (and with some significant exceptions)—prioritize being audible and seen, to the point that music scholars often take for granted the "performative" and extroverted aspects of their subject as constituting its essence. In sharp contrast, the performance of "not being there"—a presence defined by what engineers often call, using a crucial metaphor for this work, "transparency"—is often crucial to the success of live sound engineering labor, and achieving this state of transparency is a hallmark

of an engineer's skill and professionalism, as well as of the quality of their equipment (a relationship between labor and technology I explore extensively in this dissertation as well). I will observe this assertion of hidden professional behavior and discuss its significance in the following chapters. However, before introducing my interlocutors and their work, I will begin in what follows to detail the theoretical frameworks and concrete histories of practice and technology that shape the more ethnographic representation of engineering in subsequent chapters.

It is impossible to separate live sound engineering as a contemporary ethnographic topic from the broader context of a major technological and economic shifts in modern musical culture. In the final decades of the 20th century, sound engineering, along with many other aspects of the music industry, went through a fundamental transformation of its tools, discourses and forms of labor. These changes in sound engineering can be seen as a musical instance of a broader transformation of labor and production that Michael Piore and Charles Sabel have described as a "second industrial divide," an industrial restructuring as a result of market fragmentation and flexible new models of production (Piore and Sabel 1984; Attali 1985; Novak 2013). Piore and Sabel describe the changes to industrial labor in late capitalism, wherein artisanal craft labor, once deprecated under Fordist mass production, re-emerges as newly salient amidst the decreasing role of mass production and industrial structure in American labor markets.

Musicologist David Hesmondhalgh, drawing on the work of David Harvey on "postmodern" political economy, has connected this moment of "post-Fordism" or "flexibility" in relation to culture industries, with the commercial recording industry in particular. Hesmondalgh writes that, "…a particular strategy of industrial restructuring, one that involves a

shift in production back to the forms of skilled, artisanal crafting which were supposedly displaced by the methods of mass production usually associated with Henry Ford…is geared to specialized market niches"(1996: 470). The career contour I have described for my father, who began sound engineering in the mid-twentieth century, as well as the development of my own engineering practice, not only would seem to track closely the industrial shifts that Hesmondhalgh describes, but also to pivot around a related set of technological changes from analog to digital approaches in the field of sound engineering, with which the transformation of musical production as a form of labor have been closely bound up over the past 20 years especially.

Live Sound Engineering as Cultural Mediation

While the labor of live sound engineers has yet to be studied extensively in the musicological literature, I argue that their work is crucial to a general theoretical account of modern musical culture and mediation, and in turn yields to analysis within the theoretical frameworks ethnomusicologists and anthropologists have recently used to study other aspects of commercial and professional music making, especially in the recording studio. My work on live sound engineers builds on the large literature on sound technology, studio engineering, and industrial music production (Theberge 1997; Sterne 2003; Porcello 2005; Stahl 2012), while it also asserts the importance of engineers' creative labor in modern musical culture. In all of these cases, sound engineers as individuals, as well as the people they work with and impact, are part of what sociologist Howard Becker calls "art worlds." Becker defines the concept as follows:

> Art worlds consist of all people whose activities are necessary to the production of the characteristic works which that world, and perhaps others as well, define as art. Members of art worlds coordinate the activities by which work is produced by referring to a body of conventional understandings embodied in common practice and in frequently used artifacts. The same people often cooperate repeatedly, even routinely, in similar ways to produce similar works, so that we can think of an art world as an established network of cooperative links among participants. If the same people do not actually act together in every instance, their replacements are also familiar with and proficient in the use of those conventions, so that cooperation can proceed without difficulty. Conventions make collective activity simpler and less costly in time, energy and other resources; but they do not make unconventional work impossible, only more costly and difficult. Change can and does occur whenever someone devises a way to gather the greater resources required or reconceptualizes the work so it does not require what is not available (Becker 1982: 34-35).

This project contributes to scholarly engagement with an under-studied but crucial domain of the art world of popular and professional commercial music production. I draw upon the key concepts that anthropologists Louise Meintjes (2003) and Thomas Porcello (2005), in particular, have developed in their studies of the relationships between "liveness" and "recording" in studio engineering, while my work shows that the constructed "liveness" they describe as essential to studio practice is no less constructed in "actual" live performance settings reliant on engineers as mediators.

The relationship I explore here between studio and live sound engineering was noted by Boden Sandstrom in one of the earliest ethnomusicological writings on sound engineering. She explains (using the term "mix engineer" for what I am calling a "sound engineer") that:

> When a mix engineer manipulates sound, whether live or in a recording, the implication is that he or she is assuming a certain degree of creative control. Issues of power and control are inherent in access to this technology in any situation….What is a mix engineer? A mix engineer is one who controls the sound mix during the recording process or a live performance. The mix engineer may either try to reproduce the sound heard with as little alteration as possible or to enhance or change het sound as much as might be desired within the limitations of

> the existing equipment. During recording the processes is usually one of capturing sound onto some medium such as tape and then altering it later; in a live performance situation, the manipulation of sound takes place in real time and is usually referred to as 'sound reinforcement.' To have one's hands on the knobs or faders of a mixing board is to exercise considerable control. The sound engineer also controls the volume in the performance area and the way the sound covers the volume in the performance area and the way the sound covers that area in addition to controlling the actual mix. The sound reinforcement engineer has a one-shot chance to create the mix, whereas the recording engineer's mix can be repeated over and over again until everyone involved is satisfied. Usually the musicians involved and their producers have a great deal to say about the final mix during a recording session, but it is the engineer who controls the sound (Sandstrom 2000: 290).

Sandstrom treats live and studio engineering as interrelated practices in her discussion of the work of "mix engineers," the sound engineers who operate mixing consoles at concerts and in recording studios. Sandstrom also discusses the gender imbalances within the sound engineering profession, calling attention to how women mixers encounter external power dynamics with musicians and producers, in addition to the professionally internal strife that these mixers encounter with their male counterparts. Her study shows the social conditions in which women mixers operate, and suggests the different ways women manage social and technological control as mix engineers. This work introduces live sound engineering into scholarly discourse and contributes to understandings of the relationship between gender and technology. In this project, I build on Sandstrom's work on the social conditions of live sound engineers, examining both interpersonal and technological power dynamics, although I do not emphasize the clearly gendered aspects of the practice of engineering.

Similarly, in her study of professional "world music" studio engineers in 1990s South Africa, Meintjes observes that, historically, "the technological constraints of earlier studio production necessitated recording procedures more similar to live performance procedures.

Performers recorded together, at the same time, usually in the same recording booth. Singers crossed around one microphone. Guitarists and bass guitarists were miked at their amps, whereas today they usually plug directly into the console and bypass the amp"(Metinjes 2003: 124). She shows that "liveness" was a property attributed to the then-emergent genre of "world" music and achieved through purposeful manipulations of sound and technology in the recording studio. Meintjes' observation exemplifies Sandstrom's point that live and recorded engineering practices are mutually constructive domains, as indeed they are individually for the many engineers, such as my father, who work across both domains.

Similarly, Porcello also observed the importance of constructing "liveness" in the approach of the professional popular music recording studio engineers whom he studied in the 1990s in Texas. "If engineers cannot simply hang a stereo mic and achieve acceptable sound quality," he wrote, "and if multitracking and overdubbing sap the processual and textural participatory discrepancies from performances, then how can one record the Austin sound—its liveness and sincerity audibly intact —without sacrificing the sonic aesthetics expected of a contemporary sound recording?"(Porcello 2010: 107). Porcello's question not only points to an aesthetic of liveness in construing an "Austin sound" (a particular regional ethos characterized by a robust live performance scene in the city, which bills itself proudly as "the live music capital of the world") in recordings, but also calls attention to the ideological work accomplished by live sound engineering techniques, in relation to things as seemingly extra-musical as the marketing slogan of a major city's tourism industry. Meintjes, does this as well, in fact, she argues for how Zulu musicians and white engineers have divergent understandings of liveness as authenticity.

My arguments also engage with a broad and expanding literature on popular music performance and recording in relation to cultural and social modernity and musical aesthetics, that has called attention to the social construction and naturalization of properties of sound dependent on mediation. For example, in his study of country music in the culture of working-class rural Texans, Aaron Fox showed how cultural mediation "…is the discursive production of conceptual and intuitive links between domains of social experience. Mediation connects the practical and concrete domains of everyday life…with more abstract domains of memory, historical consciousness, senses of emplacement and displacement, ideologies of class, race, and gender, models of self- and personhood, poetics, theories of emotion, and structures of feeling"(Fox 2004: 34). Similarly to the ways Fox claims country music mediates the cultural, aesthetic, and technical domains of working class Texas culture, the labor of live sound engineers mediates between concrete, technological practices and deeply felt and economically structured "art worlds" across diverse musical-cultural contexts in which amplified sound is present. The technology on hand, how engineers use it, and the dynamic relationships between engineers, musicians, audiences, and producers both reflect and shape ideologies, aesthetics and concepts of musical agency.

Fox presents his Texan interlocutors as not merely "consumers" of country music in a rural Texas bar, but as themselves agents of its production as working-class art; similarly I assert that live sound engineers are not transparent or neutral "transducers" (a term I will develop shortly) of "live music" production, but rather are dynamic listeners, creators and consumers of "the music" they mediate. The work of sound engineering, like the creative work of music listeners and fans (of both live and recorded music) described by Fox, involves complex,

shifting, and recursive experiences of making sounds, modifying sounds, listening to sounds, and locating and orienting their own most seemingly "technical" practices and concepts in relation to those sounds via what Steven Feld has called "interpretive moves" that locate those practices within an interpretive social context (1984). They are agentive in mediating live music, which means that vast amounts of modern musical experience passes through the minds as well as the hands and ears of sound engineers, and this makes their labor worthy of ethnographic inquiry and phenomenological interpretation, as well as technical description. Ironically, the importance of live sound engineering is underscored by the extent to which it *has* been (and remains) neglected, not only by scholars but by music critics an fans, and by the extent to which we assume amplification as a transparent, and audibly natural, precondition of live music rather than a vital domain of its cultural mediation.

Mediation—including the work of engineers or the designers of audio equipment—is not, in other words, an externality to "music." It is fundamental to music as communicative practice —the extent to which music plays some role in managing the relationship between feeling and thought and between social actors drawn together by musical experience (Fox 2004: 188). Music, including live sound engineering, is both technical and practical, a feelingful mode of apprehending the world and interacting with people that has a structural relationship to diverse technical competencies and cultural orientations, from those of musicians to those of listeners, and in the modern context, with the competencies of engineers intervening persistently between performers and audiences.

The mediating work of live sound engineering is further complicated by the division of labor in industrial society that divergently values creative, technical and physical labor,

producing "classes" of workers who enjoy unequal control over and reward from their contributions to complex social processes of production. That division of labor produces the category of "engineer" as a distinct professional type of worker—a skilled craftsman, neither purely an "artist" nor strictly a "laborer"—who is omnipresent and yet often invisible in modern live music production. And, in an idiom of mastery that lies at the heart of this dissertation's analysis, that's how many live sound engineers seem to like it.

I examine here how engineers pursue the invisibility that sustains the illusion that live music is ontologically authentic and unmediated, despite the hours of technically specialized engineering labor required to make it audible to musicians and audiences alike. In so doing, I treat music technology—the material apparatus of sound engineering—as a dynamic social phenomenon, akin to the way ethnomusicologists now treat musical instruments and other material technologies of cultural production. This will entail a great deal of technical discussion of audio "gear," which I will introduce below with some basic historical and engineering context. But it is important to my argument that "audio gear" be understood as a site of practice and conceptualization, itself an embodiment of diverse histories of agency, and not as an inert externality.

In a study of live rock and country performance on the San Carlos Apache reservation, anthropologist David Samuels described "the material constraints that enter into the imagination and production of cultural aesthetics," as these bear on his description of The Pacers, a "technologically impoverished" country-rock band on San Carlos Apache Reservation, as they participated in an intertribal battle of the bands in the 1990s (Samuels 2004: 203). He describes how being a "real, professional" band, as opposed to a local, amateur one, necessitated a

substantial array of live sound equipment and a live sound engineer to use it. “If contemporary musical practices necessitate an investment of capital in various technologies of mediation,” Samuels writes, “—amplifiers and microphones, PA systems and cords, electricity and junction boxes, lights, signal-processing devices and batteries—it’s worth asking what effect the Pacers’ inability to procure that mediating technology had on both the band’s material sound and its imagination”(ibid). Samuels argues that “the live sound of a band is a highly mediated presence. Control over the constraints of that mediation allows a band to project its sound in ways that are compelling, involving, and participatory for audiences. A sound system can give a band a bass drum that audience members feel in the pit of the stomach, a hi-hat as crisp and sizzling as if people weren’t out on the dance floor, but dancing between the two cymbal plates”(Samuels 2004: 202).

In live music, mediation is not only a “technology of memory,” (Samuels 2004: 139), or a material process where technological “manipulation of one kind of matter with another” mirrors the mediation of social difference (Meintjes 2003: 256, 142), but it is also embodied in the work of the live sound engineer and in the properties of a live sound “system,” which itself embodies a history of such systems and the labor that produces them. In this project about soundmen (and it is about male live sound engineers) I also theorize “liveness” as such in studying the invisibility and omnipresence of live sound engineers at music events, the ubiquity and yet “transparency” of both their tools (systems) and their forms of labor. Ultimately, emphasizing the contribution of this seemingly “extramusical” labor and technology to the meaning of music in any given social and cultural context, leads to questions about what we mean when we call something

"music" in the first place—and whose labor and contributions we value or devalue in critical framings of "music making" and "engineering" as distinct practices and domains.

Live Sound Engineering and Ontologies of Music

In making "opaque" the ideally "transparent" labor of live sound engineers, and locating the embodied achievement by engineers of "transparency" and "invisibility," in this dissertation I build especially on phenomenological and historical scholarship on music as a site of cultural and technological mediation, and the implications of that work for a critical "ontology" of music —the question of whether "music" should be conceived of as a singular coherent phenomenon or, as ethnomusicologists have suggested since the dawn of the discipline, whether western scholarly or artistic confidence in the category's conceptual boundaries may be ethnocentric or historically overdetermined (Feld 1982; Urban 1991; Porcello 1998; Bohmnan 1999; Meintjes 2003; Fox 2004; Born 2005; Porcello 2005; Samuels 2004).

In recent years, ethnomusicologists and anthropologists, sociologists, and historians have emphasized how "music" is constituted as a "thing in itself" only by means of its "mediation," starting from the premise that the meaning of music lies at the intersection of its creation (or re-creation) and its reception. This theorization has generated an understanding of music as a very complexly mediated and socially dynamic phenomenon, not a clearly bounded thing in itself. While this analysis has been applied generally to all human musicality (building on the work of pioneering ethnomusicologists such as John Blacking [1973] and Alan Merriam [1964]), it has emerged as especially salient to the study of contemporary music enabled by electronic and mechanical technologies of amplification, sound modification, recording, and listening. Scholars of popular music in particular, have decentered the musicological emphasis on composers and

performers in favor of centering interpretations on live audiences and listeners (Fox 2004; Gray 2013; Feld 1984). The boundaries between "recorded" and "live" musical sounds and experiences have been increasingly analyzed as permeable and constructed through practices of using music technology in "live" settings (Auslander 1999; Sterne 2003; Porcello 2005). Conversely, several scholars have advanced a critical analysis of the recording studio as an arena of real-time labor and creative practice imbued with its own immediacy (Kealy 1979; Theberge 1997; Porcello 1998; Sandstrom 2000; Metinjes 2003).

Ethnomusicologist Philip Bohlman, in his seminal essay "Ontologies of Music," draws attention to the constructedness of the distinction between "Authentic Sound" and "Recorded Sound." In relation to recorded sound, listeners and scholars often imbue so-called live sound with the property of originality or "authenticity," obscuring how even "live" sounds are typically technologically mediated:

> The technologies that reproduce sound radically confuse the ontologies of music; indeed, few ontologies of music, whether in the modern West or in traditional music cultures, are secure enough to withstand all the metaphysical challenges that recording sets in motion….Mechanical technologies change the functions and contexts of music, both multiplying the metaphysical notions of what music is and privileging certain forms of musical production over others (Bohlman 1999: 32-33).

Here Bohlman points to how live sound and recorded sound cannot be distinguished simply in terms of the latter being technologically mediated and the former unmediated (or indeed, "immediate"). Rather he emphasizes that both the "live" and "recorded" descriptors are subject to elaborate discursive and practical constructions of sound making and interpretation with distinctive cultural processes and associations that very widely over history and across cultural traditions.

The live/recorded sound distinction is not the only framework that has confused or challenged scholarly understandings of the ontology of live music in an age of mass mediation. The dominance of the concept of the musical "work"—abstracted from contexts of production or interpretation—in Western music scholarship has also constructed a terrain for understanding musical "labor" that does not appropriately account for live sound engineering or many other forms of labor necessary for musical communication to occur across diverse contexts.

Ethnomusicologist Georgina Born offers a salient critique of the concept of the "work" as an abstraction from the actual embodied work of musical mediation. She says:

> …the ontology of the musical work envisions a hierarchal assemblage: the composer-hero stands over the interpreter, the conductor over instrumentalist, interpreter over listener, just as the work ideal authorizes and supervises the score, which supervises performance, which supervises reception…the philosophy of the work insists that neither music's objectification in recording (wax cylinder, vinyl disc, CD) nor music's sociality form part of the creative process (Born 2005: 27).

This project respond to Born's call that "…accounts of mediation need to address technological, social and cultural changes heralded early in the twentieth century and now sweeping across the production and reception of art and popular musics, developments that now signal a new ontology of the provisional work"(Born 2005: 34). However, in addition to theoretical and conceptual obstacles to hearing and seeing the labor of live sound engineers as an aspect of "music" as such—the "authentic/recorded" sound distinction and "the work" concept – it has, ironically from my point of view here, been the desire of live sound engineers themselves —who take great pride in not being noticed—to *remain* unheralded and unexamined. They, and their labor, are bound up and invested in the illusion of their own transparency. Ethnomusicology and the broader field of popular music studies have long obliged by not noticing engineers, even

as scholars in these disciplines have moved its focus into musical idioms, genres, and settings where live sound engineering is an integral and essential part of musical "performance," the primary focus of scholarly attention. It is time now to return to the scene of live music and ask the question: "what are those people in the black shirts doing?"

I build here on early answers to this question, in particular one posed by sociologist Edward Kealy (1979), whose 1974 Northwestern PhD dissertation is the only monographic study of live sound engineering in the contemporary scholarly literature of which I am aware. He positioned the live sound engineer as a "sound mixer," who operates within three components of popular music: "the music, the commercial system for promoting and distributing it to a mass audience, and the technology for recording and reproducing it"(1979: 172). He frames sound engineers, or "sound mixers," as both craftsmen and artists, a frame that weighs heavily in my thinking in this project, where I regard the distinction between "craft" and "art" as an artifact of the division of labor more than as a salient distinction between forms of musical work.

"The sound mixer is a popular art technician," Kealy writes, "a type of collaborator also common to theatrical, radio, television and film productions, but whose role in shaping the aesthetics of popular art is little understood. In addition to illuminating the role of the popular art technician, studying the recent history of the sound mixer's relationships with his collaborators provides the sociology of art with examples of how a craft becomes art with examples of how a craftsmen attempt to become artists"(Kealy 1979: 4).

Sociologist Howard Becker further explicates Kealy's study of live sound engineers in his seminal book *Art Worlds*, pointing to the exact shifts in the technology and practice of live sound engineering that I experienced through my childhood into adulthood. Becker explains that "The

status of any particular activity, as a core activity which requires special artistic gifts or as mere support, can change"(Becker 1982: 18). Becker goes on to recount Kealy's important overview of how the technological changes have shaped live sound engineer's work over the 20th century, from which I will quote at length:

> Edward Kealy (1979) documents the shift in the status of that technical activity [for sound engineers]. Up to the mid-1940s: The mixer's skill lay in using to ad vantage the acoustic design of the studio, deciding upon the placement of a handful of microphones, and mixing or balancing microphone outputs as the musical performance was recorded. Very little editing was possible since the performance was recorded directly on a disc or single track tape. The primary aesthetic question was utilitarian: how well does a recording capture the sounds of a performance?
>
> After World War II, technical developments made "high fidelity" and "concert hall realism" possible. The good mixer-craftsman would make sure that unwanted sounds were not recorded or at least minimized, that the desired sounds were recorded without distortion, and that the sounds were in balance. The recording technology itself, and thus the sound mixer's work, was to be unobtrusive so as not to destroy the listener's illusion that he was sitting in Philharmonic Hall rather than his own living room.
>
> With the advent of rock music, musicians whose instruments themselves embodied electronic technology begun to experiment with recording technology as part of the musical work. Since they often had learned to play by intimidating highly engineered recordings (Bennett, 1980), they naturally wanted to incorporate those effects into their work. Such equipment as multitrack recorders made it possible to edit and combine separately recorded elements and to manipulate electronically the sounds the musicians produced. Rock stars, relatively independent of corporate discipline, began to insist on control over the recording mixing of their performances. Two things happened. On the one hand, signaled by the prominent credits given to mixers on record albums, sound mixing began to be recognized as an artistic activity requiring special artistic talent. On there other hand, people who had established themselves as musical artists began to take over the job themselves or to recruit ex-musicians to do it. Sound mixing, once a mere technical specialty, had become integral to the art process and recognized as such (Becker 1982: 17-18 quoting Kealy 1979: 15-25).

My interlocutors—the engineers featured in this dissertation—have also experienced change in the technology and recognition of their live sound engineering work, as I will describe

in the following chapters. Indeed, they experience a microcosmic version of such changes sequentially even within the context of a single evening's labor. In particular, shifts in the engineers' work experience at a live production transition from the explicitly manual labor of loading in and setting up equipment to the somewhat egalitarian and dynamic collaborations with musicians on stage during sound check, to what becomes, in many instances, an experience of artistic autonomy and power at the moment of mixing the performance. Finally, this is followed by a repetition of manual labor in breaking down the equipment, often long after the musicians and audience have departed.

My research aims to complicate how we understand the ontology of "live" music, the ontological distinction between live music as unmediated and the work of mediating live music. This distinction has been deconstructed vigorously by scholars studying the subject of music technology in the recording studio, and has been elaborated in popular music studies focused on theorizing reception and consumption as agentive elements of musical mediation. Throughout, I will emphasize that the technologically mediated ontology of contemporary music experience is not only contextually specific in a cultural sense, but is a product of a complex division of labor (Becker 1982), reflecting its existence in an industrialized society dependent on increasingly complex technologies that affect the most intimate domains of everyday life as well as large scale possibilities for human expression and fulfillment (DeNora 2000). We now understand music not just as a sonic text, but the result of cultural ideologies, aesthetic histories, ecological resources, and forms of labor. Here, I show how live sound engineering needs to be brought within such a framework.

But before I return to the theoretical implications of this understanding for the ethnographic descriptions to follow, I will first give an overview of the history of live sound engineering and an overview of live sound engineering equipment. A basic schematic description of the history of live sound technologies and of the technical properties and functions which an engineer controls is fundamental to the more immersive descriptions of engineering practice that will be the focus of subsequent chapters. Much of this knowledge is part of the implicit and practical competence of any engineer and a large technical and pedagogical literature also describes this knowledge; it has, however, only recently been the subject of serious and critical scholarly attention, most especially in the pioneering and influential work of sound studies scholar Jonathan Sterne (2003), on whom I rely extensively in what follows.

History of Live Sound Engineering

In the (intertwined) history of electronically amplified and recorded music, the role of the sound engineer is central to both technological innovation and to the practices of for making music. As Paul Theberge, also a groundbreaking scholar of this history has written:

> Technology has thus replaced music in the old bourgeois myth of the 'universal language.' Technology has become transparent, 'a form of communication,' a 'language' itself. If you learn to 'speak,' technology, that is, if you become a consumer of technological products, you are immediately admitted, or so it would seem, into that international fraternity of musicians—the 'worldwide network of professionals'(Theberge 1997: 127-8).

Live sound engineers gain their professionalization through acquiring both a metalanguage for and practical competence in making sound engineering technologies appear "transparent" to listeners. Whether working in concert halls that draw upon the acoustic properties of amphitheaters (Thompson 2002), or in indoor clubs and venues that are often not optimized for

acoustic properties, or in outdoor spaces, live sound engineering requires a mastery of equipment, and perhaps even more importantly, a mastery of the typically musical-genre-specific social dynamics of live production. In the mid-20th century, the emergence of popular music genres and live sound engineering practices shared a parallel development. For example, it was at the dawn of rock and roll's popularity that live sound engineering practices increasingly incorporated granular, specialized tasks, and developed into a profession. The live sound engineers whose craft and skills developed around the commercial dominance of rock music in the post-war era were often consumers of rock and roll recordings. I take up aspects of this demographic and generational phenomenon later in this section. In the 21st century, live sound engineers remain mostly male, and continue to have technical and apprenticeship training that reflects the importance of rock in particular in driving the professionalization of the field. However, across a wide variety of live sound engineering contexts, from personal PA systems to mixing a Bruce Springsteen concert, professional live sound engineers share features of their labor, especially their work with live sound engineering gear.

I have found that identifying "firsts" in a history of live sound engineering, such as the first person to invent a microphone, or the first live sound engineer to mix from a front of house position, is enormously complicated by the fact that genre-specific social processes and practices of live sound engineering have been more impactful than any single inventor, engineer or piece of equipment itself. I engage below with the Audio Engineering Society's archived oral history of live sound engineering to show why this is so. Before discussing the history of live sound engineering processes and practices as recorded by the Audio Engineering Society, I briefly review the history of live sound engineering in the era predating electronically amplified music.

The history of live sound engineering could arguably begin as early as the origins of human language (and thus culture) itself, over 100,000 years ago. Another beginning moment could be when human beings disembodied their sounds to emerge from an array of materials for the purposes of both communication over long distances and in the (sometimes clearly related) development of musical instruments. For example, in their early ethnological and ethnomusicological research, pioneering comparative musicologists Erich M. Hornbostel and Curt Sachs published a system of organological categorization in the 1914 article *Systematik der Musikinstrumen*te (Zeitschri für Ethnologie 46/4–5, pp. 553–90). Their instrument classification system, reflecting a then-accepted evolutionist account of cultural diversity, sought to connect certain technological parameters of musical instruments to particular societies and their histories, often making what are now understood to be ethnocentric evaluations of relative primitivity. The history of live sound could also begin with history of the amphitheater and resonant built or natural spaces, or other manipulations of the earth to evenly disperse listeners in a space where the propagating spheres of air compressions and rarefactions from vocalists evenly arrive at listeners' ears in ways that promote intelligibility. A teleological line drawn from this moment extends into the complex architectural constructions of churches, theaters and auditoriums that functioned as venues for liturgies, dramas, operas, concerts and movies in western society (and likewise in other large-scale societies). These are spaces that persist, in some cases, through to the present as sites of audio imagination and realization (think of the continuing use of extraordinarily resonant and reverberant Gothic cathedrals to record and perform sacred music). Indeed, even since the 19th century, particular modern technological developments have converged with specific music market shifts that have programmed live, physically co-present

performances by musicians to audiences in architecturally acoustic spaces whose plans and designs directly follow those of movie theaters, opera houses, churches, and theaters, designs that have become globally standardized and refined as emblems of development, wealth, and modernity.

However, there is a temptation even among scholars to naturalize this western and ethnocentric teleology in discourses of the history of live sound engineering. Certainly, humans did not wait for modern technologies of construction or amplification to make their sounds louder or to alter their color and quality for aesthetic reasons, and there have been several developments in the amplification of live sound that have occurred far at the social and economic margins of modern Western society. More peripheral examples of live sound engineering practices in the West can be found in Norman Stolzoff's study of Jamaican sound systems of the mid-20th century (2000), Braxton Shelley's article, "'This Must Be The Single': Valuing The Live Recording in Contemporary Gospel Performance," on the value of live recordings in contemporary African American gospel music in the 20th and 21st centuries (2017), and Akili Walker's *Turn the Horns On,* which takes up one man's journey in live sound engineering within hip hop musical contexts (2011).

On the other hand, it is significant to trace a history of modern Western live sound engineering as a practice that *empowers* sound, in so far as such a story of empowerment is closely related to the dynamics of political empowerment and disempowerment that have defined modernity itself, including histories of class formation, slavery and racial subjugation, and colonial cultural imperialism. More specifically, the technologies and processes that constitute modern live sound engineering share a history with the technologies and processes of

telecommunication and warfare that have shaped modernity in the west throughout the late 19th, 20th and early 21st centuries. In addition, the pervasiveness of modern live sound engineering throughout the world was very much overdetermined by the broad reach of 20th century military technologies and technocultures that have valued different forms of signal amplification, analysis, and modification. Of course, this pervasiveness also extends to western cities such as New York City, where a wide range of globally sourced genres of live music regularly encounter a comparatively singular form of professionalized modern live sound engineering.

This social history is the broader context in which I historically situate the ethnographic encounters in this dissertation, and the experiences of the engineers whose work I describe (and my own practice as an engineer). As such, this dissertation ethnographically contributes to a broader social history of sound technology with an analysis of the specific social encounters that occur in the process of modern live sound engineering technologies and practices, encountering an array of popular music genres in New York City. The effects of capitalism, colonialism, imperialism, militarism, commerce, and globalization that have shaped both live sound engineering and every contemporary genre of popular music make the juxtaposition of live sound to specific genres of live music a richly suggestive domain of analysis for a broader history of social conflict and formation.

For example, these broader contextual factors make live jazz music performances (including the work of engineers such as myself who amplify live jazz) resist and conform to live sound engineering practice in different ways from how live rock music engages with engineering practice. It is also the case that live sound engineering practices resist and conform to the conventions that construct musical sound as effective, beautiful, or intelligible within the specific

social and aesthetic contexts of particular musical genres. As such, the history of live sound engineering in the context of popular music is as much the product of its interactions with musical genres as its collection of specific technologies and commensurate processes. Yet, the technological and cultural products and processes that live sound engineering deploys have not benefited from a balanced approach to historiography that would consider the question of genre comparatively.

Through assessing the history of patents for specific audio technologies, it is much easier to identify the inventors of technological products that live sound engineers have used over the years than it is to identify innovators who have used technological products to develop genre specific modes of live sound engineering practice. But these inventors should be understood as emerging from and returning to specific genre-based contexts in which they developed and applied the technologies with which they are associated. In a very real sense, audio technology is "invented" through a collective process that flows through the work of these pioneering figures in the field of live sound engineering, whose specific contributions I discuss below.

Throughout the dissertation, I argue that it is through *transduction*—a technical term of engineering art that also serves as a potent metaphor for cultural and technological mediation—that the ontology of music changes in the context of amplification that is at the heart of my interlocutors' work. The term "transduction" defines a process in which a signal is converted from one energetic medium to another, for example from a voltage traveling down a wire to a pressure wave in the air in front of a speaker to which that wire is connected. In the context of modern sound reproduction technology, processes of transduction take place in apparatuses that

convert what humans refer to as “sounds” in air to electrical signals that represent those sounds that were once in air, as well as from electrical signals back in to sound in air.

The advent of electricity transformed the ways that humans met the need to amplify sound as a means of communication and interactivity. Historically, amphitheaters, and in western music, 18th- and 19th-century-style concert halls, were acoustically designed to amplify sound. When Ernst W. Siemens introduced the moving-coil transducer, a mechanism consisting of a wrapped coil of wire that would be structurally suspended in a magnetic field, possibilities for live sound reinforcement opened. Changes in the charge of the coil would result in mechanical movement of the coil in relation to the magnets used to create the field. Even though Siemens applied for and received a U.S. patent for this concept in 1874, Alexander Bell was the first to use the technology for his telephone invention that was patented two years later. Despite this, Siemens traveled to Germany where he would patent a cone-like “nonmagnetic parchment diaphragm” that would act as a sound radiator for his transducer. The idea behind this 1877 German patent became the first loudspeaker that was utilized in phonographs soon after. The same basic loudspeaker design, enormously refined, remains at the heart of live sound reinforcement systems today.

In 1898, British inventor Oliver Lodge improved the loudspeaker by adding nonmagnetic spacers in and around the coil for the sake of reducing the negative effects of air gaps in the mechanism. In 1901, John Stroh patented the “conical paper diaphragm” that was connected to the wire coil at the center and to a structural frame. Seven years later, Anton Pollak made an improvement to this by creating a “voice-coil centering spider” that ensured oscillation in one

axis. Soon after, Edwin S. Pridham and Peter L. Jensen invented the “Magnavox” a moving coil loudspeaker (Hartley 1994).

The Austrian born Jensen, prior to his dealings with Pridham, had worked with Vlademar Poulsen, the man who first demonstrated the telegraphone in 1900. With Poulsen, Jensen helped in developing a wave arch transmitter that would transmit signals of human voice. After further development, Jensen traveled to the United States where and while working on a radio station, he met Pridham, an electrical engineer. Together, Pridham and Jensen married the arch transmission technology with their own “electro-dynamic principle” specifically for the reproduction of the voice. Like most developers would, they took their ideas to a patent office. The idea was the inspiration and catalyst for the further developments that lead to the “Magnavox” a loudspeaker intended for public address.

President Woodrow Wilson’s 1919 San Diego speech exemplifies the impact of this live sound reinforcement development. On September 9, 1919, to plead for his League of Nations, President Wilson arrived at the Santa Fe depot on a special train with a squadron of seaplanes flying overhead. He began speech at 5pm in City Stadium (later renamed Balboa Stadium) in Balboa Park. 50,000 crowded into the stadium and the temporary bleachers on the field. Wilson’s voice was amplified by a public address system recently developed by Magnavox, based on the invention of a loudspeaker in 1911 by Peter Jensen and Edwin Pridham. Pridham had come to San Diego to supervise the installation and Jansen was in the glass platform with Wilson. Rather than use a microphone, Wilson stood on a circle drawn near the front of the stage and spoke into two large horns suspended over his head that directed his voice to the microphone. The loudspeakers were hidden behind flags and bunting around the platform. Although a tube in the

amplifier shorted and had to be replaced just before the speech, the system worked well during the hour-long speech. The audience could clearly hear Wilson's words, applauded and shouted their approval. Wilson's voice could be heard one mile from the stadium. The sound did not project clearly to the far north end and people moved to the field to get closer to the glass platform. Pridham later concluded that the large size of the glass-enclosed platform created an echo effect that made Wilson's voice sound hollow in some directions.

While these early examples of loudspeakers used a method of electro-magnetic or dynamic transduction, a method that is still used today for loudspeakers, they all used an acoustic "horn" design that in some cases would exponentially flare for the sake of matching acoustic impedance. At the time these examples were accepted. However in 1921, C.L. Farrand invented the Phonetron, the first "coil-driven direct-radiator loudspeaker." With the introduction of this loudspeaker, there was clearly competition for the companies who still sold the original horn loudspeakers and scientists were also taking an interest in the new technology (Jones and Davis 1987). A similar history of electrification can also be described for microphone and recording technologies. The primary technologies that are at the heart of live sound engineering include microphones, cables and stands, mixers, amplifiers, and loudspeakers. In the next section, I will explain these technologies in turn.

Live Sound Engineering Equipment

For the purposes of amplifying live musical sounds that musicians make for audience members who share the same space with musicians, live sound engineers use an array of technologies that transduce, transmit, intensify, and transduce again, often through dozens of

such cycles between the initiation of the terminal amplified sound event and its reception by a listening audience (which can be thought of as initiating yet another cycle of social and experiential transduction, a process also fundamental to how humans hear and process sound organically). The following is a general overview of the specific technologies that live sound engineers typically use. In Chapter 1, in which I discuss my own live sound engineering work with *Jazzmobile*, I further detail the socially constructed factors that overdetermine the specification of specific live sound technologies in relation to a specific genre, and a particular operating budget, as well as the accommodation of musicians' and audiences' acoustic needs within specific venues.

Microphones

Live sound engineers use microphones (commonly referred to as "mics") that transduce sound energy that propagates through the air around the mic and into electrical alternating current signals. These signals that flow from the output of microphones are electrical voltages that are nearly instantaneously analogous to the changing air pressures that enter the microphone (for example when someone sings into it) and vibrate its diaphragm. A microphone cable, with its twists of three different wires, conducts the alternating currents that electrically represent a microphone's representations of sound as variations in air pressure, sending these signals to a "preamplifier" (or "preamp") that is typically housed in an audio "mixing console," ("mixer"). Historically, technical developments towards what would become the modern microphone range from the mouthpieces of simple conical megaphones or acoustic amplifiers, to the recording horn of the Edison phonograph that terminates to a diaphragm and etching crystal, to the introduction of carbon microphones for telecommunication, to the the Radio Corporation of America

Company's (RCA) development of ribbon microphones, to the invention of the condenser microphone by E. C. Wente at Western Electric in 1916, to the invention of the pervasive electret microphone invented by James West and Gerhard Sessler at Bell Laboratories and finally to the most widely used microphone in the context of live sound amplification: the dynamic microphone, such as the Shure SM58, the most widely used microphone in live sound engineering.

Preamplifiers

Preamplifiers intensify the comparatively weak alternating current ("AC") electrical signals from the microphone and microphone cable into a more powerful electronic alternating current signal. Engineers refer to this electronic signal's typical voltage amplitude as "line level." This line level signal is potent enough to undergo functions that occur within and beyond the audio mixer. Preamplifiers can also include devices for alternating or coloring sound, as is typically the case for guitar amplifiers which may output a line level signal directly to the engineer's mixing board, in addition to driving their own speakers and amplifier sections.

Equalization

One such function is equalization. In the process of equalization, an engineer can adjust potentiometers, or knobs, on a mixer's surface that will amplify or attenuate specific high, middle, or low frequencies of the line level signal. Thus the "tone color" and balance of the signal can be altered significantly, shaped to adapt to the physical location of the sound, and tonally blended from the point of view of the audience and the engineer.

Auxiliary Output Buses

After equalization, the signal can be sent to auxiliary output "buses." These are a particular kind of output from the audio mixer that are separate from the mixer's "main" outputs to an amplifier and speaker system. There are several uses for auxiliary outputs. Engineers often use these outputs to send signals to "monitor" amplifiers and speaker systems that allow musicians to hear themselves on stage. "Monitor" systems often have a different "mix" than the speakers facing the audience, and contemporary musicians can be incredibly particular about the quality of their monitor mix as an independent domain from the "mains" mix heard by audiences (indeed, modern versions of these monitor systems often include personal monitors worn in the musician's ear, giving each musician on a stage their own individual "monitor mix"). Finally, engineers also use auxiliary outputs to send signals to signal processors and sound effects units like those that are also found in professional recording studios. Examples of these units include dynamics compressors, reverberation units, and delay units, among other devices that add and change (and sometimes even purposely "distort") the sound's "color" or timbre. Beyond the potentiometers that allow an engineer to send a signal to numerous auxiliary outputs, the next function that a signal encounters as it is transduced through an audio mixer's channel is a "pan" potentiometer.

Pan Potentiometer

The pan potentiometer allows the engineer to send a particular portion of the signal to an aurally perceptual space between a left and a right loudspeaker configuration that the audience and the engineer will eventually hear. Within the audio mixer, the two main outputs feed these left and right channels (assuming the most common modern configuration of "stereo"

amplification) that power amplifiers will amplify and eventually drive the corresponding left and right speakers. Typically, however, live sound engineers seldom pan audio signals drastically between these left and right channels. Doing so can problematically privilege audience members who sit between and equidistant to the left and right loudspeakers that are commonly positioned on either side of a performance stage, and can affect the entire audience's perception of the sound field and its depth, changing the illusion of a "transparent" and stable reflection of a sound emanating from the center of what is typically the center and front of most performance spaces (sometimes, however, this is intentionally sought as an "effect").

Faders

The fader itself typically resides at the bottom of the aforementioned series of potentiometer knobs that control the pre amplification of input signals, equalization, auxiliary output controls, and pan controls on analog consoles. It looks like a small sleigh that slides vertically. It is typically light in color, or illuminated, enabling engineers to see faders clearly in their notoriously dark mixing positions. Horizontal indentations line the inner space of its curvature making the fader ergonomic for the engineer's finger. Numbers mark the positions where the fader can slide up and down the chassis of the mixing console. From bottom to top, these numbers typically include: infinity, -40, -30, -20, -15, -10, -5, 0, 5, and 10. There is less space along the slider between the smaller values and their positions, such as the space between -40 and -30. Conversely, there is much more space between positions -5 and 0. This demonstrates the degree to which the scale of fader movements (measured in decibels of gain, or "dBs" in engineering parlance) is logarithmic, reflecting the non-linear physics of the human perception of amplitude as "loudness" or, more colloquially, "volume." Fader motions between

infinity and -10 have a much more drastic effect on an input signal's perceived output than movements between -5 and 0. This logarithmic scale, measured in decibels (or, as engineers typically say, “dBs”), not only similarly corresponds to orders of magnitude of sound pressure levels as perceived by human hearing, but also to the allocation of output voltages within the mixing console.

The fader is not, however, a simple volume control. Its function, within a bank of other faders used for discrete “channels” of signal transduction that allow engineers to balance the power of particular signals from diverse sources, is inherently comparative, mediating between the input and output transmission of a sound. Its position determines whether the preamplified input signal simply passes through to the mixer's output, with or without further amplification or attenuation. At stake in these decisions is how much—or even if—an engineer transmits a "clean" or "transparent" signal, or to what degrees they will add the mixer's electronic noise and signal processing capacities in the effort to amplify or attenuate an input signal.

The term "unity gain" describes the unencumbered transmission of the input to the output of the mixing console when the fader resides at the 0 position. During a sound check, many engineers pre-position faders to 0 while adjusting the preamp potentiometer knob when checking the level of an instrument or vocalist on stage. Their goal is to boost the preamp to a level that will keep the fader on or at least close to 0, or unity gain, throughout as much as the performance as possible. However, engineers move the faders throughout the mix of a performance, responding to features of acoustics in the venue, demands for the intelligibility of specific components of a mix in relation to each other and ambient conditions, audience expectations of

genre resonance and power, and consistent directness and intimacy between an individual vocalist's or instrumentalist's sounds and the expectations of a listening audience.

Mixing with faders is also a practice through which engineers negotiate their labor position as also a mix, between subject and sovereign, amplification and musicality. No action is more emblematic of the engineer's work, and moving faders is a popular metonym for (and visual reference to) the entire activity of "mixing" sound.

Signal Processing

After using the array of potentiometers and faders on an audio mixer's surface to construct a mix of several musical sounds into a consolidated singular "mixed" signal, many engineers transmit this signal from the output of the audio mixer to signal "processors" that similarly adjust features of the mixed signal that accommodate its eventual resonance within the frequency-based, amplitude-based, and waveform-based demands of the architectural and acoustic resonances of the venue and the sounds made within it. From the output of such processors, this mixed signal, whose qualitative and quantitative dimensions, are now complementary to those of the venue, flows into the input of the power amplifier.

Power Amplifier

The power amplifier is a device that generally uses the alternating current signals from its input to instruct how its internal transistor directs flows of powerful electricity to the output of the amplifier. In this setting, the mixed musical signal instructs how much electrical power from the venue flows in ways that resemble the qualitative and quantitative parameters of the mixed

musical signal. The output of the amplifier flows through thicker copper cables and connects with loudspeakers.

Loudspeakers

From the power amplifier, the inputs of these loudspeakers encounter an alternating electrical signal that is somewhat analogous (how much being a matter of the engineer's choices and the inherent limitations of the technological means involved) to those that had first flowed from the microphones and instrument amplifiers on stage. These high-current analog charges electrify a coil of wire that connects to the rear side of a loudspeaker's diaphragm. Engineers refer to this coil as a "voice coil." A magnet surrounds the voice coil. When the coil is electrified by a positive charge, the magnet responds by applying a flux energy that pushes the coil and its attached diaphragm away from its place of rest; when the coil is electrified by a negative charge, the magnet responds by applying a flux energy that pulls the coil and its attached diaphragm away from its place of rest. What is significant about this elegant technology within the loudspeaker is that it is the same exact technology within the dynamic microphone that live sound engineers commonly use on stage. As such, the larger diaphragm of the loudspeaker is a transducer that pushes and pulls, compresses and rarefacts air molecules in ways that reproduces sounds in that space with a greater magnitude than the input signal.

These technologies are the basic tools used by almost every professional live sound engineer, standardized through mass production and under constant development in relation to shifting norms of genre-based practice and new developments in electronic signal processing. In recent years this signal flow has increasingly moved from an "analog" to a "digital" medium as well. The term "analog" derives from the word "analogous," which describes the ways in which

the oscillating characteristics of an audio signal are transmitted through an audio system (or, more abstractly, a "signal chain") in the engineer's constant effort to maintain a similar, thus, analogous, expression of the frequency amplitude and waveform complexities that first entered the system at its acoustic source. In order to achieve this, analog systems utilize long lengths of electrical conductors that connect input devices to processing devices and output devices. The passage of these signals through what can often be miles of copper wire, as well as the necessary forms of resistance, electrical reactance (inductance, or capacitance), and insulation, all co-produce an electrical "noise floor" (perceptible in many systems as "buzz," "distortion," and "hum") in analog audio systems, as well as tiny amounts of "delay" or "latency" in the temporal movement of a signal.

Engineers of the analog era sought to amplify desirable audio signals to an amplitude that was far greater than that of the system's noise floor. They did this by achieving what they described as an adequate "signal-to-noise ratio." However, the presence of noise in analog audio systems is inevitable. In fact, these noises have been so pervasive that they have come to be the foundation of a form of sonic nostalgia for people who long for the presence of these noises of an analog past, a noisiness that is seldom heard in the digital era.

Digital counterparts to the older analog audio systems rely on "analog-to-digital conversions" (or "A/D conversions") at the system's input, and then conversely, on digital-to-analog conversions "D/A conversions") at a system's output. These processes, which entail a digital process called "sampling," convert analogous alternating current signals into binary numeric signals associated to pulse code modulation and vice versa. Within these digital audio systems, as code, digital audio signals are both processed and amplified though the application of

computer-based programming algorithms that alter the input signal without adding noise (although latency remains a challenge in transducing any signal through space, as sound and electricity travel at different speeds from and through different sources and signal paths). In the context of live sound engineering, many of these processing algorithms are software "emulations" of older analog audio devices, which can include the digital simulation of properties of older analog systems, even including the *reintroduction* of the "noise floor" effects that digital technology can theoretically reduce. This manufacturing and software coding practice represents the current transition between generational cohorts of musicians, engineers, and audiences who came of age in the analog audio period, and those who came of age in the digital period. The digital audio system structures, however, greatly reduce the presence of the noise floors that are ever present in analog systems, although it is important to note that even digital systems must eventually output an analog signal via loudspeakers for the output sound to be perceptible. Thus, analog audio systems are very efficient in the amplification process and offer a wide variety of ways to affect an audio signal.

"Imagine That You Are a Sound": Encountering Signal Flow

Anthropologist Thomas Porcello has advocated for modes of experimental ethnographic representation of the ways engineers and musicians engage with each other via the phenomenological properties as well as the technical capacities of these tools and machines and the sonic phenomena they transduce and mediate. His article *"Tails Out": Social Phenomenology and the Ethnographic Representation of Technology in Music-Making* (1998) demonstrates the

point with a “thick” description of general signal flow in the context of a professional popular music recording studio. Porcerllo urges his reader to conceive of themself as the sound that is transduced multiple times throughout a recording process.

Porcello writes:

> The recording studio is a particularly appropriate research site in which to work through such experiments in representation, because it is a music-making context that is virtually defined by a refusal of narrativizing (musicalizing) closure. In the recording studio, the continual work performed on constructing moments of tuning-in, the densely layered performances of musical, verbal and cultural play and competence enacted in a clearly circumscribed space of intense artistic collaboration, where music launches talk and talk launches music, and the fluidity of inner and outer time, coupled with the consequent movement between the individuated and distanced we-nesses…. Such "tries"are not mere artifacts of the postmodern fragmentation of experience…Rather, they are strategic, intentional, deeply felt forms of performed cultural activity, and living embodiments of multiple local epistemologies enacted in the flow of internal and external time in and out of the recording studio (Porcello 1998: 500).

Following Porcello, here I assert that this account is also applicable to descriptions of live sound engineering and its social and technological encounters and the electronically overdetermined temporal narratives of experience and the limits and possibilities of contemporary audio technologies. Following his advocacy for such approaches to description, the next section describes my application of his model in describing a phenomenological encountering of signal flow within the context of live sound amplification.

Imagine that you, the reader, are the sound produced by a singer on stage and mediated by a sound system controlled by an engineer. The singer arrives to the venue, and live sound engineers lift, carry, setup, and hide hundreds of pounds of microphones, cables, mixing boards, power amplifiers, and loudspeakers throughout the performance space. Their preliminary setup is an effort to amplify you, to make you louder without technologically distorting you or socially

distorting the singer's primary control of you. Together, the engineer and the singer test and modify how you flow from the stage, through the audio system, and to the audience seats. They discuss how you do it. They argue about how you should do it, but the engineer gives in and makes compromises to meet the singer's desire. The singer feels comfortable knowing that she will feel good about the show in the next half hour, when she will sing you out loud in front of her fans.

During your debut at the sound check, as a series of neurological charges within the singer's brain, you flow from the brain to the diaphragm, instructing it to push a burst of air from the lungs, through the trachea, towards the larynx. Your other neurons from the brain fire to the larynx where you shape the vibrations of the vocal chords and the air from her lungs. More neurons fire to the articulators—the tongue, palate, cheeks, and lips—that mold your constantly fluctuating air and your individual character outside of the body. You escape the body.

You leap from the lips, nostrils, and chest of the singer into a thick array of air molecules, and you push them together and pull them apart. You are everywhere! You emanate throughout the performance space as spheres of energy, both penetrating and bouncing off of any surface in your path. But away from a microphone, you are weak and the audience in the large auditorium cannot adequately hear you.

During the performance, the singer intently clasps her fingers around the microphone. You glide through the short distance of air from the singer's lips into the metal wire mesh guard of the microphones surface. You penetrate the protective layers of the mic's windscreen, where you approach the sensitive diaphragm of the microphone. Your pushes and pulls of the air molecules sympathetically push and pull the surface of the diaphragm. The diaphragm connects

to a coil of wire and your movements of these connected components allow the coil of wire to receive varying electrical charges from a magnet, which is adjacent to the coil. In your audio amplification process, here at the microphone's diaphragm, coil, and magnet, you die as sound in the air and exist only as an electrical sound signal.

From the coil, you flow as a series of positive and negative electrical charges that correspond to your former pushes and pulls of air. You move near the speed of light through twists of copper wires, pushing loose electrons from atom to atom. Through microphone cables, you move from the stage to the engineer's mixing board, near the back of the audience section. A mixing board's input accepts you.

The sound engineer uses knobs, faders, and switches on the mixing board to boost your charge through a preamplifier, alter your unique character by augmenting or filtering your shape with an equalizer, add effects to you such as reverberation or delay, and balance you with other sounds. From the output of the mixing position, you flow back to the stage, towards one of the wings.

You encounter the power amplifier. Hidden in a dark corner of the backstage area where not even the singer could see it, the power amplifier holds a portion of the venue's electrical power. You enter its input as a relatively small electrical signal. You approach the device's transistor that holds the building's power as a stored charge ready to be released. Upon your arrival into the transistor, the chemical properties of the transistor's silicon direct the amplifier's power supply to donate large sums of electricity to reproduce your positively and negatively charged character at greater voltages and current levels. Now you are powerful. Out of the power amplifier, you flow through much thicker bundles of copper cable and into the loudspeakers.

Within the loudspeaker, you enter the large wire coil that attaches to the speaker driver cone. A reverse process of the microphone, your changing positive and negative charges react with the large magnet beside the coil and this reaction pushes and pulls the large cone backwards and forwards. At the cone, you die as an electrical sound signal and reemerge as sound in air, once again a variation in pressure energy rather than electricity. The movements of the loudspeaker's cone project you from the stage, through the air, and into the ears of audience members, whereupon you enter another chain of transductions that produce the experience of "music."

I place this experimental ethnographic writing here in order to conclude the overview of reoccurring examples of live sound engineering technology, following Porcello's call for such efforts to represent temporal and spacial, as well as electronic, acoustic and social complexities of music production. This phenomenological approach, as Porcello defines it, constructs the intimate encounter between the reader and, not only these pieces of equipment, but more specifically how sound and audio signals flow through such systems. This mode of representation intensifies the significance of encountering the sound engineer. Signal flow within live sound amplification is part of a broader process of live sound engineering, the history of which I detail in the following section.

History of Live Sound Engineering Processes

The Audio Engineering Society (AES), an "international organization that unites audio engineers, creative artists, scientists and students," was founded in 1948. Its mission is to "promote the science and practice of audio, by bringing leading people and ideas together." In developing an oral history of live sound engineering, AES has worked to delineate the engineers

and engineering techniques that shaped sound engineering of popular music at live concerts in the 20th century. What follows is a collection of selected paraphrases from the "Live Sound Seminar: History of Live Sound" session during the 2009 AES national conference. The session reviewed the contributions of engineers Bill Hanley, Abe Jacob, David Robb, Roy Clair, and Stan Miller.[3] AES archived a recording of the session.

AES designates Bill Hanley as the first live sound engineer to advocate for the "front of house" mix position now standardized for most professional audio productions.[4] Hanley is best known as "the father of festival sound." He was born in Bedford, MA in 1937. His first sound job was as a record hop at the Belmont School in Malden, MA in 1950. In the 1950s, he was building amplifiers and experimenting with speaker design, determined to improve the sound he was hearing at big shows. Hanley began mixing sound for the Newport Folk and Jazz Festivals in 1957. Other clients throughout the late 1950s and throughout the 1960s included the Kingston Trio, The Beatles, The Beech Boys, Woodstock, Blind Faith, Velvet Underground, Jefferson Airplane's European tour, Festival Express in Canada, The Electric Circus, The Fillmore East and many more. Hanley provided sound for the inauguration of President Johnson, and was the leader of the tour for the Nixon-Agnew Campaign. For Woodstock, he custom designed microphones with Shure components, tweaked the electronics including 12,000 watts in mix-tube and transistor Macintosh amplifiers, and specially built the loudspeakers. From the 1970s on, he would continue to be called on for sound work and he also turned his attention to staging.

---

3 150A AES History of Live Sound. 2009. Audio Tracks 1-3 on Compact Disc. http://www.aes.org/events/127/livesoundseminars/session.cfm?ID=2142

4 The front of house mix position is a location, typically at the rear of an audience section, where a live sound engineer uses an audio mixer and other signal processing devices to mix the many independent sound signals from the stage into a singular mix that then gets amplified through a loudspeaker system that is directed toward the audience.

Hanley received the Parnelli Award for Innovation in the Sound Industry in 2006. Today Hanley is still involved in the business, though more on the staging side. He keeps two 40-foot, trailer-mounted hydraulic loudspeaker towers—formerly employed by the New York Metropolitan Opera Company for Central Park performances—parked in his yard.

Abe Jacob, innovator of theater sound design, recognized as the "dean of theater sound design," has had a career that spans four decades. Jacob started mixing rock and roll at McCune Sound in San Francisco and went on to create concerts opposite legendary artists such as Jimi Hendrix, Mamas & the Papas, Peter, Paul and Mary, and the Monterey Pop Festival. Then he brought that rock sensibility to Broadway audiences. Jacob's achievements in theater "sound design" virtually brought the profession that now bears that name into existence. His major Broadway, touring, and worldwide production credits include "Hair," "Jesus Christ Superstar," "The Who's Tommy," "Rocky Horror Show," "A Chorus Line," "Chicago," "Joseph and the Amazing Technicolor Dreamcoat," "Evita," "Cats," "Black and Blue," "Fascinating Rhythm," and many more. His extraordinary career was acknowledged by the United States Institute for Theater Technology with a Distinguished Achievement in Sound Award in 1999. He was also honored with a Lifetime Achievement Award by Entertainment Design Magazine. In his present capacity at the New York City Opera, his work there includes productions of "A Little Night Music," "110 in the Shade," "Harvey Milk," "Sweeney Todd" and more. Jacob also teaches sound design masterclasses and has mentored several generations of talented sound designers, many of whom are Broadway's top theatrical sound designers today.

David W. Robb, is considered one of the innovators of modern audio installation design. His background includes over 20 years as a sound company manager, mix engineer, production

manager and electronics technology specialist on worldwide tours with artists such as Jimi Hendrix, Grateful Dead, Tom Petty, Bonnie Raitt and Bob Dylan. More recent years have been spent designing audio systems for real-time interaction for performing arts, and higher education lectures/instruction. He has worked at some of the most esteemed venues in the world. He is active in several industry associations including InfoComm International ICAT Council, and recently became a "Life Member" of the Audio Engineering Society. Robb spent twenty years as backbone of an audio video design group, providing design criteria, quality standards, stock supervision and a critical ear for well over 100 performance space projects including Lincoln Center, Alice Tully Hall, and The Juilliard School, Hollywood Bowl, Kennedy Center, NASCAR Hall of Fame, Radio City Music Hall, Tokyo International Forum, New York Philharmonic and the Metropolitan Opera's Carlos Mossley Pavilion.

Roy Clair, of Clair Brothers Innovations, is a leader of developing the use of monitor and "flying" speakers.[5] Clair Brothers have been instrumental in a number of audio innovations, including the use of two-way loudspeakers coupled to the then-new Crown-DC 300 power amplifier, which would become an iconic industry standard in following yers, at the 1968 Cream concert at the Philadelphia Spectrum. Clair Brothers built a slanted speaker for Blood, Sweat and Tears, and sat in front of the artist to provide them with a monitor mix of what was being amplified of the audience, thus inventing the "stage monitor" systems found in every major live sound context ever since. Clair Brothers designed the "Frampton Comes Alive!" tour with the world's first full range, four-way loudspeaker system. The design used a total of 960 drivers and 96 boxes. The advancements following these included systems being "flown" instead of stacked,

[5] The process by which rigging professionals hang several heavy loudspeakers via steel cable to heavy duty trusses above a stage.

which gave designers more flexibility with staging and set pieces. Elvis Presley was one of the first musicians to have a flown system, and it opened up the entire stage or Presley's use.

Stan Miller was one of the first engineers to hang speakers through a steel cable drum, the wench system, of his own making. He was also the first to use multicore "snakes," or large single cables that combine the many individual signal cables required by modern sound systems. Miller was the first to dare to take a graphic equalizer (or "EQ") on the road. In the 1970s and 1980s as owner of Stanal Sound, he created the high-end Stanley Screamer speakers for Altec. Later he also consulted with JB to create advanced touring speakers and rigging. Most of all, he's known for his pioneering work in digital audio. To suit the needs of a range of concert touring, Miller took 14 small Yamaha digital sound consoles, hooked them together with a computer to recall specific audio settings. Miller developed a relationship with Yamaha's pro-audio division that has lasted twenty years. It led to today's PM 1V and PM 5D digital consoles. The last two Neil Diamond tours tours have been 100% digital. Miller was the first to insist on digital remote control of systems, and helped pioneer the technology that allowed and set amps remotely. The moderator of the AES oral history section also said, "On a personal note, I recall sitting at an AES live sound session at the Waldorf-Astoria in the mid-1970s where Miller told us: 'If you have only one speaker, aim it at the performer, not the audience.'"

While this brief history excludes inventors and innovators who have worked outside of the US and UK popular music commercial recording industry, and also excludes those live sound engineers who work in the less dominant genres of popular music, in particular those beyond rock music-centric practices, this AES history does represent the overwhelmingly white and male demographics of live sound engineering as a profession, which mirrors the demographics of

participants in the production and consumption of commercial rock music. The AES history of live sound engineering also foregrounds how common it was for 20th century live sound engineers to design and build their own equipment (which often eventually served as prototypes for mass reproduction and more low-budget options available to less professional or successful artists and engineers). Most important to this project, however, is Stan Miller's assertion to prioritize making sound audible and intelligible to musicians above anyone else. This exemplifies the importance of the social process in the practice of live sound engineering, where collaborating with a production team through the pressures of live production determines the function and approach to the use of equipment. I now turn to engage more specifically the ways that those like the aforementioned engineers encounter the common aspect of live sound amplification in the experience of their labor: transduction.

Transduction and Live Sound Engineering

Beyond developments in technological transduction throughout live sound engineering history, as I discussed earlier, I consider transduction as a *metaphor* for a particular kind of cultural mediation that accounts for changes in the engineer's experience as a laborer, an experience that changes throughout the duration of any given live sound production. I make claims about mixing as a practice that transduces sound in air to audio signals that engineers amplify as sound in air again. In this process of transduction, considering Kealy's and Becker's observations about the changing status of the sound engineer, or "sound mixer," a similar kind of

transduction occurs in the status of the engineer/laborer, from craftsman to artist (Kealy 1979; Becker 1982) .

Composer and musicologist George Lewis explores a similar kind of "human transduction" amidst the process of musical transduction in experimental musical improvisation. He explores this phenomenon with a consideration of what he terms "emotional transduction." Drawing a similar metaphor between signal flow and musical expression in improvised music, Lewis describes a motivated relationship between transduction of musical data and the communication of emotion in improvised music. He writes:

> The attempt to thoroughly map, parse and develop the input data is based on the notion that, through the accumulation and articulation of many small details, an interactive, adaptive input structure that generates a sufficiently detailed representation of its input can then produce a musical output perceptible by an improvisor as analogous to various states that were experienced during improvisation (Lewis 2000: 36).

In this dissertation, I consider audio signals and an engineer's tactile engagements with faders and other controls (or potentiometers) as the two primary inputs through which creative human agents make direct contact with the live sound system. This, what Lewis describes as "the accumulation of articulation of many small details, an interactive, adaptive input structure," represents not only the musical audio signals from concert stages, but in ways similar to Lewis' "Voyager,"[6] produces an output that the live sound engineer perceives as analogous to the various and changing experiences of the engineer's work. Lewis continues, expressing that:

> This notion of bi-directional transfer of intentionality through sound—or "emotional transduction"—constructs performance as an intentional act embodying meaning and announcing emotional and mental intention. In this way,

---

[6]George Lewis's composition *Voyager,* is a "nonhierarchical, interactive musical environment that privileges improvisation." This software listens to and reacts to live performers. See Lewis, George. 2000. "Too Many Notes: Complexity and Culture in Voyager." *Leonardo Music Journal*, Vol.10. pp. 33-39.

> I believe, the emotional state of the improvisor may be mirrored in the computer partner, even if the actual material played by the computer does not necessarily preserve the pitch, duration or morphological structures found in the input (ibid).

Lewis's notion of bi-directional transfer of intentionality through sound as "emotional transduction" in the context of live sound engineering not only defines live amplified musical sound as a specifically mediated epistemological and ontological form, but suggests that the emotional states of the engineer may be mirrored in the output of the sound system, even if the amplified musical material does not explicitly preserve outward musical contributions for the engineer's mixing. In other words, an engineer participates in feelingful mediation even as s/he manages technological transduction (and indeed, Lewis blurs distinctions between engineer and artist in improvised electronic music especially).

Lewis goes further to assert that:

> The incorporation and welcoming of agency, social necessity, personality and difference as aspects of "sound" distinguish such music from work that "incorporates" or "uses" improvisation, or that features "indeterminacy" or aleatoric practices. "Sound" becomes identifiable, not with timbre alone, but with the expression of personality, the assertion of agency, the assumption of responsibility and an encounter with history, memory and identity (Lewis 2000: 37).

Live sound engineering is a form of technological, social, and individually emotional transduction. These transductions *are* constitutive aspects of live sound and not merely *incorporated in* the live sound. Live sounds identify "expressions of personality, the assertion of agency, the assumption of responsibility and an encounter with history, memory and identity."

Fidelity and Sound Reproduction in Live Sound Engineering

Following from Lewis's argument that live sound is constituted from the simultaneous transduction of both audio information and emotional intentionality in "sound" as such, I seek in what follows to answer the following questions: How can amplified sound be conceived of as "faithful" to the sounds that musicians create on stage or the large intentions of musicians to sound a certain way? How can the mixing of the live sound engineer be analyzed in terms of their "faithfulness" to the way an engineer experiences his or her work? Jonathan Sterne's scholarship on the cultural history of recording and sound technology informs my approach to analyzing the conception of "fidelity" in engineering discourse as both a technological and a social construction in which the engineer's work is enmeshed. He wrote "Sound fidelity is much more about faith in the social function and organization of machines that it is about the relation of a sound to its 'source'"(Sterne 2003: 219). I closely follow Sterne's assertion that:

> ….the idea of sound fidelity could never really be just about the sound points us back toward the network, toward fidelity as marking a kind of faith in reproducibility. Sound fidelity was, thus, more about enacting, solidifying, and erasing the relations of sound reproduction than about reflecting on any particular characteristics of a reproduced sound. If perfect fidelity simply meant a set of social and sonic relations in which participants could have faith, it would be no wonder that we find repeated declarations of perfect reproduction from the 1870s on down to the present (Sterne 2003: 274).

Sterne here outlines a history of a modern and culturally specific conception of sonic fidelity, one that reveals the extent to which practitioners and consumers of sound reproduction technologies have often naturalized their faith in reproduced sound products with little regard to the social processes they transduce. The legacy of the social value of this kind of fidelity persists in the term "transparency," often used by audio equipment manufactures, marketers, engineers,

and the consumers of reproduced sound to describe a similar overlooking of the processes of sound reproduction in favor of the product of that work as an apparently flawless copy of an original acoustic image. Lewis's attention to emotional transduction and Sterne's historicization of the concept of "fidelity" combine, for me, to suggest the utility of an ethnographic approach, as I undertake here, to research a form of musical labor that is often overlooked by audiences of live popular music.

The discourse of fidelity does not originate in live sound engineering. It is precisely for this reason that an ethnographic research method is productive in analyzing the vivid social life of fidelity in the context of live music production. Currently, the discourse of fidelity in live sound engineering relates to the discourse of sound recording. Sterne explains:

> The discourse of fidelity is most common and most developed in discussions of sound recording, as opposed to other forms of sound reproduction. This is likely because of the increased ease of careful listening and comparison made possible by recordings as well as by their mobility. Yet the centrality of recording to the discourse of fidelity should not be mistaken for a theoretical privileging of recording as such in my own account: my argument is that the problems described under the rubric *sound fidelity*—some of the key questions that orbit around the concept *reproducibility* itself—apply equally, although in slightly varying ways, to the other kinds of sound reproduction (Sterne 2003: 217, emphases in original).

This dissertation follows Sterne's exhortation and focuses on the construction of "fidelity" in live sound reproduction. The inscriptions of sound to a medium or a format, as well as the extended temporality of a technologist's encounters with an original sound and its reproduced copy, have both produced a common association of the discourse of fidelity with sound recording. The comparatively immediate transductions of sounds and social positions in the process of live amplification may, conversely, explain why less emphasis has been placed on describing the relationship between an amplified "copy" and an "original" sound performed on a

live stage. This seeming immediacy of live performance limits the possibility of transduction coming fully into analytic awareness, although it seeps through when live sound must be negotiated or when problems develop during performances, and especially in the phenomenon of the pre-performance "sound check," as I will describe in ethnographic detail in later chapters.

In Sterne's analysis of audio history, he considers the emergence of the category of "live" performance, which is quite clearly an artifact of the emergence of recording technology requiring the backformation of a qualifying adjective ("live") to distinguish the exclusive conditions of music making from the moment humans first made musical sound until the late 19th century:

> Nowhere is this more clear that in our anachronistic use of the word *live* to describe performances that are not reproduced. As Sarah Thornton has written, the term *live* as we apply it to music (and potentially to all face-to-face communication) entered 'the lexicon of music appreciation; only in the 1950s, as part of a public relations campaign by musicians' unions in Britain and the United States. Although our accepted idea of *live* music emerged from a serious labor struggle over musicians' abilities to make a living at their trade, the term has taken on a life of its own in aesthetic discourse, completely abstracted from its original context. At the time of the unions' public relations campaigns, the word *live* was short for *living*, as in *living musicians*: 'Later, it referred to music itself and quickly accumulated connotations which took it beyond the denotative meaning of performance….Through a series of condensations…the expression of 'live music' gave positive valuation to and became generic for performed music. It soaked up the aesthetic and ethical connotations of life-versus-death, human-verses-mechanical, creative-verses-imitative (Sterne 2003: 221).

This very recent naturalization of "liveness" as a condition of music itself continually frustrates broader social regard for the complex social and technological mediations that produce live popular music. The discourse of "liveness" deprecates the work of engineers by locating technological mediation as an adjunct to, rather than a constitutive element of "living" music. These meanings that the word "live" evokes undermine the highly technical, socially

collaborative and creatively artistic contributions of live sound engineers in the production of contemporary music.

Phenomenology: Time and the Representation of Live Sound Engineering

In order to describe in detail the processes of live sound engineers production of "live" music, I present in the following chapters a phenomenological and ethnomethodological description of live sound engineering. I follow Porcello's engagement with phenomenology as an approach to the work of recording studio engineers, and his emphasis on the complex interactions of aesthetic discourse, technical practice and sound as such in that context. In particular Porcello's application (Porcello 1998) of Alfred Schutz's phenomenology of togetherness and consciousness as aspects of musical performance shapes my approach to describing the temporality of live sound engineering labor, and in ways similar to Porcello, lies at the foundation of my use of "thick description" and narrative writing to evoke the social contexts of sound reproduction in New York City (Geertz 1973).

Porcello uses a metaphor of "print-through" (Porcello 1998: 485-488)—heard as a series of pre- and post echoes in recorded sound from an improperly stored audio tape where magnetic deformations of one layer of tape imprint on the layers below it on a reel —as a way to frame his understanding of how recorded music and its production involve an interpenetration and mediation of particular listening agendas of engineers, musicians, and ethnographer. This closely relates to my fieldwork experiences when encountering live sound engineers during load-ins, set-ups, sound checks, mixing, and breakdown, as well as the brief and fleeting moments when engineers' mixing actually transduces audio signals into amplified sound. The pre-hearing,

hearing, and re-hearing Porcello describes with the metaphor of print-through are common processes in the context of studio sound engineering; as Porcello argues throughout the article, his experience in the recording studio environment required a similar violation of musical time that has been basic to ethnography as well. Porcello describes the phenomenon of print-through to further define it. According to Porcello:

> Audible print-through has both epistemological and phenomenological ramifications for music. It questions the autonomous status that formalist theories (e.g., those of Immanuel Kant, Eduard Hanslick, and Nelson Goodman), through their obsession with musical structure, have granted the musical text, performances of the text, and reproductions of performances of the text. Simultaneously, print-through elasticizes the boundaries drawn around standard conceptions of encounters with music; one's way of experiencing a musical work needs not—in practice, *does not*—begin with the first note and end with the last (Porcello 2003: 264).

As he further explains, the elasticity alluded to in the above quote helps shape the similar contributes to the significance of the ways in which sound engineers and ethnographers alike listen and work. From here, Porcello shifts his focus toward the ramifications of print-through for his work in and around the studio as an ethnographer. He writes:

> print-through struck me as a type of effective narrative practice that foreshadowed events in small ways prior to their further revelation or manipulation in the music. And because of the very fact of foreshadowing—the building of anticipation, tension, and desire attendant to the particularly known object—the eventual impact was that much more intense. An unknowing disciple of Roland Barthes, I reveled in the material *plaisir du texte* and the boundaries of time and sensation that can be blurred by intense encounters with music (ibid: 265).

While Porcello credits literary critic Roland Barthes for his insights into the openness of the sonic text and the blurring of boundaries between interpretation, performance, and engineering, Porcello's phenomenological use of the "print-through" metaphor to analyze the experiential

complexity of musical time as a mediation of social relationships stems especially from the work of Alfred Schutz in his 1951 article "Making Music Together: A Study in Social Relationship" (Schutz 1951).

Porcello writes that his "use of the print-through metaphor both draws upon and opens the space for a reconsideration of the work of Alfred Schutz, who, as part of a larger effort to probe the phenomenology of experience and consciousness, authored two works concerned with music and its implications for a great general philosophy of intersubjectivity"(ibid, 266). According to Schutz, music (for Schutz, this means live performance, but by extension for Porcello, also includes the active interpretation and consumption of live or recorded music) structures a flow of intersubjective time, an internal temporal "flow," which determines intersubjective musical experiences.

This internal flow also "organizes" intersubjective time to create the experience of shared temporality and "togetherness" in acts of music-making. For recording studio engineers and producers, despite the "flow" of musical togetherness that happens in the studio, the demands of the production process and the manipulations of analog audiotape (and more recently, digital signal processing) require and facilitate multiple and temporally divergent hearings of a single musical work, which, in Porcello's view, makes Schutz's conception of shared time and musical togetherness more fraught and complex in the context of recorded music in ways that are congruent with Steven Feld's development of composer Murray Schafer's conceptualization of "schitzophonia" as the "splitting" of sound from the moment of its creation by a source.[7]

---

[7] Feld, Steven. 1994. "From Schizophonia to Schismogenesis: Notes on Discourses in World Music and World Beat." *Music Grooves: Essays and Dialogues.* Eds. Charles Keil and Steven Feld. Chicago: University of Chicago Press.
Schafer, Murray. 1977. *The Tuning of the World.* New York: Knopf.

I deploy a mode of ethnographic writing famously called, by Geertz, “thick description,” in the following chapters in an effort to attend to the relationship between research, writing, and practical participation in live sound engineering, in order to capture the experiential temporalities of live sound engineering in ways similar to Porcello’s descriptions of studio engineers. In explaining his theory of “thick description,” Geertz writes:

> Such a view of how theory functions in an interpretive science suggests that the distinction, relative in any case, that appears in the experimental or observational sciences between "description" and "explanation" appears here as one, even more relative, between "inscription" ("thick description") and “specification” (“diagnosis") between setting down the meaning particular social actions have for the actors whose actions they are, and stating, as explicitly as we can manage, what the knowledge thus attained demonstrates about the society in which it is found and, beyond that, about social life as such. Our double task is to uncover the conceptual structures that inform our subjects' acts, the "said" of social discourse, and to construct a system of analysis in whose terms what is generic to those structures, what belongs to them because they are what they are, will stand out against the other determinants of human behavior. In ethnography, the office of theory is to provide a vocabulary in which what symbolic action has to say about itself -that is, about the role of culture in human life-can be expressed (Geertz 1973: 27).

Following Geertz and Porcello, my representation of live sound engineers in the following chapters seeks “to uncover the conceptual structures that inform our subjects acts” in ways that similarly converge inscription and specification. Ultimately, from these works, Porcello understands the equivalence between research and writing. He writes, “These works strongly problematize the relationship between research and writing, reminding us that anthropology—and certainly ethnomusicology—are as much the latter as the former, are representational practices as well as a strategies for investigating Others' understandings of the social worlds they construct and inhabit”(ibid: 277). The live music context, with all of its differences between inner and outer time, lead me to the writing strategy that I employ.

The following chapters include extended and often introspective narratives that serve my approach to a phenomenological and ethnomethodological representation through thick description. I draw on phenomenology as a mode of analysis that values the experiences, concepts, and social encounters of my research subjects, and ethnomethodology as a mode of research that represents how research subjects produce their own formalized "methods" for understanding their negotiations of their social world. My own subjectivity as both the ethnographer and a live sound engineer, in conjunction with my use of thick description to detail the work of other engineers, as well as my own reflexive phenomenological encounters in the production of live sound, define this ethnography as an example of ethnomethodology.

Chapter Summaries

Chapter one focuses on doing live sound beyond the context of transparency through the example of my own live sound engineering labor. I describe my engineering work with Jazzmobile, Inc. Following the legacy started by Dr. Billy Taylor, I describe practices as a sound engineer in the contemporary practices of Jazzmobile, and argue that these phenomena are acts of cultural repatriation. In this way, the Jazzmobile live music production is an example of community production in which the collaboration of regular performers, production workers, audience members and live sound engineers, in the context of Harlem as a community, greatly problematize the modern ideology of transparency as a practiced mode of amplifying musical sound. This description and analysis is presented in stark contrast, not only to the context of production that the following chapters explore in the work of other live sound engineers, but also to my own earlier experiences in the profession. The significance of this reflexive engagement with my own experiences of professional labor manifests in juxtapositions of the experiences I

describe working with other engineers with the opening of this introduction and my reflexive considerations in subsequent pages.

Chapter two studies the live sound engineering work of Randy Taber, a professional live sound engineer who as worked in New York City for over twenty years, offering a representation of standard labor practices in professional live popular music making. I describe his contractual work in multiple venues, and working with different genres of music in the New York City metropolitan area. These shifts in venue and genre directly impact his labor. The chapter focuses on a thick description of a show at Tarrytown Music Hall, where Randy worked as a system technician at a live performance by popular rock music artist Pat Benatar; another at Hammerstein Ballroom, where he mixed a music theater review; and a third at the nightclub City Winery, where he mixed a folk revival and rock performance by John Sebastian and Jimmy Vivino. I focus on set-up and sound check more than musical performance at Tarrytown Music Hall and Hammerstein Ballroom, in order to attend to the different processes of labor Randy faces in each venue. At City Winery, I focus on how Randy constructs intimacy through his tacit knowledge in fader movements while mixing between two transductions at the mic and the loudspeaker. I also trace how Randy preemptively mitigates feedback and odd resonances that threaten the transparency ideal through fine-grained temporal adjustments that strategically delay the amplification of sounds from loud speakers. This is one of many salient virtues of Randy's live sound engineering practice that distinguishes him from comparatively amateur live sound engineers who would compensate for these anomalies using an equalizer. Randy's discussion of time alignment in this chapter theorizes how examples of sonic colorations are the product of temporal discrepancies. As Randy's status on the shop floor changes from venue to venue, he is

practically collaborative with musicians and stage managers and ideologically invisible to the audiences.

The final chapter describes the labor of Broadway theatrical sound engineer Justin Rathbun. Sound production on Broadway is the joint effort of sound "designers" and live sound engineers (who are sometimes the same people, but more usually specialists). This chapter introduces the sound designer team for this Broadway musical and compares and contrasts aspects of their role with that of live sound engineers and how their choices about selecting sound amplification equipment is a negotiation with the budgetary concerns of producers as well as the sound art of a musical. In Justin's work as the sole engineer in the art world of the Broadway production *Porgy & Bess*, sonic color, as an interrelation between timbre, human hearing, genre, equipment resonances, venue and race, shapes his live sound engineering. Justin's labor exemplifies how mixing mediates ideological oppositions of color and transparency, and heterogeneity and homogeneity, in live popular music. Live sound engineering on Broadway represents arguably the most prestigious example of live sound engineering practice, with the most state of the art sound amplification equipment available in the world.

Engineers and those selecting live sound reinforcement equipment share an ideological and technical preference for sonic intelligibility and transparency. However, in practice, variations in the understanding of transparent and opaque—or clear and colored—sound amplify at different times in very subtle and nuanced ways at these productions. Listening and adjusting for sonic colors is a central aspect of a Broadway musical sound engineer's labor; in particular, such an engineer works to listen to distinctions in the sound quality between direct acoustic vocal sounds from the stage verses amplified versions of those sounds that are further colored by

equipment resonances and acoustic resonances within the venue. In addition, the challenge associated to critically listening to and mixing the same Broadway production eight times a week is fatiguing for engineers in this context. This fatigue makes the engineers' efforts to maintain both the intelligibility of sounds from the stage, as well as his efforts to artfully effect sounds in the mix, very difficult. The engineers' negotiation of these sonic colors within the process of amplifying sound in a Broadway theater also expresses the engineer's musical aesthetics and participations in modes of producing sound that evoke specific associations to aspects of race and representations of race and genre.

In summary, and as I discuss in the Conclusion of this work, this dissertation focuses on the work of highly experienced engineers at the height of the profession, and working typically within an industrial style of shop floor culture, where labor is subject to unionization and strict rules of conduct and compensation. I represent this milieu as crystalizing over a century of the development of live sound engineering as both practice and technology. These laborers remain central in the broader ideologies of mediated sound and are just as relevant today as they were a century ago. I also represent my own sound engineering work as a way to think about what has happened in live sound engineering labor, in ways that could complicate sound engineering as social practice by attending to its moving relationship to music culture and technology more generally.

Chapter One: Whitney Slaten Engineering for Jazzmobile in Harlem

Jazzmobile, Inc.

Dr. Billy Taylor founded Jazzmobile in 1964 as the first non-profit arts organization committed to jazz. Jazzmobile's primary mission is to present live jazz, free of charge, to the greater Harlem community. Taylor conceived of this initiative in response the economics of the late twentieth-century jazz industry, in which jazz promoters primarily booked professional performances in downtown nightclubs and concert halls with high-ticket prices for predominantly white upper-middle-class audiences.

Through its business office located in Harlem, Jazzmobile has hosted Summerfest, a festival spanning the months of July and August, for over fifty years. Summerfest features professional live jazz performances throughout New York City neighborhoods, including a weekly performance series at Grant's Tomb in Harlem. Corporations, city agencies, community boards, block organizations, churches, and park associations sponsor and co-host the outdoor concerts. Taylor's vision was to bring jazz to the communities from which the genre developed, "directly to the people where they live"(Schramm 1982: 4). All of the concerts are outdoors, beginning at seven o'clock sharp and ending at dusk. Audiences, ranging from groups of fifty up to one thousand, gather for these free concerts, bringing folding hairs, food, alcohol, and blankets as a part of a leisure experience. Marcus Garvey Park, Jackie Robinson Park, the 155th Street Block Association, the 32nd Police Precinct, Brooklyn Bridge Park and Brooklyn's McDonough Block Association are some of the organizations that annually co-host Jazzmobile Summerfest concerts.

My Work Engineering with Jazzmobile

My own association with Jazzmobile began in 2007, when I was contracted for live sound engineering services through my audio company for the organization in its first (and only) Summerfest performances in Newark, New Jersey. In spite of the fact that audiences were scanty, Jazzmobile organizers, members of the Newark parks department, and I produced jazz concerts outdoors in every ward of the city. My association with the organization has continued since then, as I describe in detail below.

The Jazzmobile Team

In New York, at the request of Jazzmobile's Vice President of Programming, Linda Walton, I began live sound engineering for Jazzmobile at its primary venue, the Grant's Tomb National Memorial, in 2008. We routinely put on concerts there for audiences of over 1000 people, with the then-elderly founder, Dr. Taylor, often seated in the front row, accompanied by Robin Bell-Stevens, the president and CEO of Jazzmobile. It was in the course of these gigs that I met Darryl, one of the fastest stagehands I have ever seen, and Eddie Moncion, once Billy Taylor's handler and a devoted worker who assisted Robin, Linda, Vicky, and myself. For a period, I had the great pleasure of working with someone affectionately referred to as "The Queen of Hang," Sheila Anderson, the longtime host of a program on the New York Metropolitan area's famous jazz radio station, WBGO. Sheila would MC at certain performances, and it seemed that she knew every musician, where each of them had just performed, and where they would be performing next, without ever having to ask or refer to a sheet of paper. I also met

Johnny Gary, warmly known as “Mr. Jazzmobile” by the Jazzmobile audience and musicians. Johnny had been the stage manager for Jazzmobile since its inception. In addition to working as a road manager for Count Basie and his Orchestra and for Sarah Vaughn, Gary had been the manager of the world-renowned jazz club Birdland. With his extensive background experience, Johnny brought unique knowledge to the Jazzmobile performances he ran.

The icon of Jazzmobile is the truck-based parade float that served as its outdoor stage for performances throughout Harlem and other New York neighborhoods. This float, on which all of the necessary sound amplification equipment was stored, had become the visible symbol of the organization’s efforts to mobilize jazz performance in the city. Johnny would simply have workers and volunteers lift and position the equipment within and around the float in preparation for each performance. However, the organization’s second float had begun to deteriorate due to water damage, and the costs of storing the float and equipment in separate locations throughout the year prompted Linda to hire me to set up my own sound equipment at traditional Jazzmobile sites, without the float.

Vicky would typically get to the sites first. She almost always gave me a hard time about something, and, while I never quite understood what her role was, it never seemed appropriate to ask. I think Robin and Linda paid her, but I had never seen them ask her to do anything in particular, in marked contrast to their explicit instructions to and demands upon Eddie and Darryl. Moreover, while Eddie and Darryl often asked me what they should do in setting up the stage areas, I was leery of instructing them, since I was

unsure of the formal division of labor in these unique shop floor cultures. Eddie and Darryl were paid members of the Jazzmobile staff, and held positions distinct from the managerial staff, which was inclusive of Robin, Johnny and Linda. Often Vicky, a volunteer, would micromanage everything that I did, tell me where I should park my car (and where I should re-park the car after I parked it), and where she thought the main speakers should go after I had positioned them. She would ask me why I didn't bring more equipment, or a generator to venues with no power source nearby. When I asked her questions about the setup, however, she would tell me to ask Robin or Linda or Johnny. Just before Johnny and Eddie arrived in their small red car, Vicky would set up a microphone stand or two, and then mysteriously disappear.

Vicky was ever-present and involved at Jazzmobile productions. However, as a significantly autonomous and, at times, sovereign volunteer—in ways that structured her subject position far beyond the formal manager-employee dynamics—she vacillated between representing the interests of Jazzmobile as an organization, musicians, the audience, and the broader Harlem community. She sometimes directed me to set up or break down the sound system in ways that were responsive to the needs of the homeless, nearby children, the elderly, and residents who might not have even attended the Jazzmobile events. As such, as the live sound engineer for Jazzmobile, my encounters with Vicky significantly shaped my regard for Jazzmobile productions as very socially constructed and intrinsically situated within the milieu of everyday life in Harlem. My regular encounters with Vicky about the significance of the interactions between Jazzmobile, my sound engineering, and the community, and the years it took me to learn

this lesson from her, led me to consider the ways that other participants have also contributed to a finer definition of how the worlds of modern technology, arts production, and community involvement converge. What follows are descriptions of my encounters and relationships with key Jazzmobile participants.

Johnny Gary

Johnny,[8] a man in his 80s, would limp out of the car supported by a West African carved wooden cane in hand, large-framed Billy Taylor-styled eyeglasses on his face, a gold chain and medallion around his neck, and a toothpick in the corner of his mouth, yelling, "Where's that girl?" "Girl" was Johnny's overt code for a traditionally patriarchal jazz industry attitude. This patriarchy extended to Johnny's assessments of Robin's and Linda's creative efforts to sustain Jazzmobile during a period when many other not-for-profit arts organizations (including the New York City Opera) failed, due in part to lingering fallout from the 2008 recession. I was always aware of the fact that what I observed of Johnny's patriarchy was mild compared to the patriarchy of the big band era in which he began his career.

Economic factors notwithstanding, Johnny primarily thought of Robin's and Linda's work as, in his words to me, "women ruining Jazzmobile." In my earlier visits to the organization's office on West 127th Street, I would wave to Robin in her corner office when the door wasn't closed for a meeting, typically on my way into Linda's office. In so doing, I also passed by Johnny's small office. In most cases, he would be tilted back

[8] At the deposit of this dissertation, sadly, Johnny Gary (1924-2018) had just passed away.

in his office chair with his hands folded resting on the top of his head, sleeping, while a small speaker on his desk played Sarah Vaughn singing obscure ballads.

At the Jazzmobile offices, I always felt like I entered a world sharply divided between what jazz scholars have called "moldy fig" and "progressive" attitudes toward the music's identity, expressed as conflicts about Jazzmobile's future, its role in the music's changing social context, and the intersection of gender politics, with Johnny's views on jazz coming into conflict with the current powerful centrality of women in the management of arts organizations. Yet, in spite of these clashes, I could see that everyone involved found a familiar comfort in the performances of such gendered roles as female "organizers" and male "producers," before, during, and after the concerts. This ebb and flow of conflict with and resignation to a patriarchal system of gender roles dynamically characterized the relationship between the three of them.

At the performance sites, Johnny was very kind to me, in part due to his apparent expectation that, as a male musician and engineer, I would be sympathetic to his views. He would often complain about Robin and Linda; I generally shrugged my shoulders in an effort not to become involved in those clashes. Nevertheless, I do not mean to paint a negative or one-sided picture of Johnny Gary. His tough exterior never seemed to fool anyone into thinking he did not have a warm and genuine presence. Through exchanges of firm handshakes and stern talk, Johnny maintained his persona in the eyes of musicians, crew, and audience members as "Mr. Jazzmobile." My wife would often attend performances, and Johnny would frequently embrace her and tell her that she reminded him of his own spouse. When we were married, as the regular MC, Johnny had

us stand up in the middle of the audience and announced, “The sound man got married!” and then quickly, in front of everyone, asked, “When are you going to have kids?”

His commentary to audiences as an MC also revealed his complex gender politics, especially when the headliner was a female vocalist. Typically, the rhythm section of such an ensemble would play a few numbers before the vocalist entered the stage. Before her entrance, Johnny would grab an announce microphone and say, “First you had an appetizer, then you had the entree, now it’s time for dessert!” and announce the vocalist’s name. Johnny’s performance also exemplified a masculine shopfloor culture of sound engineering and its relationship to a larger patriarchy in the music business and the broader culture, a culture in which my own male privilege and role as a male live sound engineer are implicated, in spite of my best efforts to resist these oppressive cultural structures.

After stepping out of his car and briefly working with me to ensure that I knew what I was doing, Johnny spent most of his time organizing the leather-bound account book, which he would have Eddie make sure all of the musicians signed, and then he would give out paychecks to the musicians. During brief moments of downtime, before the shows’ 7:30pm start, he would commonly tell us his road stories. Once, he described to me his theory of stagecraft, which equated the stage itself to a woman’s body that we crew members properly dressed and undressed over the course of a production. This was his way of expressing the modern industrial ideal of “transparency” in the production and amplification of staged “live” performances.

In my analysis, throughout this work, of the different concepts of "transparency" that emerge from social negotiations across live music contexts, Johnny's understanding of the concept stands out for its imagery. His conflation of "dressing" a woman with the transparency achieved by the placement of sound equipment in an outdoor, not-for-profit jazz concert, was a far cry from the understanding of transparency I gained from working with my father. Although both my father and Johnny Gary were black men of a similar age, with roughly equal seniority in the New York City music industry, their perspectives on hidden production labor were very different. While my father's belief system and work ethic do not easily lend themselves to sexualized comparisons, Johnny Gary's frank assertion of stagecraft and live sound engineering labor ultimately undermined the ideal of transparency.

Vicky Gohlson, Ph.D.

Although I tried, it seemed as if I could never be transparent or invisible enough for Vicky, who always seemed to reemerge once the habitual commotion of Johnny's entrances settled. Vicki made a concerted effort to treat artists very well in front of me. This in itself did not bother me, as it has always been a goal of mine as well, especially since, in other contexts, I have identified as the artist in this scenario. However, Vicki's solicitousness extended to asking me to provide chairs and tables for keyboardists and bassists, rugs for drummers, and water for horn players or vocalists. I often explained to her that I did not have those items, and that I only provided the sound system. Meanwhile, others, like Eddie, strategically knew when to leave the stage so as to avoid

being bombarded by such directives. As the sound engineer, however, I could not leave, which Vicki appeared to interpret as my being available for her instructions. During the stress of preparing for the downbeat at 7:30, further intensified by Johnny's mandate that there be no sound checks at Jazzmobile, which was very different from the flow and professional standards of a commercial popular music gig, where "transparency" isn't improvised on the spot. I was always scrambling to get ready and establish a mix for anticipated sounds that I had not yet heard. At these times, however, Vicky kept up her barrage of requests. Sometimes I did what she wanted.

At other times, however, I resisted. For example, Vicki would never let me get away with confronting her in front of the artists. On one occasion at 7:15, just before the start of the show, she told me to aim my headlights at the steps of Grant's Tomb so that the musicians would be able to see their way back to Riverside Drive. My car was parked near the Tomb, with the headlights facing away from the Tomb, so that my trunk, where I unloaded equipment, was positioned as close to the Tomb as possible. Vicky told me to turn my car around. I blew up and said that I wouldn't do it. Within five minutes, park rangers told me to remove my car from the steps of the Tomb that night and for the rest of the summer, which meant that I had to lug equipment from a whatever street parking I could find. At times I played nice with her, and at times I was hardheaded.

Slowly, however, over the years I began to respect how productively persuasive she was in the service of making our experience producing the shows better. She seemed magically able to secure things like electricity or generators from NYC Parks Department workers, even in cases where there was no permit for this, as well as to prevent parks

workers and police from stopping me from moving my car and equipment closer to prohibited stage areas. I will never forget an occasion when she was in the passenger seat as we were headed deep into an overcrowded Brooklyn Bridge Park. Through email exchanges with Robin days prior, I was sure that we wouldn't be able to enter the park, and that park workers would meet me with a pickup truck to take my equipment to the stage, roughly half a mile away, which, though it complied with Parks Department regulations, was not an ideal situation. Vicky said to keep driving into the park's pedestrian entrance. A college-aged woman with a boom microphone and a clipboard immediately stopped us and said that cars were not allowed in the park. Vicky said that we were the crew for the performance and added, "Oh, we aren't parking, we're just passing through." The young woman was perplexed and in that pause, Vicky told me to keep on driving. We ended up parking there.

Tricks like these worked on many people whom Vicky sought to persuade, including me. Whenever I resisted her influence or demands, or when I thought she was being ridiculous, I feared that I was going to suffer the consequences in some way. Despite her sometimes annoying and infuriating style, Vicki revealed herself over time as a wise and powerful leader. Alas, and sadly, Vicky Gohlson died on October 14, 2014. Beyond easing the pragmatics of putting on jazz shows in Harlem's outdoor settings, she taught me the importance of sincerity in representing and reproducing culture in that context. In ways that made it seem eerily as if she knew of my lifelong struggles with visibility and invisibility in the world of live sound engineering, Vicky's work encouraged me to believe that engagement—not just with audio gear and sound levels but

also with audiences, musicians and crew members in Harlem—could reveal my own explicit place in the world, a prospect that is not common for many of my counterparts who engineer live popular music productions. I will always miss her.

Vicky never easily described her life experiences to me, preferring instead to inculcate her community values through direct instruction. Although she had long been a member of Community Board 9 in the Sugar Hill neighborhood, as well as of the West Harlem Development Corporation, she rarely discussed her work. Likewise, she almost never spoke about her extensive work in media, including her role in the documentary *I Remember Harlem* (Miles 1981). And she absolutely never spoke of her activities with Columbia University's expansion planning, which I only learned about by overhearing people talking with her during Jazzmobile events, and by looking her up online. Somehow I knew that it was better for me to not bring those things up with her. Perhaps my being a Columbia student, as well as a young African-American man working in Harlem, encouraged her to choose the immediacy of our tasks as a way for her to share with me her respect for the community, particularly for Harlem's youth and seniors.

In moments of reprieve from her usual didactic approach, Vicki revealed certain places, events, and people in the Harlem community to me, as well as her loving ways of interacting with them. At the conclusion of a co-sponsored Jazzmobile event, in which I amplified sound for a music/theater/dance group within the highly reverberant Wilson Major Morris Community Center, Vicky took me through the back door of the space and showed me the senior garden that she had been working on for years. It was an expansive, well-manicured green space bordered by Amsterdam Avenue, St. Nicholas

Avenue, and West 152nd and 153rd Streets, with flowers, paintings, sculptures, and detailed murals about black history, partitioned by a long, winding paved path between benches. She told me that it was a quiet place for the seniors in the neighborhood, and that children could explore the space and encounter its art and history murals after school. Vicky's obvious dedication to this garden reinforced my understanding of her commitment to Harlem as a community.

After one Jazzmobile event at Grant's Tomb, I gave Vicky a ride to her home in West Harlem. As I made a right turn from Broadway onto West 125th Street, we saw that the comedian Chris Rock was shooting a movie in the supermarket on the corner. Bright lights and production trucks lined the street, and Rock himself was clearly visible through the large supermarket windows. Vicky told me to stop directly in front of the supermarket and wait there until she said it was time to drive away. Immediately, an annoyed assistant director, a young white man with a boom microphone headset and clipboard, came up to the car. Vicky calmly rolled down the window. Trying not to be too frantic or angry, the assistant director explained to this elderly, somewhat militant-looking black woman wearing a bright bandana and dark sunglasses, that they were in the midst of shooting a scene and our car was in the frame.

Vicky asked him if the production had made a donation to the community garden that was adjacent to the supermarket. His demeanor changed, and he quickly became much more accommodating. He said he was not sure if a donation had been made, and asked for the contact information of the recipient. Vicky wrote the information on a piece of paper and gave it to him, asking him in turn for the contact information of the member

of the production who would be making the donation, all the while gesturing that we would not move until he went back into the supermarket to get her the information. He did. She was satisfied, and we drove away.

During another Jazzmobile setup in front of the police precinct on West 135th Street for the "National Night Out" police and community block party, as I waited for an officer to throw an extension cord from the second story window of the police station while being bombarded by cacophonous rap and new jack swing from the DJ's woofers, Vicky screamed into my ear while pointing out the many youth groups that would perform on the temporary stage before the Jazzmobile performance. She told me a little about each of the groups and their directors. I had seen some of these groups, such as the historically black college/university style marching band at the 153rd Street Block Party that Vicky organized every August. She always asked a band with a singer from Jazzmobile to perform and me to do the sound, negotiating a lower rate, which I agreed to because she paid in cash—which, however, she made me chase her down for at the end of the gig. Inevitably, this entailed following her into the senior garden. After I had packed up, and the clash between the sound systems of the R&B DJ and the Bachata DJ resumed, Vicky had a reception for the local seniors and the Jazzmobile audience regulars in the garden. There, she would pay me, always giving me a warm plate of food as well.

Linda Walton

Linda Walton was a similarly important figure at Jazzmobile. She always impressed me as a deeply spiritual woman whose interiority seemed to touch the people

with whom I worked. In addition to emceeing and cutting everyone's checks, it was clear from the way she greeted me and the musicians that, in addition to her participation in the pragmatics of the organization, Linda cared deeply about the sound of the music and the people who were making it. She listened carefully. She knew, heard, and felt every adjustment I made to the mix, evidenced by subtle nods that she would make when listening. It seemed to me as if Linda and I listened to the improvisations of the musicians in a similar way: our attention to the details of the music was precise, almost granular, like the attention a linguist would give to tiny adjustments in the sounds of a language's phonemes. Linda programmed the festival schedule, strategically selecting, hiring, and scheduling performers in ways that gave a well-defined arc and an almost sonic narrative to Summerfests each year.

Robin Bell Stevens

After Vicky's passing, Johnny moved away from New York to be with his daughter in Maryland and Linda moved on to run the Harlem Arts Alliance. Thus, in addition to her executive and fundraising duties for the organization, Robin became more involved in each Jazzmobile production. In countless phone conversations over the years in anticipation of upcoming Summerfest events, I learned about her work with corporate sponsors, city council members such as long-time Jazzmobile supporter Inez Dickens, and the New York City Parks Department, as well as about the partnerships she forged between Jazzmobile and different arts organizations in Harlem. Robin's work was complicated, and she deserved significant credit for sustaining Jazzmobile over more than

fifty years of dedicated service to the presentation and promotion of jazz. In her role as the guiding figurehead of Jazzmobile, Robin can be said to have faced the organization's funding issues and relationship to the business community strategically, in spite of the fact that some of her colleagues accused her of simply selling out to corporate interests.

Nevertheless, in putting Jazzmobile's mission first in her relationships with the business community and private benefactors, Robin was able to divert corporate funding streams to the preservation of the art, culture, and history of Harlem—by some measures, a fairly subversive way to use profits. One such set of Robin's cultural-corporate partnerships with which I was involved was the Harlem Jazz Shrines Festivals in the spring of 2011, during which Jazzmobile, The Apollo Theater, Harlem Stage, and Columbia University, as well as participating restaurants, clubs, and property owners, collaborated in reviving and commemorating historically significant jazz venues of the twentieth century, including the Apollo, the Alhambra Ballroom, Lenox Lounge, and Minton's Playhouse, among others. Over the years, I had provided my services to the festival at the Alhambra Ballroom, as well as an unused space in Magic Johnson's Movie Theater decorated to pay homage to one of the clubs that had been demolished, and at Minton's Playhouse. Minton's, with all of its original fixtures, was abandoned when Robin and I first discussed outfitting the space with a sound system. It smelled a bit moldy, the floor tiles were loose, and all of its surfaces were covered in soot. It was a major undertaking for Jazzmobile workers and volunteers to prepare the old club, which is often credited as the birthplace of bebop.

I met Robin and Linda at Minton's in May of 2011 to assess the electricity in the precarious venue, as well as the possibility of a loudspeaker delay network for the long, narrow space. During the festival, I spent several twelve-hour days there engineering lectures and discussions by the likes of Stanley Crouch and Farrah Jasmine Griffin, performances by Steve Turre and Robert Glasper, and late-night jam sessions that filled the space with epic improvised solos from many New York-based jazz musicians. At four in the morning, when the music ended, I had to unload all of the sound equipment through the narrow doorway and into my small car, finally arriving home to see the sun start to rise. I was tired, but it was worth it. Not only did these long hours help pay the rent; they also allowed me to play a crucial part in commemorating and revitalizing Harlem's history and culture. This is how it was to work with Robin: She started with a vision for each event, then procured the corporate funds. Next, she and I would discuss the feasibility of pulling it off. In the end, we pulled it off.

Eddie Moncion

Robin and I could not have achieved as much as we did during Jazzmobile events had it not been for Eddie Moncion. The son of a father from the Dominican Republic and a mother from Puerto Rico, Eddie had never been to either place; instead, he identified as a Harlemite, and had lived his entire life in Spanish Harlem. A "roadie in a suit," Eddie would meet me onstage at each show and begin helping me set up, frequently reminiscing about traveling the world on tour with Dr. Billy Taylor. Eddie knew my setup better than anyone who has ever worked with me. He would yell out to ask me what the evening's

lineup was; I would yell back that it was either a quartet, a quintet, a singer, a Latin jazz group, or a big band, and he would know immediately what microphones I preferred where and how I wired them into the mixing console. Eddie's expertise emerged from his years of work with Jazzmobile under Dr. Taylor's mentorship, as well as his keen observations of my engineering practices. Like Vicky, Eddie knew how to smooth things over with members of the parks department staff and the police. He was always lighthearted, and made working in the demanding context of live musical performance much easier; it was a pleasure to work with him.

The Jazzmobile Audience

"Let Us Have Peace"—the epigraph etched above the tall columns of Grant's Tomb—has always inspired me. Ulysses S. Grant, the Union general who defeated the Army of the Confederacy at Appomattox, spoke these words in 1868 as a presidential candidate—words which, in the aftermath of the Civil War and in the wake of the conflict-ridden efforts of Reconstruction to establish full citizenship for African Americans, had a profound resonance. Indeed, the ultimate failure of Reconstruction was, in a certain sense, responsible for the cultural vibrancy of Harlem itself, to which Grant's Tomb stands as a gateway: As the escalating violence against southern blacks led to a great wave of migration to northern industrial cities, African-American enclaves like Harlem, with its amalgam of southern rural and new urban cultures, sprang up.

As a resident of Harlem whose family was among that first great wave of southern black migration, I have often stood at the foot of Grant's Tomb, reading his words and

reflecting on the tensions between the peace for which he advocated and the many historical violations of the dignity of families like mine. I have also pondered in these words the absence of my own peace just before beginning my labor as a live sound engineer—a lack of peace informed by a particular kind of internalized capitalism, and overdetermined by the intersections of my black masculinity and my status as a laborer in a cultural service economy—a laborer responsible for amplifying sounds while avoiding coloring these sounds with proof of my own agency, and even for hiding any trace, as I duck behind the sight lines of audiences and musicians, of my own existence.

The ideology of transparency that encourages these expectations of invisibility closely resembles my father's participation in creating his own invisibility while engineering the Hasidic girls' school shows. In fact, being invisible was not only a naturalized state for my father; it was also a state that had been passed down for generations in his family. His father was a professional church keyboardist, his uncle was a piano mover, and his grandparents, upon their arrival in New Jersey from Virginia late in the nineteenth century, had worked respectively as a chauffeur and caterer for wealthy beer barons. While each generation experienced a consistent upward mobility, this progress also entailed the expectation to work quietly and to remain, as it were, hidden. (This reminds me of the scene in Lee Daniels' 2013 film "The Butler" in which Cecil Gaines begins working within the White House and is instructed to serve in ways that makes the room feel empty when he is in it.) For me, not only as my father's son and as a live sound engineer, but also as an African-American raised in a supposedly integrated

middle-class suburb, perpetuating such invisibilities posed a special challenge when doing live sound.

Musicologist and composer George Lewis has discussed the effects of the Great Migration African American musicians. Drawing on Griffin's work, he emphasizes the experiences of loss that informed an "assertion of mobility and agency" for musicians formed in that experience.

> The first-generation AACM founders were all children of the first wave of migrants to venture north [from the US south]. Here, literary theorist Farah Jasmine Griffin's analysis of texts around the migration constituted an important influence on my own reflections on the first-generation AACM musicians. Like many migrants' recollections, the stories of the South told by the early AACM founders tended to coalesce around the theme of loss: in particular, the loss of land, and the fall from a state of independence that such losses produced. Another Southern theme concerned the social and physical violence to which these communities were constantly subjected; usually some watershed threat obliged the former Southerners to become refugees. Following Griffin, I observe that the migrants' twin assertions of mobility and agency set the stage for how these musicians looked at artistic practice later in their lives"(Lewis 2008: xxxvi).

I argue here that these effects have continued down through generations, including in my own family, and can be applied to the broader art world around the musicians Lewis discusses. My work live sound engineering at Jazzmobile exemplifies a way in which my personal relationship to my role as engineer is mediated by my social identity and experience of (in)visibility as a laboring/raced/gendered subject and as a descendant of the Great Migration working to present Jazz in Harlem in the present. I argue that such factors can be generalized to other engineers working in other contexts, and that live sound engineering, as an artistic and personal labor, is overdetermined by layers of social

power and identity—or the "twin assertions of mobility and agency" that Lewis describes (ibid). In short, the meaning of being visible or invisible, in charge or at someone else's service, creatively free or answerable to the aesthetic demands of others, is always embedded in the particular histories of the individuals, communities, and fields and genres of practice with whom and with which live sound engineers must interact to do their work.

Jazzmobile Audiences and Outdoor Labor

As I stood before Grant's Tomb just before doing sound for yet another Jazzmobile show, I tried to suppress my inner conflict. Nevertheless, the mere fact of my work as a live sound engineer in this location exemplifies some key disruptions to the aforementioned history of tactical black invisibility, as well as to my own experiences of "invisible" technical labor in the context of that history. Doing live sound engineering at Jazzmobile and amplifying jazz music outdoors disrupted the live sound engineering industry's expectations for a live sound engineer's hidden labor and the historical and current dangers of the outdoors for black people. Indeed, even the seemingly neutral setting "outdoors" has a historical implication, since the outdoors has often been the setting for public violence against black populations in the United States, as the locus both of most enslaved (agricultural) labor and of lynching. Moreover, the outdoors, and parks in particular, have historically been sites of police brutality against black people, for whom racial "visibility," and audibility in public spaces has traditionally been dangerous. The invisibility of a live sound engineer, a seemingly neutral aesthetic/ technical fact, is emotionally and ideologically connected to the invisibility of my black

laboring male body in public space as a form of hegemonic power that shapes my own agency and experience. I detail below these two disruptions to describe how current Jazzmobile audiences, and I, as the engineer, listen for cultural repatriations of professional jazz performances within Harlem's urban soundscape. Harlem, like other black communities, formed, in part, as ways of defending against racist violence. Historically, these community members sought safe spaces to be outdoors and not under threat. This history is also part of Dr. Taylor's insistence on outdoor live jazz performances in Harlem, a politic that undergirds my live sound engineering at Jazzmobile.

Three groups appear to comprise the majority of the audience for Jazzmobile's concerts at Grant's Tomb. One group, defined broadly by their lack of deep familiarity with jazz or the Harlem community and their irregular attendance at Jazzmobile events, consists of young white families (reflecting an ongoing gentrification of Harlem), as well as middle-aged Japanese and European tourists, young professionals from an array of racial backgrounds, and fans of a featured jazz artist, who otherwise attend Jazzmobile concerts only occasionally. A second group consists of older African Americans—members of the so-called "Great Generation"—who are committed to the music and culture of Harlem, and whom I call the "older regulars." The third group—of particular interest to me—includes what I call the "younger regulars": African-American baby boomers and those born just after desegregation—my own cohort. The younger regulars talk about having attended Summerfest events as children with their parents. Most of them no longer live in Harlem, but return to the concerts in an act of remembering their

childhoods and commemorating their family history. In what follows, I profile selected members of the Jazzmobile audience to draw out their common characteristics as well as their divergent motivations and expectations. These audience members sometimes interacted with my live sound engineering practice, in forms like saying hello to me, asking about how I was doing, and commenting on the quality of the sound or the musicians' performances—rupturing my labor transparency. But in a broader sense, they did so whenever they attended to the sounds emerging from the speakers by the stage, whether or not they were aware of my active role in helping to create that experience of "live" music in a historically salient space.

Profiles of Individual Jazzmobile Audience Members

Mtu

An African American man who went by the name Mtu was one of the younger regulars. Mtu was always outfitted in crisp linen, and always wore a straw fedora or pork-pie hat above his sunglasses and thick mustache. He called me "Brother Whitney," which I appreciated. Mtu always greeted me as I was setting up and asked about my equipment, wondering how I got such a big sound from my medium-sized sound system; he was himself active in producing jazz concerts and related events in Brooklyn and Staten Island, and told me that he had been looking into buying some sound equipment to bring to clubs and spaces that did not have their own sound systems. I was happy to talk shop with him before he made his way to the front row of outdoor folding chairs, that spot near

the constantly circulating wine spritzers that I always missed out on. Mtu and I shared a rare relationship between audience member and live sound engineer.

Buddy

Buddy, an older African American man, on the other hand, never left me out when pouring and passing inconspicuous dental rinse cups of warm Grand Marnier in front of the Louis Armstrong House and Museum in Queens, where Jazzmobile presents a Latin jazz group every year. Buddy lived way out in the borough near Cambria Heights, and drove his large Mercury Grand Marquis to almost every Jazzmobile performance throughout the city, usually accompanied by his wife and adult daughter. As vintage as the car were his classic folding lawn chairs, which always seemed to outlast everyone else's new chairs purchased from Amazon.com. We would typically wave to each other before the beginning of each performance, and afterward we would talk. Buddy knew that certain performers regularly gave me a hard time, like wanting the mix louder in their monitor, and he would ask how it went with them. It felt good that I could kvetch to him about it all, as he was someone who offered a forum to debrief about my live sound engineering labor and practices at Jazzmobile performances. Like my relationship with M2, my relationship with Buddy was another example of a rare audience member-live sound engineer relationship.

The Photographers

There was always a large contingent of audience members who seemed to identify as photographers, although they couldn't all have been making a living in the profession. While I do not profile individual photographers, their collective presence among the Jazzmobile audience is worthy of note. A few of them even had the iconic fisherman's vest, as if all of those pockets were holding canisters of 35mm film. All of them shot with professional-grade digital single-lens reflex cameras, whose immediately recognizable white Canon telephoto lenses were an obvious status symbol in the group. These self-styled photographers, all African American man, as a whole must have shot thousands of exposures yielding a plethora of impressionisms of every Jazzmobile performance. However, no one could ever find a single one of these photos online. Johnny Gary used to say that even before the emergence of the Internet, not once in fifty years had he ever seen a single photo. I used to see some of the photographers at B&H Photo on Ninth Avenue in Midtown, but there, as well as at Jazzmobile gigs, we just nodded to each other. In those nods, nevertheless, was a tacit understanding that we were all gear-heads to some degree, and, perhaps, that they, as well as I, worked in the capacity of transparent or invisible laborers.

Erroll

Erroll was also one of the older African American regulars, and a quiet fellow who mainly kept to himself. He would be at the venues early, and would limp over to shake my hand, and, though we never had much to say to each other, I always felt a deep sense of appreciation from him. One day, I ran into Erroll at a Whole Foods Market;

evidently, both of us were trying to eat a bit more healthily. We sat down and had lunch together, and he told me that his father used to bring him to every performance when he was a child. Jazzmobile was a part of his life. He had worked for Con Edison for over thirty years, though he didn't specify his particular role, and in the summers he would ride his bicycle to every performance: It helped him, he said, to get through his job. I saw him at every gig.

Sabella, the Woman with Topless Feathered Hats

A woman whose name I never knew, until years later, sat in the center of the front row at Grant's Tomb and Marcus Garvey Park. She, too, was an African American, who seemed to be in her eighties. She wore brightly colored dresses and matching broad-brimmed hats; the tops of the hats were lined with feathers, but the lid was exposed. You couldn't miss her. She would always look my way and holler out, "Hey there, darling," in what sounded like a hybrid Virginian/Northeast drawl. She looked, sounded, and in many ways acted like my late grandmother. She was a warm, feisty presence who made me feel as comfortable as possible doing the labor that was so fraught for me.

These profiles of selected Jazzmobile audience members is not an argument about how all live sound engineers are always aware of their role in mediating a community's access to and ownership of its musical heritage. Rather, I profile these people in order to highlight how culturally specific my live sound engineering of Jazzmobile is in comparison to other live sound engineers. While there were audience members who did

not interact with me, there were a significant number of those who did acknowledge me as the engineer in ways that I did not observe in the labor of other live sound engineers.

Repatriation, Sincerity, Acoustemology and Cosmopolitanism

Repatriation

The current Jazzmobile concert organizers and workers, following Billy Taylor's vision, continue to produce live concerts in an effort to bring jazz "back" to Harlem. I believe that this mission is an example of cultural repatriation: a redistribution of jazz performances from their place of commodification in the music industry, to Harlem communities as cultural events. This repatriation also reacts to the commercial recording industry. Jazzmobile audience members recognize jazz records as cultural artifacts upon which the larger music industry capitalizes, and the repatriation of jazz within Harlem's soundscape serves to resist the cultural de-African-Americanization of Harlem in the face of generational mobility and gentrification. Amidst an atmosphere of rampant relocation and dislocation, Jazzmobile audience members participate in the soundscape's mix of jazz music and the ambient sounds of the Harlem environment, simultaneously consuming and contributing, through the enactment of racial sincerity, to it in an active performance of sonic repatriation.

While the labor of sound engineers is intertwined both with the ways that audiences and musicians conceptualize their relationships to each other, and with the

ways that these relationships are mediated, their labor in these relationships mostly remains invisible. In this, engineering shares some properties with social scientific research as such. I consider my activities as a sound engineer for Jazzmobile to be a form of social science, socially and technologically mediating and simultaneously representing the production, circulation, and consumption of the Harlem-Jazzmobile soundscape. I also understand my work in relation to what music archivists and ethnographers do when they "repatriate" sound reproductions to the communities that produced them. Aaron Fox's work on repatriating field recordings from the Laura Boulton Collection at Columbia University's Center for Ethnomusicology to an Alaskan Iñupiat community, which included the descendents of those whom Boulton recorded, is an example of this sort of repatriation focused on returning archival resources to their source communities. Fox writes:

> As it turns out, the value of the Boulton Collection as a scholarly and educational asset could only be discovered and actualized for the future—for and of its stakeholders—if we (and here I include all of my collaborators in this work, far too numerous to name) approached its reconstruction by engaging with the descendants of those who had given songs, and if we in turn gave it away again with the humility and generosity and a sense of responsibility to tradition (Fox 2013: 552).

Although Dr. Billy Taylor's work with Jazzmobile did not involve the re-transacting of recordings from an academic archive, Taylor had similarly conceptualized Jazzmobile as a *repatriation* of live musical performance to the communities and neighborhoods from which the music had originally emerged, and which, furthermore, the recording and jazz club industries have traditionally exploited and even more often

ignored. In many ways, my encounter with Jazzmobile has given me the opportunity to observe the perpetuation of this repatriation in the 21st century, and to participate, with my live sound engineering, in this socially collaborative process.

In analyzing this socially collaborative process, anthropologist John Jackson's scholarship on "racial sincerity" in Harlem is particularly applicable. The ethnical context of the events for which I engineered at Jazzmobile required interaction between me, the soundman, audience members, and musicians in order to fulfill the mission of the organization and the diverse exceptions of the different groups in the audience. I turn now to explicate Jackson's theory.

Sincerity

At Grant's Tomb, shared subjectivities—specifically, experiences of racial oppression among African Americans, as well as shared relationships to jazz as a genre—produced an interaction between audiences, musicians, and myself which was different from the common conceptualization of a sound engineer and his or her specialized, ideally transparent labor within the field of live sound engineering. In one of the more salient aspects of this interaction, musicians and audience members often talked to me before, during, and after concerts. Greetings, such as, "Hello, how are you doing?"; critical comments during the show, such as, "It sounds good, man!"; and valedictories such as "See you next week!" while breaking down my sound system were a regular part of my labor experience at Grant's Tomb. At other popular music concerts, audiences rarely know who the sound engineer is, and certainly do not speak to him or her. This

opacity of production work at Jazzmobile exemplifies the framework of "racial sincerity" described by anthropologist John Jackson as a code that Harlemites use to identify interactions within their community in the current climate of relocation, gentrification, and dislocation. Audience members' and musicians' recognition of my subjectivity is the substance of the "racial sincerity" Jackson asserts:

> Questions of sincerity imply social interlocutors who presume one another's humanity, interiority, and subjectivity. It is a subject-subject interaction, not the subject-object model that authenticity presumes—and to which critiques of authenticity implicitly reduce every racial exchange . . . . Racial sincerity is an attempt to. . . explain the reasons it can feel so obvious, natural, real, and even liberating to walk around with purportedly racial selves crammed up inside of us and serving as invisible links to other people (Jackson 2005: 15).

After the initial hyperactivity and frequent movements of the labor required during the load-in, setup, sound check, and mixing of the performance, I settled into position in the front row of the audience. More significant than the lack of length of my microphone snake, loudspeaker, and power cables, which relegated me to such close proximity to the stage, my regular placement in that location encouraged the kind of subject-subject interactions between me and regular audience members which Jackson describes as a racial sincerity common in Harlem.

From that position, my mixing resounded the merging of improvisation, musical repertoires, and conversations among audience members, as well as the sounded boundary between the urban ecology of the western edge of Manhattan and the tree line surrounding the grounds of Grant's Tomb. I worked to balance the professional standards of transparency with my personal investments in the meaning of the Jazzmobile events

that I mediated, as well as the relationships that I had with people in Jazzmobile's art world.

Mixing for the Audience and the Space: Acoustemology at an Outdoor Concert

My mixing at Jazzmobile performances entailed a series of negotiations encountered through a cycle of listening, attenuation, and amplification. I responded to the expectations, desires, and needs for specific sounds on the part both of musicians and of the audience in the large space in front of Grant's Tomb. My primary responsibility was to ensure that the sounds created by the performers were not only audible, but also *musically intelligible* to the audience, and reflective of the expressive intentions of their performers, regardless of the distances separating audience and performers. However, I also mixed in ways that negotiated the necessary relationship of a "jazz in the outdoors" aesthetic with the sounds of jazz that both performers and listeners recognized—sounds associated with the acoustic resonance of the small indoor venues that saw the rise of the intimate improvisatory assertions of 1940s beboppers.

Steven Feld has called for ethnomusicologists to attend to what he calls, following Shafer, the "acoustemology" of musical cultures, by which he

> …conjoins 'acoustics' and 'epistemology' to theorize sound as a way of knowing. In doing so it inquires into what is knowable, and how it be comes known, through sounding and listening. Acoustemology beings with acoustics to ask how the dynamism of sound's physical energy indexes its social immediacy. It asks how the physicality of sound is so

> instantly and forcefully present to experience and experiencers, to interpreters and interpretations (Feld 2015: 12).

The lack of six surfaces—four walls, a floor and ceiling—at Grant's Tomb posed both technological and cultural challenges to such a negotiation in the mix. What physicists describe as the inverse-square law—where the intensity of an amplified sound is exponentially related to various distances between the amplified sound source, or loudspeaker, and the listener—determines how close I place microphones to musicians, how close I place loudspeakers to the audience, and how much more intensely I amplify musical sound outdoors without the acoustic help of walls. As one might hear in sound recording examples from stage microphones, as opposed to an omnidirectional microphone in the audience, the stage microphone signals represent a somewhat harsh and direct sound, while the recording from an omnidirectional measurement microphone in the audience represents a plethora of different resonances. Each resonance corresponds to the uneven reflections, reverberations, diffusions, and absorptions that my amplified sounds encounters in its collisions with the tomb, the trees, the air, and bodies, as well as the mixture the contributions of people, birds, insects, and passing vehicles.

While doing live sound engineering for Jazzmobile at Grant's Tomb, I frequently observed how the racial sincerity I experienced in my interactions with colleagues and audience members on these gigs emerged not only through the social dynamics of the event and its cultural history, but also through the neighborhood's particular urban ecology, which in turn had an impact upon acoustics: the sonic sensation, for instance (to use Steven Feld's term) that derived from the combination of the evening wind blowing

through thick trees in Harlem, the cars passing on Riverside Drive, and my amplification of live jazz performances on a hot, humid summer night. Indeed, following Feld's call, I attend to the environments from which jazz sounds originated, and in which they are recreated, in my live sound engineering. Jazz sounds, for instance, and their location in resonant spaces throughout the industrial urban north have historically organized certain ways of knowing for African-Americans amidst their geographical and economic mobilizations. (The historical example of bebop's birth at Minton's, a small, low-ceiling acoustic space in central Harlem, is an example of the jazz sound that I reference when mixing jazz outdoors for Jazzmobile). Indeed, as these movements of people and capital continue today in twenty-first century Harlem, I assert that the relationships among these movements, the epistemology of a collective listening to and knowing jazz in Harlem, and the collaborative productions of music mark a significant interaction between sound and the social landscape at these Grant's Tomb events, the kind of sonic epistemology, or acoustemology, for which Feld has called (Feld 2015:15).

The Cosmopolitan Canopy

The enactment of principles of racial sincerity between me and Jazzmobile audience members like those I profiled within the acoustemology of Jazzmobile, where I share listening to and knowing jazz in Harlem with Jazzmobile audiences and musicians, made my labor opaque and unhidden among both musicians and audiences. This opacity, however, was a part of a larger sociality at the Jazzmobile concerts. Sociologist Elijah Anderson describes this overarching sociality as "the cosmopolitan canopy":

> Canopies are in essence pluralistic spaces where people engage one another in a spirit of civility, or even comity and goodwill. Through personal observation, they may come casually to appreciate one another's differences and emphasize with the other in a spirit of shared humanity. Under the canopy this sense of familiarity often breeds comfort and encourages all to be on their best behavior, promoting peaceful relations. Here, racially, ethnically, and socially diverse peoples spend casual and purposeful time together, coming to know one another through what I call folk ethnography, a form of people watching that allows individuals informally to gather evidence in social interactions that supports their own viewpoints or transforms their commonsense understandings of social life. In this context of diversity and cosmopolitanism, a cognitive and cultural basis for trust is established that often leads to the mergence of more civil behavior; Essentially, cosmopolitan canopies allow people of different backgrounds the chance to slow down and indulge themselves, observing, pondering, and in effect, testing or substantiating stereotypes and prejudice or, rarely, acknowledging something fundamentally new about the other" (Anderson 2011: xiv-xv; Anderson 2004: 25).

The cosmopolitan canopy of Jazzmobile, and the civility that this canopy encourages, includes the live sound engineer's labor in the contested space of the outdoors. What is more, rather than valuing transparency, Jazzmobile's diverse audience members sometimes seem to wish to see revealed the live sound engineer's labor in constructing the event, and, in doing so, contributing to the acoustemology of the urban soundscape of summertime in Harlem.

Equipment for Live Sound at Jazzmobile

The equipment that I acquired over the years I spent working for Jazzmobile reflects the acts of consuming and producing jazz in Harlem, while at the same time serving the many musicians who utilized parts of the sound system onstage in their efforts to convey the sonic and cultural power of their music. Deciding whether the sound

system at Jazzmobile was for the musicians, audience, crew, or myself was a complex matter. Our collective social practices of racial sincerity tended to discourage such a decision; in principle, the sound system was for all of us, though at times it was against all of us too. For musicians, the sound system enabled audience members to hear their quietest musical dynamics from a great distance, yet the same system made it difficult for some musicians to hear themselves, especially those who were used to hearing their monitors in indoor spaces. For the audience, the sound system enabled a sonic intimacy with the musicians, yet it was too loud for people who sat close to the stage, and too quiet for people sitting too far from it. For the crew, the placement of the sound system demarcated the stage and the shop floor of our labor, especially in the years after the loss of the beloved parade float.

My system was not the simple float-based system that crew members were used to, and my contracting of it changed the division of labor among crew members. For me, the system outlined a mode of production through which I earned money, while at times it was a musical instrument through which I could express myself, and it became a means through which I could provide for everyone, from crew members to musicians, with whom I had developed supportive relationships over the years. And yet the system tainted my reputation when parts of it broke, or when its limits could not accommodate all the needs of the many participants in Jazzmobile. In spite of the system's occasional challenges for everyone involved, however, it was consistently a complex apparatus that intensified our co-presence at events. The components of the system itself were constructed in anticipation of this co-presence, and, inversely, these components also

constructed the co-presence itself. Furthermore, the sonic norms associated with the genre of jazz, the exigencies of amplifying these sounds outdoors rather than indoors, and the correlation between the limits of non-profit community arts funding in the post-2008 recession, and the size of the sound system, were also factors that influenced the following list of audio equipment that comprised the sound system at Jazzmobile.

Microphones

Microphones are audio transducers, as I discussed in the introduction. They convert the changing compressions and rarefactions of air molecules, as sound in air, into analogous positive and negative electrical charges that represent sound as an alternating electrical current. All of the microphones that I used at Jazzmobile were so-called dynamic microphones. Small circular diaphragms hidden behind the protective mesh of each microphone connect to coils of wire. These coils of wire are suspended around magnets. As sounds change the adjacent air pressure, the diaphragms oscillate back and fourth, changing the position of the wire coil in relation to the magnet. The magnet's positive and negative poles induce positive and negative charges into the wire coil that terminates to the microphone's connector. Beyond the microphone's connector, these alternating current signals amplify from a faint electrical signal to a comparatively more potent electronic signal strength that engineers refer to as "line level." Once these signals from microphones pre-amplify to line level, they are powerful enough to transmit throughout the rest of the system. What happens to those signals from the microphones on stage continues with the live sound engineer's encounter with listening and the mixing

console beneath his or her hands. Meanwhile, onstage, much attention is given to the selection and placement of microphones.

Different microphones transduce differently. In the case of dynamic microphones, the diameter of the diaphragm, the consistency of the wire coil, and the strength of flux of the magnet determine the differences between microphones made by different companies, as well as specific models of microphones (at vastly different price levels), though they may be made in the same factories or with the same basic design.

Differences among the aforementioned factors account for how well or poorly microphones represent specific frequency-based resonances from the sound sources at which they are aimed. One microphone might easily represent the sibilance of a singer and the engineer might not need to boost that sound with the controls on a mixing console. The engineer might actually attenuate such a signal from a microphone that favors the 8000Hz sibilance from the singer, as it might overpower other high frequency sounds within the mix. Conversely, the same microphone might struggle in representing the lower resonant formant of the same vocalist, and the engineer might need to compensate for this shortcoming. Engineers, technologists, and marketers use frequency response graphs to generally and visually describe these collective tendencies of the diaphragm, wire coil, and magnet of dynamic microphones. Sometimes the metal mesh and foam behind it also affect these tendencies. However, hearing the sounds of a microphone, learning them, and being able to anticipate these tendencies is a very significant aspect of the craft of live sound engineering. During setup and sound check, it is important for the engineer to pair certain microphones with particular vocalists and

instrument sound sources onstage, and musicians very often have their own strong opinions on microphone choice and placement.

A particular microphone dominates this sort of function: Shure's legendary SM58. However, the SM58's popularity means it can quickly become a technological artifact that evokes a depressing cross-genre standardization when it becomes a sound shaping device for all genres and styles of live popular and live art music. This is why I have never owned a Shure SM58 and why I never included one in my system for Jazzmobile. The microphones I used included Sennheiser e835s, Electro-Voice (EVs) CO4s, and AKG P5s. I mainly used the Sennheisers for vocalists and wind instruments, EVs for drum sets, percussion instruments, and guitar cabinets, and the AKGs for speech, clusters of vocalists or instruments that needed to share one or fewer microphones, or sound sources that were proximate to monitor or main loudspeakers. The AKG P5s are supercardioid polar pattern dynamic microphones. As such, they accept sounds through a comparatively narrower scope than the Sennheisers and EVs, which are cardioid and more generally directional. The vast majority of live sound microphones are "directional," for the purposes of avoiding feedback, a type of noise that is the result of a microphone representing sounds from an adjacent loudspeaker that is amplifying sounds from that microphone. This produces a feedback loop that people hear as a series of squeaks and ringing. The more directional the microphone, the less likely feedback will occur on stage.

Cables and Stands

Cables and stands of different types also shape the performance of the live sound system. One might consider these items to be of the least importance relative to the components they connect and support. However, without them, or with the wrong ones, the system would be severely compromised. As there are many of these pieces at a live music production, how they are stored and organized can often be as important as the quality of each cable and stand in a sound system. The system I used at Jazzmobile included twenty rubberized microphone cables, each twenty feet in length. They terminated to male and female XLR connectors on each end. XLR connectors are a sturdy metal conical housing that contains three prongs in the case of the male version and three sockets in the case of the female version. These prongs correspond to the three insulated wire conductors that are within the cable's rubber housing. One wire conducts the positive charge from the microphone, another wire conducts the negative charge, and the third wire connects (or "grounds") the chassis of the microphone to the chassis of the mixing console. In the United States, the bare wire ground terminates to pin number one within the XLR connector. The red-sleeved positive wire connects to pin number two within the XLR connector, and the black or white-sleeved negative wire connects to pin number three.

Over the years, ever since installing sound systems in local churches with my father, when I had to solder several microphone cables to XLR connectors underneath a pulpit or within mixing desks that were tucked between pews, I had come to memorize these facts. At Jazzmobile, I kept this wiring schematic in mind in case I was short of microphone cables or need to repair one mid-show. I stored these cables on a winding

spool. This way, either Eddie or I could easily pull out an additional cable during setup, or if an unannounced musician showed up onstage at the last minute. During breakdown, Eddie would use the spool to quickly wind up all of the microphone cables while standing over the snake box.

The snake is another important cable in the sound system. It is tasked with consolidating the many microphone cables onstage into one thicker cable which is long enough to stretch between the stage and the mixing console, often located in the audience area. Its consolidation, as well as the fact that it is black like all of the microphone cables, reflects the modern industrial transparency ideology that encourages expectations that all of the equipment be hidden from audience sightlines during the performance. Onstage, the snake terminates in a large black metal box with female XLR sockets, or "jacks," as engineers call them. Eddie and I typically tucked the snake box behind the bassist's amplifier or the drum kit, so that the audience could not see the large yarn-like mess of microphone cables connecting to it. The other end of the snake terminates in what engineers refer to as a "fan out" of loose male XLR connectors. Each of these connects to the many input female XLR jacks that line the back of the audio mixer. Due to the consolidation of several microphone connectors, the metal box, and the fan out, microphone snakes are heavy, and it can be back-breaking physical labor to quickly wind them around your forearm at the end of a production.

Microphone cables and the snake send microphone signal from the stage to the mixer. They also send similar low-impedance signals from direct induction (DI) boxes on stage to the mixer. In place of microphones, DI boxes connect to the outputs of

electric keyboards, upright bass pickups, instrument amplifiers, laptops, and turntables. These boxes accommodate the relatively high-resistance or high-impedance signals of these sources and convert them into a low-impedance signal for the purposes of optimizing those signals' travel from the stage to the mixing console.

Loudspeaker cables are also vital to a live sound system. I used four heavy ten-gauge speaker cables that were each fifty feet in length. These cables connected the outputs of the amplifiers to the main and monitor speakers at events. Like the snake, these cables were sizable, and their placement through the perimeter of the stage area often collected the grime of the city, which made everyone always a bit reluctant to be the first to hand-wind them (this was also the case for the fifty- and one-hundred-foot red extension cords that connected the mixer and amplifiers to the security booth at Grant's Tomb, to the New York City Parks Department's power generators, and through the basement windows of grandmothers' historic brownstones in Harlem and Brooklyn).

The microphone stands took the worst beating of all the items in the sound system. I had twelve of them, eight tall and four short, which I kept in a large heavy-duty black nylon bag. The microphone stands were black—until they were beaten from being knocked over on stage, thrown quickly in the bag, or jostled around, rubbing against each other in transit. Then, scratches removed the black paint here and there, and areas that showed bare metal began to rust, until I sanded them and painted them black again. All of them had low-profile tripod bases, and included booms that allowed me to articulate the microphone at different angles and move the base of the stand away from the artists.

I repaired them frequently. At the end of some seasons, I had to completely dismantle them to get them working properly again.

The speaker stands were far less prone to abuse. Unlike the microphone stands, which were steel, they were made from hollow two-inch black aluminum pipe, which extended to a height of ten feet. In their folded position they were half that length, and they easily slid into their long padded bag during breakdown. During setup, we opened their tripod bases, then lifted each main speaker from the ground and lined up the hole at the bottom of each speaker with the shaft of the stands, a strenuous task. Then we hoisted the top adjustable pole with the speaker on top, so that the speaker would be about twelve feet off the ground.

Mixer

The audio mixing console, or "mixer" as engineers and musicians universally call the device, performs a number of crucial functions. First, it houses the microphone pre-amps that amplify the faint electrical signals from microphones and DIs to the electronic signal of a "line level" output to the amplifiers. Second, it allows the engineer to boost or cut, amplify or attenuate specific frequencies of the signal. This is equalization (EQ), and as stated earlier, engineers use it to compensate for anomalies from the pairing of certain microphones with uneven bass or treble resonances from vocalists or other sound sources. Engineers also use the EQ in mixing consoles to creatively shape the resonances of singular sound sources, as well as the whole of the mix. Third, the mixer also contains auxiliary channels (AUXs) that allow engineers to send signals to outputs that are

separate from the main output of the mixer. In my medium-sized sound system, I used AUX 1 as an independent monitor mix, a mix that only the musicians could hear on stage, while the main output transmitted the mix for the audience.

Mixers also have volume faders. Faders are sliding potentiometers in analog mixers, and voltage-controlled amplifiers (VCAs) in digital mixers. Each fader controls the amplification of each signal that flows through the mixer channel controlled by that particular fader (master faders control all the channels together). However, a separate, usually knob-controlled, pre-amplifier gain control has more direct influence on the gain of each signal being amplified by the mixer. The fader more specifically, particularly in the example of an analog mixer, controls the mixer's activity in either attenuating a particular signal, passively maintaining the pre amplified amplitude of the signal, or further amplifying the signal. The fader's position in its vertical sliding path at any given moment instructs the mixer to perform one of those tasks and as such, the fader position make the mixer compare the input power of a signal to the output power of that signal in the mix. The significance of this comparison refers to what engineers define as the "gain structure" of the system. Adhering to gain structure ensures a consistent and efficient amplification from microphones to the speakers. At the mixing console, the ideal position for the faders is at the midpoint 0 dB position that passively transmits the power of the pre-amplified signal to the output. However, in practice, the drastically-changing musical dynamics in a performance onstage, as well as the engineer's immersion among an audience with feelingful expectations for the intensity of liveness or the muteness of certain kinds of intimacy, all push and pull the fader above and below 0 dB.

In my first years at Jazzmobile, I used an Allen & Heath ZED-24 analog mixer. I appreciated the direct tactile encounter between my fingers and the faders on the mixer's surface, which gave me a fine-grained control of each signal. While looking at the stage and listening, I could simply rest my hands and fingers on the mixer and its faders and immediately convert my listening and my choices to slight or drastic movements of the faders. However, using an analog mixer meant setting up a fixed mixing position in the audience and running the long snake and an extension cord to that "front of house" (FOH) position. In addition, to minimize the possibility of someone tripping on the thick cables, the entire length of those cables had to be taped down with gaffer's tape from the stage into the audience section, a task that none of us jumped to do, as it was very tedious.

I later replaced the analog mixer with a digital mixer, a Presonus StudioLive 16.4.2. With the addition of a laptop, wireless router, and an Apple iPad, the Presonus allowed me to keep the entirety of the sound system onstage and to mix with the corresponding app and its virtual faders on the iPad. I could travel around within venues and mix with the iPad from different locations within the space. This allowed me to more easily produce a mix that would satisfy more people throughout the audience section. The digital mixer also offered the effects and plugins, such as reverb or compression, found in digital audio workstation software like Avid's Pro Tools or Apple's Logic Pro, which I began to use sparingly in certain situations. The digital console also enabled me to save all of the settings associated with particular artists or types of musical ensembles, such as quartets, quintets with a vocalist, or big bands, which made the setup much easier.

Neverthless, in deciding to keep the mixer onstage and control it remotely with the iPad, the tactile immediacy I had with the analog Allen & Heath was lost, as was, potentially, some of the transparency associated with the traditional placement of the mixer. On the iPad, I used a rubber tipped stylus to move the virtual faders. It just was not the same. To come close to the same immediacy I had with the analog mixer, I walked around the venues with the stylus in my right hand, constantly pressed on the iPad in my left, always looking to make sure I was moving the correct fader. There were no wireless MIDI controller real fader surfaces on the market when I engineered at Jazzmobile, so I made do with the iPad in lieu of setting up a fixed FOH mix position in the audience. Another drawback of using the iPad to mix was that, in no longer having a fixed spot in the audience, I sometimes became too preoccupied with traveling around the audience, and worried that I might have in some way socially abandoned the regular audience members that sat near me and the analog mixer. In order to minimize this sense, I would sometimes I re-fix myself in my old spot with the iPad and a folding chair.

Amplifiers

Power amplifiers accept electronic line level input signals, and transduce those to higher-powered electrical charges that drive large loudspeakers in ways that closely represent the quality of the input signals. The input signals' encounter with an amplifier's transistor temporalizes that electricity in ways that try to match similar temporalities in the musical sound signal.. The amplifiers I used at Jazzmobile events drew electricity from the outlets of buildings, or from the gas-powered generators that were on hand

Indeed, one can say that my amplifiers turned the infrastructure of the city's power grid into a musical instrument, adding to the sense that I was mixing an urban acoustemology.

With the Class H QSC GX5 power amplifiers that I used with the analog mixer, the line level input signals terminate to the semiconductor of the amplifiers' transistors. The semiconductor's state, as either an insulator that impedes the flow of electrons that orbit around the valence band of copper atoms that comprise the wires of the amplifier's input, or as a conductor that transmits these orbiting electrons, changes with the oscillations of positive and negative charges in the AC alternating current of the line level input signal. This instruction by the input signal at the semiconductor within the transistor directs positive and negative charged DC direct current electricity from the rails of the amplifier's power supply to the output, again in ways that, ideally, closely (and thus "transparently") emulate the original temporality and amplitudes of the musical AC alternating current of the input signal.

At Jazzmobile concerts, the system I used always included two two-channel power amplifiers. Channel 1, on one amplifier, powered the left main loudspeaker, while channel 2 of that same amplifier powered the right main loudspeaker. Channel 1 of the second amplifier powered the pair of monitor loudspeakers on stage. The main output the mixer connected to the inputs of the first amplifier, and the AUX 1 output of the mixer connected to the input of the second amplifier for the monitors. Both amplifiers were housed in a heavy but very roadworthy black ATA rack case. When I first worked with Jazzmobile in Harlem, that rack of QSC amps was adequate for neighborhood block parties, and I modified the system with more amplifiers and loudspeakers for larger

venues like Grant's Tomb and Marcus Garvey Park. However, eventually budget cuts dictated that this one moderate sound system was the only system I could use for all Jazzmobile events across venues, with the result that the QSC amplifiers, on their own, struggled to amplify sound at Grant's Tomb. When I "upgraded" to the Presonus digital mixer, I also replaced the Class H QSCs with Class D Crest ProLite 3.0 power amplifiers. Class D amplifiers use transistors that pulsate in ways similar to those found in digital converters, although Class D amplifiers are not digital audio devices. The benefit was that they were very efficient power amplifiers with high output at a relatively low cost, and they were much lighter in weight, making the amp rack case much lighter.

Both the activity of the magnetic field within the dynamic microphone and the loudspeakers at the end of the sound system's signal chain, as well as the AC alternating current it produces exemplify the early work of Nikola Tesla at the technological foundation of audio modernity. Thomas Edison's developments of sound reproduction associated with the phonograph have made him a popular figure in the historical discourse of music production. However, Edison's advocacy for DC direct current had also been foundational in modern audio equipment, in spite of the older and broader clash between Edison and Tesla about the use of AC verses DC as the principal modes for distributing electricity. In analog audio technology, Tesla's AC and Edison's DC are inextricable modes of electrification within the process of amplification, particularly in the AC and DC encounters within the amplifier that empower the audio mix signal to drive the loudspeakers on stage and in the audience.

Loudspeakers

Loudspeakers, like microphones, are audio transducers. They convert the positive and negative electrical charges from amplifiers (which represent sound as high-powered alternating electrical currents) into analogous compressions and rarefactions of air molecules, and then back again into sounds in the air—only now at a greater magnitude than when those same sounds in first encountered the microphones. Loudspeaker drivers use the same materials found in dynamic microphones—magnet, wire coil, and diaphragm or cone—but in much larger form. As a positive or negative charge from an amplifier electrifies the wire coil, the coil attached to the cone pushes forward or backward as a result of its charge and the polarity of the surrounding magnet. These pushes and pulls of the cone produce compressions and rarefactions of air that are analogous to the qualities of the signals flowing through the sound system. In addition to these materials and their functions within the speaker driver, the efficacy of the loudspeakers is significantly overdetermined by a number of factors, including 1) the enclosure for the loudspeaker, itself a significant apparatus, and its porting and ventilation; 2) the shape, size, weight, material, internal volume, and placement of the drivers; and 3) the passive crossover circuits, which send the appropriate frequencies to the tweeter drivers for high frequency reproduction, and to the woofer drivers for lower frequency reproduction. The diameter of the woofer and tweeter drivers corresponds to the frequency bandwidth of reproduction, in particular for a wider driver, which produces lower frequencies. Similarly, a loudspeaker enclosure with a larger internal volume also

produces lower frequencies. The addition of ports in an enclosure can extend the bandwidth to include still lower frequencies.

Considering the styles of bebop, hard bop, and Latin jazz that musicians usually perform at Jazzmobile, I found that main speakers with twelve- or fifteen-inch woofers were preferable. The first pair of main loudspeakers I used at Jazzmobile were OAP MT-122s with twelve-inch woofers and one-inch tweeters. They were black, wooden, trapezoidal, and weighed seventy pounds each. They served us well, seeming to boost frequencies around 250Hz, which could have been the result of the resonance of their wooden enclosures. It became too laborious to lift them on and off of the stands multiple times a week, however, so I replaced them with a pair of Electro-Voice ZX4s. I also acquired a pair of similar but smaller Electro-Voice ZX1s to use as stage monitor speakers. The ZX loudspeakers were injection-molded from heavy-duty black ABS plastic, and shaped like prisms. The ZX4s, though they included fifteen-inch woofers, were only half of the weight of the OAPs, and the ZX1 monitors, which included eight-inch woofers, were nevertheless high-powered enough to cover the stage. Indeed, they were the most transparent-sounding speakers – in the audiophilic sense, meaning that they seemingly added significant coloration of their own – that I have ever worked with, especially when paired with the digital mixer and Class D amplifiers. In addition, they offered greater projection and coverage than the OAPS, and thus were able to accommodate the larger audiences and outdoor conditions at Grant's Tomb more capably.

Like many technologists in the late twentieth and early twenty-first centuries across many contexts of media production, I "went digital" during my time engineering at

Jazzmobile. Digital audio equipment, as well as computer-designed equipment like the injection-molded ZXs, offered greater efficiency, less heavy lifting, and a comparatively more professional sonic product. Once again, I must emphasize that there was less heavy lifting, not to mention the fact that all of this equipment, whether analog or digital, had to fit tightly into every crevice of my Honda Accord sedan. Rotating the heavy snake, old amp case, and seventy-pound OAP speakers while bent over in the trunk or back seat had exacerbated my severe back pain for years. Still, there were aspects of the analog system that I missed (though only after it was already set up and before it had to be broken down) -- mainly, the quality of the old system's sound. The sound of the digital system was impressive indeed in many ways. This was a sound that seemed cleansed of the hissing noises of analog audio circuitry, and the sound of each instrument that I amplified seldom ever competed for a sonic space in the digital mix.

Nevertheless, the analog system, though rife with this hissing and sonically-present noise floor and uneven resonances, had a character that I sometimes longed for when working with the digital system. The mix from an analog system produced a sound that seemed to compact several instrumental sounds into a comparatively dense whole, a property that has become a nostalgic icon that attaches to larger domains of cultural memory. In many ways, to a live sound engineer who made this transition, the live sounds of the analog system resounded with a nostalgia similar to the way the performances I mixed were often experienced by the Jazzmobile audiences who had, like me, personal histories with the genre and the location, and who "collected" and cherished

memories of summertime musical performances from decades past.

The Musicians: At Venues, During Setups and Mixes

My Brief History Mixing Live Jazz

One of my earliest memories of engineering live sound for jazz performance dates back to when I accompanied my father in his work in this domain. Regardless of the client or the genre, my father simply referred to each job as a "show," seldom explaining what type of show it was. One jazz show I engineered with my father was a birthday party for swing drummer Panama Francis at a YMCA in Manhattan in the 1980s. The then-aged Francis performed on his drum set, the one on which he had played during the Big Band era in the illustrious Savoy Ballroom. I faintly remember setting up the microphones and stands and running cables on the stage. Back then, I probably aimed one microphone on a boom stand above the drum set as the only microphone for the instrument. I recently saw Panama's kick drum prominently displayed at the Smithsonian National Museum of African-American History and Culture, the same one that I encountered those many years ago. However, I probably did not put a microphone up to it; back then, my father generally avoided overamplifying kick drum and bass frequencies, a preference I first learned when teachers, mothers, and Rebbetzins at the Hasidic Jewish girls' school shows requested that he turn down the bass, as it contributed to what they perceived as a worldly, secular sound.

Nevertheless, I do not believe that the accusation of worldliness was my father's rationale for a reluctance to preferentially amplify lower-frequency sounds. For my

father's generation (he was born in 1935), the sounds of jazz—whether live, broadcast, or recorded—did not foreground bass frequencies as much as the sounds of jazz (and other popular music genres) from my own era as an adult. When, as a young teen, I began mixing at jazz shows without him, he would try to impress upon me that the audience should not hear the upright bass and the kick drum: they should only *feel* them. Both as an act of adolescent resistance, and as a self-conscious participation in the generational aesthetics of the burgeoning neoclassicist "Young Lions" movement in jazz, I embraced the deep resonant characteristics of these sound sources in my mixes, while simultaneously the sound production practices of jazz in the 1990s were being influenced by the aesthetics and practices of other musical genres.

While my father preferred the comparatively very gentle and faint pulsations of the Count Basie rhythm section, with only the light, scratchy string attacks of Freddie Green's famous quarter-note chordal guitar strums, I preferred the driving, hard-edged, and, to my mind, more egalitarian representations of the bass, kick drum, and piano of Kenny Garret's rhythm sections. The clash about pre-bop and hard bop aesthetics between my father and me marked one way that I expressed myself as a teenager. As I came of age, however, I developed a much more nuanced respect for the sonic aesthetics that have emerged from different periods and movements in jazz history, as these sounds index broader social movements, historically and regionally, locally and globally.

My father and I worked at the Panama Francis show during the same time period that we provided sound amplification each summer for the New Jersey Jazz Society. The Society's JazzFest took place at Waterloo Village, a historic nineteenth-century canal

town reenactment near Stanhope, New Jersey. There were three venues in the village: a large circus tent that held over a thousand seats; a gazebo within an outdoor garden; and a more intimate clubhouse. My father mixed the large ensembles and big names in the big tent. I mixed smaller groups or performers who were less well known.

Before I was old enough to mix at the gazebo or the clubhouse, I hung around my father at his larger analog mixing console, or stayed in the backstage area of the tent. It was there that I met many prominent jazz musicians, one of whom was Jay McShann. McShann was the legendary pianist and bandleader who had hired Charlie Parker in 1938 to be a member of his Territory Band; Parker's first professional recording was made when he was a member of McShann's band. On this occasion, McShann pointed a finger at me behind the big tent. I went up to him, and he handed me a couple of dollars and asked me to get him a bag of popcorn. I brought it back to him and he let me keep the change. I never told my father, as I was not allowed to talk to strangers.

I also first encountered Dr. Billy Taylor in the big tent at those festivals. He always made a distinct impression with his large eyeglasses. Dr. Taylor only performed with his trio at those shows; Earl May and Chip Jackson were his bassists at different times, and Winard Harper was his drummer. They produced a richly dense and, at times, large sound for such a small ensemble. At that time, I did not know that Taylor had been running his own summer jazz festival in New York City, Jazzmobile's Summerfest. People considered Winard Harper to be a young player then. In many ways, his youthfulness was seen as a sign of Dr. Taylor's work in jazz education.

Around the same time that I began mixing at the other venues at that festival, Harper also began performing with his own larger ensemble. While I had grown accustomed to simple mixes for musicians like guitarist Bucky Pizzarelli and his sons, Winard's bands were complex, with multiple horns, African percussion, and vocalists. One such vocalist was Carrie Smith. While singing Winard Harper's arrangement of "Lift Ev'ry Voice and Sing," stylized by shuffle and 6/8 Afro-Cuban Bembe rhythms, Smith noticed that I adjusted the volume of her voice playing back through the monitor speaker at her feet. Upset by this, she stopped singing, dropped the microphone to her side, pointed directly at me behind the mixing console, and easily yelling above the band said, "I have been doing this for years and years. Don't you ever mess with my monitor mix again!" That was the last time I ever adjusted a musician's monitor mid-performance.

In a more collaborative exchange, alto saxophonist Antonio Hart asked that I fully attenuate all of the frequencies above 8000Hz, so as to make the otherwise overly-brilliant alto saxophone sound a bit darker—a similar process to the way that ribbon microphones captured alto saxophones in recordings from older jazz eras. I cut my teeth, so to speak, learning how to mix live jazz – and collaborate with highly skilled musicians -- in those smaller venues, while my father mixed in the big tent.

In what follows, I will describe how those skills I honed under my father's guidance and early career were applied in the context of my work as a professional engineer for Jazzmobile.

Musicians and Gigs at Jazzmobile

Houston Person at Grant's Tomb

During our years working at JazzFest, my father engineered Houston Person, who also regularly performed with his quartet at Grant's Tomb during the Jazzmobile Summerfest shows that I engineered. When my father amplified him under the big tent at the festivals in New Jersey, Person performed alongside his wife, the vocalist Etta Jones; they always seemed inseparable on stage. However, Jones passed away before I worked with Person in Harlem, and when Person performed at Grant's Tomb, the Jazzmobile community seemed to understand that all of the many ballads that Houston called were a tribute to his departed wife. I could sense that Houston was specifically playing to the older regulars who fondly remembered Etta.

Houston Person played the highly-regarded Selmer Mark VI tenor saxophone with a solid brass Geoff Lawton mouthpiece. Houston clearly loved this setup. Although he seldom referred to his saxophone, it went without saying that a serious professional saxophonist of his generation would not play on anything but a Mark VI, and Person lauded the Lawton mouthpiece. Don Braden, my teacher in college, also played on a Lawton. I had always wanted a Lawton myself, but they were hard to find, and with these two established tenor titans playing them, I felt as if I had more living to do before I ascended to such a station in life.

After repeated conversations with Person about his mouthpiece, he told me that a music shop owner in the Midwest had given it to him for free because the opening at the tip of the mouthpiece was too wide for most players. Person told me how he practiced regularly with the Lawton in his bathroom, with a rolled up towel in the saxophone bell.

This built up a significant back-pressure and muted the tone, which allowed him to further develop and control different inflections in performance. Egging me on further about the mouthpiece, Person, after playing the elaborate melody of a ballad, would sometimes leave the stage of the Tomb to reflect with me about all of the Lawton's tonal possibilities.

Houston Person's sound seemed larger than life. The diaphragm-supported breath that he had blown through the reed and thick brass walls of the Lawton seemed to vigorously shake the brass body of his Parisian saxophone. Yet the technique that he had developed over decades of playing allowed him to accentuate the lower resonant formant of the instrument at times, and intensify the higher tones and harmonics at others. However, his mid-range was always very present and foregrounded, giving his melodies a distinctly vocal quality.

My setup for Person's stage was fairly straightforward. At Grant's Tomb, I positioned the main loudspeakers near the lower steps of the Tomb, with the monitor speakers aimed toward the musicians and the Tomb itself placed in the same line. Eddie and I ran a long extension cable to the only outlet in the small green security booth on the west side of the Tomb. We placed a microphone in front of the kick drum of the drum set; an overhead microphone above the drum set; either a microphone in front of the bass amp or a DI box connected to the bass amp; a DI box intercepting the connection between the electric keyboard and keyboard amp; a microphone on a downward facing boom stand for Person's saxophone; and a microphone on a taller stand for the few spoken

announcements from Person and the standard introductions and announcements by Robin Bell-Stevens.

The mix for Person's sound was also fairly straightforward. He and his ensemble played with dynamics that seldom needed adjustment from the faders on the mixing consoles. In addition, unlike Antonio Hart, Person wanted me to represent the full frequency bandwidth of his saxophone. At times, he asked for a Shure SM58 for his saxophone, the ubiquitous stage microphone that favored higher frequencies. While I did not generally like frequency emphasis (one of the reasons I used Sennheisers), for Person, I generally reshaped the resonance of the input channel with equalization in order to approximate the resonances that he liked about the SM58.

As Person played his saxophone at the steps of Grant's Tomb, his sounds would enter into the grill of my microphone. There, they would be transduced from sounds in air into electrical pulses of alternating current, representing the once-dynamic compressions and rarefactions of sound waves in air, those faint electrical charges transmitted though the microphone cable and snake towards the microphone preamp within the mixing console. The preamp would amplify these electrical representations of both Person's saxophone sound and my microphone's particular character into an electronic line level. This line level version of the representation traveled through an array of filter circuits that I had affected by adjusting the knob potentiometers that controlled the amplitude those filter circuits would amplify or attenuate (specific high, middle, or low frequencies), based on my listening and consequent decisions to affect Person's sound. After passing though the Aux bus that eventually fed the monitor speakers on stage, the now-equalized

signal encountered the main output bus of the mixer. My listening-informed decision to move, or not move, the corresponding fader determined how much of Person's sound amplified from the sound system in relation to the signals from the other instrumentalists. This mixed signal entered the input of the power amplifier, where it varied the pulse of the electricity from the green security booth, as well as the timing of the charges as they pushed and pulled the drivers of the main loudspeakers that faced the audience. Then, at an amplitude greater than before, that newer version of Houston's saxophone sound emerged back into the air in front of Grant's Tomb. This mediated sound propagated spherically, both directly toward the listeners, and indirectly through complex paths that made these late sounds reflect off of the Tomb, the trees, the humid summer air, Harlem itself, and the individual bodies and minds, desires and memories, of the audience.

Winard Harper at Grant's Tomb

Winard Harper and his Jeli Posse group also frequently performed at Grant's Tomb. Once the sideman in the trio of one of the organization's founders, Harper was revered as Jazzmobile royalty, a far cry from the up-and-coming "young lion" status he had held under Taylor's wing at those jazz festivals in New Jersey years ago. At Summerfest, Harper rightfully presented himself as a master of his craft. This time, he was the one hiring much younger energetic sidemen. It meant a lot to me to bear witness to such an honorable generation shift within the tradition of the music.

At Jazzmobile, Harper's group was entirely composed of college students or recent graduates of jazz performance programs throughout the area. I knew firsthand the life-

changing impact such performance opportunities could have on a music student, as I had had a similar opportunity touring as a member of the Clark Terry Big Band while still in college. However, I could tell that part of the curriculum for Harper's young sidemen was to practice making requests and asserting expectations of me, the soundman. These apples did not fall far from the tree; Harper was notorious for requesting highly specific items or actions from me, though over time we had developed a kind of routine. He might want a table or chair for his balafon or an extra microphone for it, or for his announcements from behind the drum set, or a monitor speaker to be right next to his seat, or the last minute addition of a microphone for a tap dancer, all above and beyond the general setup requirements for his ensemble of nine musicians. In addition to these occasionally arbitrary-seeming requests, Harper would sometimes instruct one of his sons or one of the musicians to walk around the venue to ensure that the mix sounded good. While they always told him that it did, I never felt good about it, even after twenty years of engineering for him. Harper was slow to trust me with his amplified sound, though I knew that he appreciated me when I remixed and re-equalized the sound of his drum set during his improvised solos.

Winard Harper's approach to the drum set was varied, dynamic, and active, in many ways similar to the styles of Max Roach and Elvin Jones. During the presentation of a melody and during players' solos, beyond the standard swing patterns on the high hat and ride cymbals and basic interjections on the snare drum, Harper regularly struck the tom drums and kick drum in ways that seemed to emulate a kind of always-responsive and yet assertive exchange with the other players on stage. This activity intensified in his multi-

chorus solos. Both in his accompanying and in his solos, Harper would frequently build suspense by dropping out while other members of the rhythm section would continue until his return, typically on the downbeat of a significant section in the song form. He also produced a sense of suspense when he would decisively strike a crash or splash cymbal, then immediately mute it with his opposite arm, within the deeply syncopated in-betweens of the beat as a tense dissonance, eventually resolved with a commanding strike of his ride cymbal. Typically during a solo he would foreground a kick- and snare-based back beat. Whenever he did this, I increased the amplitude of the kick drum, and boosted the lower frequencies of its signal, in an effort to pull the sound of the drums from jazz toward hip-hop, which Harper seemed to appreciate. Even after almost a decade of this exchange at Jazzmobile—Harper foregrounding a back beat in his solo, and me deepening the sound of the kick drum—we never spoke about it. He never requested it, and I never asked him about it. I knew in those moments, however, that he could hear the deeper resonances of his kick drum reflecting off of The Riverside Church near Grant's Tomb. He gave me a positive head nod once, and I knew he liked it.

Antoinette Montague at Marcus Garvey Park

Antoinette Montague was a professional jazz singer whom I met in Newark, where she was born and raised, when we were both working at a Jazzmobile show during a time when the organization was experimenting with producing an independent Summerfest in that city. The stage for that show was an unfolding Wenger trailer. When Antoinette started to sing, all of the children from the neighborhood in the Ironbound section, which

locals call “Down Neck,” started to gather around the stage. She had a full-ranged voice, and was never bashful about using her middle resonant chest voice. Her vocal approach was very soulful. To me, her voice evoked a very local style of immediate, no-frills urban-north Baptist gospel singing, a style that I grew up hearing at my Newark church and other churches in the area.

In addition, the cadence of her speech was very Newark-sounding to me; it reminded me of how my grandmother and my father spoke only to close members of the family and to people at church. Sometimes Antoinette’s conversation with me before or after a gig was comforting, reminding me of my history, and of how both of us, though very much a part of Harlem’s jazz culture, were also a little bit outside of it. Unlike many of the other musicians, Antoinette was very involved in Jazzmobile as an organization. She donated and actively encouraged the audience to donate to the organization. She also functioned as an emcee and manager at Jazzmobile shows beyond her own when Robin, Linda, or Sheila Anderson were double-booked. She looked out for members of the production team, and we looked out for her too.

On several occasions during Summerfests over the years, Antoinette and her ensemble performed at the bandshell in Marcus Garvey Park in central Harlem. The bandshell was Jazzmobile’s traditional Friday night venue, and it was a difficult venue for me. During some summers, I was able to park my vehicle right next to the stage, but during others, NYPD or Parks Department workers prevented me, which meant that I had to find parking around the perimeter of the park. This was territory utilized by drug dealers, who, like many others, had turned to illicit activity in response to the

increasingly-dwindling legal economic possibilities for Harlemites in the late-capitalist culture of New York City. They watched me unload the sound system from the car and push it all back around the perimeter of the park to the path that led to the stage. Especially before the bandshell's renovation by the family of Richard Rodgers in 2011, it was not uncommon to find homeless people using the covered stage as a shelter. Eventually, Vicky or Parks Department workers would gently ask them to relocate, and then would try to sweep or mop the stage floor. All too often, Eddie and I ran into difficulty convincing park workers that our permit included electricity; on several occasions, Robin had to show them the permit. Once we were set up and had tested the system, the large venue revealed its impressive acoustics, which almost made the challenges of getting there and setting up seem worthwhile.

Antoinette's group changed personnel over the years, but two mainstays were pianist Danny Mixon and bassist Lisle Atkinson. Danny was a fun loving, light-hearted, loud-talking and outspoken favorite at Jazzmobile. He maintained regular gigs at clubs throughout Harlem with his own bands, and thus had his own following. Behind a grand piano, Danny's playing exuded a level of pianism that was serious enough to easily confuse someone who might become too used to his humor. It was not uncommon for Steinway & Sons to donate a grand piano for Jazzmobile performances at Marcus Garvey Park, but in most cases, pianists brought their own electric keyboard and amp. Danny never had the same keyboard and amp twice when I worked with him. He mainly played acoustic pianos in his club dates throughout the year; Jazzmobile shows were among only

a few to which he needed to bring a portable instrument, and he borrowed these items from other people.

The challenge for me was making solid DI (Direct Input) box connections to this borrowed equipment. Sometimes I could, but at other times I simply aimed a microphone at his amp. Then, I would need to equalize his piano sound, sometimes drastically. However, this was a common practice for almost everyone who brought an electric keyboard. Some of them were bass-heavy, while others produced a muddy-sounding midrange that I needed to attenuate in order to accommodate a vocalist or soloist in the mix. Yet none of this ever prevented Danny Mixon from sounding great to the audience. Lisle Atkinson, known for having accompanied superb vocalists such as Nina Simone and Betty Carter, also brought different amps with him to the park. They would all be designated as vintage bass amps when I worked with him, meaning both that the amp's speaker was an important part of its tonal quality and that the amp would lack an onbard DI. I aimed a microphone at those amps instead of getting a direct signal through a DI box. Atkinson's playing was very nuanced and dynamic. With the fader, I often had to ride gain, a term that engineers use to describe continual fader movement to maintain an overall even amplitude for a sound source that exudes a comparatively dynamic amplitude over time. Regardless of the technical challenges, Atkinson was a virtuosic bassist, and also provided great musical and personal support to Antoinette.

A blues shuffle in a major key, with reluctantly major, dominant, and diminished chords moving at a slower-than-medium tempo would have been a common setting for Antoinette's voice. Sustaining tonic pitches above such accompaniment, she elaborated

this progression with a very rich and meaningful vibrato, modulating around the held pitch that carried the vowel of a lyric into her microphone. This oscillation of air molecules underwent the transduction within that microphone that flowed to my mixer, and, through very little equalization for her signal, toward the analog variable resistor that was the fader beneath my finger. The mix of her vocal signal with the signals of her accompaniment flowed beneath my fingers and entered the input of the power amplifier. There, they controlled how much, and at what times, the electricity from Marcus Garvey Park pushed and pulled the drivers of the main loudspeakers that were aimed at the audience. Then, at an amplitude greater than before, that newer version of Antoinette's voice emerged back into the air in front of the bandshell. It propagated spherically, both directly toward all of us listeners, as well as indirectly to us through complex paths that made these late sounds reflect off of the surfaces of the cavernous shell, the trees, the humid summer air, Harlem and our bodies and minds, individuals and groups, selves and persons.

Antoinette Montague Interview

The following interview with Antoinette Montague explores her experiences working with live sound engineers, as well as what she values as best practices in collaborating with them.

WHITNEY: What have been your best and worst experiences with live sound engineers in the New York City area?

ANTOINETTE: I am Antoinette Montague, an African-American Jazz, Blues, and Beyond category singer and entertainer, and I have learned to work *with* the sound engineer assigned to a concert. In my work with you as an engineer at Jazzmobile, you work in a manner that is "cat's-paw quiet." The sound that makes me *forget* about the technology of sound, *be* in the moment of the anointed production of sound, and the party I'm creating and experiencing *with* the audience [emphasis hers].

I learned, very early in my career, that I am surrounded by support. There is 360 degrees of service around me before, during, and after a gig. Once the booking, marketing, and musical prep is done, then the arrival at the venue happens and I am surrounded by support. The sound engineer is a part of this for me as an artist. Arriving early, just before the sound check, is where the dream materializes. Before a performance, my heart is pumping happy fluid. It's sacred to me as an artist. It's time to go to my highest calling as a human being, and I'm about to connect with the other humans who are at their highest calling.

The sound engineer, I believe in my heart, shows up to do an excellent job. It must be so. It's way too much hard work to not have your heart all in. I'm sure there are both artists and sound engineers who are battle-fatigued and that many sound engineers feel burnt by this. But, at these gigs, I maintain a positive outlook and will not be discouraged. I encourage the engineer to also have a positive outlook as well.

I found out, some time ago, that showing up early and making my way to the "sound man" engineer FIRST is important. I let them know that I am there to help them get what they need from me and my band. I express love on them, because without them,

I'm going to have a holler fest and sore throat. Sound engineers can help or hurt a vocalist. To that effect, there are times that it just sadly, painfully falls apart regarding sound.

The worst experience that I've ever had with a sound engineer was due to the prior sound engineer's lack of respect to a fellow sound engineer and artist (me), who was hired by the concert producer. The engineer was late getting set up, late breaking down—not leaving an energy source. It was a mess and he left toxic energy that we had to rebuke!

WHITNEY: How do you develop a trust in engineers between the sound check and the show?

ANTOINETTE: The show starts upon arrival into the venue. The first and most important part for me is: get there early and speak with the sound engineer. Speaking with them first establishes trust and respect.

WHITNEY: What types of factors led you to carry your own vocal microphone to gigs?

ANTOINETTE: I stopped carrying it because it was too complicated. I'll use what is there.

WHITNEY: Why do you think that stage monitors are so difficult for engineers?

ANTOINETTE: Monitors are hard for artists, too. It's impossible to get into another human's brain, or to understand hearing impediments [or] pitch preferences in another person's head. This is true for artists, sound men, and the audience members. It's best for sound engineers not to take the multiple requests of monitor adjustments personally and get frustrated. I know that I'm still learning how best to work with them. Every artist

you're trying to satisfy is different. There are layers of artists on the bandstand, who all need clarity of sound in their monitor. There will either be a symphony in the monitor, or a clash of sound that turns everyone off—everyone meaning the band, the engineer and the audience.

Some sound engineers may come up and listen to monitors and see if they sound good to them. But you may be wise to constantly remember that sound engineering and being an artist is a service and a calling. Releasing egos all around will make our work less hard. Good engineers let go of the need to be right, giving the artist their best.

Often artists will let monitor issues go, so that they won't fight with the engineer, either verbally or physically. I've seen a near fist-fight and blow-out with T.S. Monk in Central Park with a sound man. Monk was right. The sound man told him to "play the drums, and I'll do the sound." That may be indicative of a "Sound Man God Complex"—thinking that they are God over mice, monitor, sound. Engineers must never forget the higher calling of servicing the client. Stage monitors are about people hearing themselves enough to support their need for pitch, time, and comfort.

WHITNEY: What strategies do you use or avoid to collaborate with engineers at gigs?

ANTOINETTE: I use a musical director, or, rarely, a stage manager, to help communicate if needed. But overall, I'm cool with sound people. Honestly, I have *never* needed to avoid sound engineers. I love them!

WHITNEY: Are you able to size up an engineer before a sound check? If so, how? Do you believe engineers size you up before a sound check? What conclusions do you think they draw?

ANTOINETTE: Of course they size me up! That's the art form at its best. Engineers sizing me up can go right or wrong quickly, though. Many do their homework and look at my website, and listen to clips of my music. I show up with a quick statement, like a comedy routine: "I NEED you to help me WIN tonight! There's more of them [the audience] than me, so please give me an unfair advantage over them!" And we laugh, I either hug them or give them a professional nod. We then begin the session of romancing the best sound that does not distort, but brings out the very best of my voice and the voices of the artists and musicians that I have had the privilege of hiring to make music with me.

I let the musicians know that it helps me if we cooperate *with* sound engineers. My band is comprised of the best of the best. I encourage a good energy from the cats during sound check. I refuse to stomach any negativity during the sound check from anyone. I have had a new band member who was a mega-perfectionist. I loved on them and talked to them after the gig about what worked or didn't. They apologized, and it got better. In the end, I am the bandleader. I only pay the band, not the sound man. I can't control anyone. I have to set the example of what works for me. Great treatment all around is the sweet spot! In the end, a sound engineer hopefully says, "She came to play, make a joyful sound, love on everybody, show up and show out, starting with a warm greeting to the sound engineers."

WHITNEY: How would you characterize your experience as a woman working with male sound engineers? As a black vocalist working with white engineers?

ANTOINETTE: Sound engineers seem to have a ball working with a woman who is black. I feel very respected because I'm bringing respect. At the end of the gig, I see the love in their eyes. Especially if they've never heard me live. They respect the early shmooze, my involvement in the set-up, and my ability to *get out of* their way (Montague 2017).

Bobby Sanabria at Marcus Garvey Park

Bobby Sanabria, a Grammy-nominated artist, frequently performed at Jazzmobile's Summerfest. His specialty was Latin jazz, musics associated with Afro-Cuban cultures and the Caribbean. He would perform with ensembles of various sizes at most of the venues in which we produced concerts. Sanabria performed with great reverence for the many different traditions that he represented on stage. In addition to his appearances at the annual Latin jazz block party that Jazzmobile co-hosted with Louis Armstrong Foundation in front of Armstrong's House in Corona, Queens, the Jazzmobile audience also welcomed Sanabria's contribution to the Summerfest schedule. In particular, listeners enjoyed his sonic tours through the geography and histories of the regions that his performances represented. In addition to all of this, he was a great drummer, and was always accompanied by talented musicians. The commitment and passion that he poured into his shows at times manifested in the difficulty his collaborators experienced when interacting with him. He yelled a lot. He was a taskmaster. He got into people's faces, and

he was intent on conveying his power to everyone on stage, including me. Yet this never went overboard, and I never witnessed him viciously degrade anyone. Eventually, he would mellow a bit, usually towards the middle of a performance.

Much of the clash, and what always seemed like disorder, occurred during what were supposed to be simple sound checks but turned into full rehearsals, sometimes of the entire show, right in front of the audience that had gathered early. His excitement about and commitment to the music seemed to correspond to the fact that his ensembles, ranging from a nonet to a big band, were regularly sight-reading new arrangements. During these rehearsals, he would get frustrated when players would miss entrances, not follow the number of repeats, or miss a coda. Bobby directed a part of his frustration towards me. He frequently complained that he could not hear on stage, that he wanted every microphone for every musician amplified in the monitor system, and that he also wanted his announce microphone to be prominent in the monitors. I knew that this would overburden the monitors, and would actually make musicians' efforts to hear themselves more difficult. My efforts to explain this to him were futile, however, so I tried to strike a balance between what the monitor system could sustain and what he wanted. Then, amidst these long "rehearsals," he would ask the audience if it sounded good, and they cheered, sometimes not really knowing whether or not the show had already started.

One summer evening at Marcus Garvey Park, Bobby Sanabria was scheduled to perform with his Ascension Nonet. The weather reports were threatening. By that point, having a sense of Robin's decisions to cancel the outdoor concerts due to inclement weather, I was at home, expecting her to call it off. She did call, but she was not certain

that she would cancel the evening's performance. She explained that representatives from J.P. Morgan Chase Bank, a significant sponsor of Jazzmobile that year, were scheduled to attend the show. She made it clear that Bobby, his group, and the Parks Department workers were wiling to perform that night, and that, given that my cables and other electrical components would be in danger, the decision to carry on with the show was mine. I said that we could do it.

When I arrived at the bandshell at five PM, a time when I am usually the first member of the crew at a show, I noticed that a small portion of the audience, as well as Robin, Vicky, Eddie, and Bobby and his band, were already there. By that time, everyone already seemed tense, not only because it was a Sanabria show, but also because Chase Bank was coming. There was an atmosphere of controlled chaos: assigned seating, more Parks workers saying "no" than "yes," Eddie busy hanging Jazzmobile and Chase signs, Vicky in rare form, Bobby being Bobby, and his bandmates feverishly testing microphones that had not yet been plugged in. Through it all, I eventually set up the system, and Sanabria rehearsed the band. Robin made her usual announcements, and introduced the representatives from the bank. The show started, and then the rain started as well. It began to rain heavily.

I had already covered my mixing console with a plastic tarp, but water was collecting everywhere. While the band was still playing, Robin came up to me assuming I would cancel the show. However, I could tell that it was important for her to keep going for the sponsors, and there was enough of a lip in the roof of the bandshell to cover the front of the stage. Eddie lifted all of the speaker cables onto the front of the stage, Robin

invited the audiences to sit and stand around the ensemble beneath the covered stage, and I lifted the mixing console and power amplifiers from the audience section to the front of the stage. Then, I reduced the overall amplification by half and aimed the main speakers to the sides of the ensemble. This way, the amplification serviced the newly relocated audience without it being too loud for them.

There we all were, musicians, audience, engineer, crew, president, and sponsors, huddled up on stage, sitting, standing, and dancing. I kept the tarp over the mixer, as water was still splashing everywhere. I also left the spot where the mixer was in order to make sure that all of the cases would be dry enough to take the equipment home. The new position of the main loudspeakers—closely aimed towards the musicians and their monitor speakers—produced a mix of sounds that made it difficult for the musicians to hear themselves in the ways they expected based on the rehearsal and the beginning of the show. Now, only a few feet from Bobby, I began adjusting the monitor mix to his liking mid-performance. However, I was focusing too much on Bobby's demands, in between walking around the stage in an effort to listen to this new mix, when Chris Washburne, the trombonist in Sanabria's group, began to solo.

Washburne soloed leaning forward, making the bell of his instrument almost appear to swallow his microphone. Some brass players like the effect of this posture, but many only adopt it during live performances when they cannot hear themselves clearly. This is probably why Washburne leaned over now; he had not done so when he soloed earlier in the show, before the rain had forced changes in the mix onstage. Away from the board, I heard his trombone sound intensify both in passion and amplitude. Almost as if

encouraged by Bobby and the other musician's swelling accompaniment, as well as by his own development of this well-crafted solo, Washburne leaned in on the microphone even further, and, with a powerful blast of air conjuring the deepest resonances of his trombone, overloaded the microphone, the preamp, the power amplifier, and the loudspeakers. I was not near the fader, which I could have used to ride gain on his input channel in an effort to protect the system. As a result, Washburne's blast destroyed one of my main loudspeakers. The show continued until the scheduled end; I got my check, went home, dismantled the loudspeaker, and sent the woofer driver and much of the funds from that check to ElectroVoice to have them re-cone the driver. Waiting for that repair, I used my backup speakers for the rest of the summer.

Chris Washburne later apologized for the speaker damage and explained that he assumed that the system had limiters and compressors that would intervene and shut down before any damage could occur. He simply could not hear his playing over the loudness of the ensemble. The sound system for this Jazzmobile performance was commensurate to the size of the typical ensembles, venues, audiences, and the organization's budget. This performance's ensemble size and musical dynamics were not representative of those of the other performances throughout the season. These factors overdetermined my choice to utilize the same sound system components that were adequate in accommodating the vast majority of performances during Summerfest.

Conclusion

The event that damaged my speaker symbolized an almost poetic break in the usual, taken-for-granted activities through which musicians and engineers interact with one another, mediated by a live sound system. It is an example that overturns and denaturalizes not only the power dynamics that I have described in this chapter, but also those similar power dynamics between professional musicians and live sound engineers in different contexts. One can interpret the transduction of a musician's sound within the microphone as a relinquishing of her power to the audile and tactile interventions of an engineer's listening and fader movements, as a naturalized condition of modern professional live sound production. However, one can also interpret Washburne's blast as exemplary of the capacity that musicians have to resist the limiting industrial powers of live sound engineers, as well as the ideological transparency that many such engineers seek as an ideal mode of labor. This explicitly reveals the socially constructed dimension of sound engineering power, and how it is garnered, maintained, and lost on the shop floors of live music production. Moments like this one have continually encouraged me to ask the following question: How is this power negotiated between musicians and live sound engineers in other contexts beyond my own?

Chapter Two: Randy Taber and the Labor of Live Sound Engineering

This chapter focuses on the live sound engineering work of New York-based engineer Randy Taber. Randy's labor exemplifies a certain standard for professional popular-music live sound engineers doing itinerant work. He works at multiple venues, which has the result of emphasizing the "labor" aspect of live sound engineering, since it means he has to perform a great deal of physical grunt work and often works in solitude (though he occasionally also works as an assistant within a production team, or manages an assistant of his own). Here, I offer three case studies of Randy's work, focusing in each case on the conditions of his labor. The first two case studies, one set at the Tarrytown Music Hall and the other at the Hammerstein Ballroom, both larger professional venues, give special attention to the set-up and sound check phases of a performance —more so, in fact, than to the musical performance itself, while the third, which examines a show at City Winery, excludes these steps in his work process and focuses instead on Randy's mixing of the musical performance. This final case study also exemplifies live sound engineering in a smaller venue, and analyzes Randy's technological construction of intimacy through the tactile use of mixing and fader movements.

The chapter concludes with an analysis of mixing popular music as a technological, social, and cultural mediation between two important transductions—at the mic and the loudspeaker. In this analysis, I describe how Randy moves, in the same performance, from his initial status as a laborer to his later status as an artist in his own right, enacting choices about musical sound. The sensory phenomenology of Randy's encounters with sound with his ears and faders with his fingers, and the concomitant encounter of the signals with the mixer, and their passage through the console mediated by his listening, effect this change in his status on the shop

floor. Before the signals come to the mixer, he is a laborer, his artistic labor ideologically invisible to the audience. This invisibility shifts, however, during musical performance, thrusting him, while still quasi-invisible, into a kind of perceptible prominence. Finally, Randy returns to his laborer status at the end of a show, after the audience has left the venue.

"To make them believe that I get it": Building Trust and Confidence Between an Engineer and Musicians

Randy and I discussed his live sound engineering work in an interview at Camille's Restaurant on Amsterdam Avenue in New York City on April 7, 2011. As we sat down, I gave him an overview of my research and asked him to share his thoughts about his recent labor experiences. I discussed my interest in focusing not only on the technological significance of amplifying live sound at concerts, but also on how similar considerations for the transparency and fidelity associated with live sound carries over into the social interactions between people involved in the production of live popular music. I described to Randy the types of settings I would want to conduct ethnographic research in as well as the types of questions I would ask and phenomena that I would observe and describe.

At the conclusion of my description of the project, I started by asking Randy an open-ended question about whether he had any introductory thoughts about certain examples he encountered frequently, relating to both social and technological manifestations of "transparency" or "fidelity." Randy's response focused on what he anticipated in an upcoming concert that involved amplifying a rock group that was performing in front of a small orchestra.

It was a concert of "music of Pink Floyd with an orchestra and a rock band" (Taber 2011). He shared the challenges of amplifying a live rock band and an orchestra in the same space simultaneously:

> And right there, I mean, it couldn't be any more different social settings in terms of interacting with a rock band and interacting with an orchestra. This has been a challenge for about two years, this project. It's really beautiful music as a rock setting. Also the arrangements are wonderful. But to try to get the two groups to see the same vision, and move forward and create this music, it's very challenging. So I believe the first challenge was being able to identify the persons in that organization to make them understand that I know what they do, the music that they normally do. Therefore, they know that I can understand what's important as far as music. And also, this builds the social and the musical trust, in terms of their instruments, that I how important these aspects of the performance are…So the first challenge I find is just being able to identify the people in the organization with whom to build trust, to make them believe that I get it, that I understand the music, and that I understand all the details with the lyrics. But the next challenge is to get them across to our [the engineer's] side so that I can do the work of making this rock and roll. This is what the people want (Taber 2011).

Even before discussing technological considerations associated with this challenge, Randy emphasized the importance of establishing trust—what I will call "social fidelity"—among the various individuals associated with the orchestra and the rock band. His reply exemplifies the importance of social fidelity in live sound engineering. He expressed the importance of conveying the appreciation of the musical traditions associated with both ensembles, conveying this appreciation or sincerity to both the conductor of the orchestra and the instrumentalists in the rock group. He found that without this established appreciation or respect,

the possibility for trust between the musicians and the engineer starts on feeble ground, in turn threatening the quality of the musical experience for the audience and the performers.

Randy began his description of the two ensembles associated with this tribute concert by treating them fairly equally. However, he moved towards identifying himself as on the rock "side" of that performance—as well as the audience's side—in contrast to the agenda of the orchestra "side." After detailing the needs of the orchestra, the delicate construction of the orchestra's instruments, and the dynamic needs of an orchestra sound, Randy also indicated the importance of fulfilling audience expectations, and expectations associated with the orchestra's role in amplifying the Pink Floyd repertoire.

Randy also used the word "persons" a lot in his description of the various social groups on stage for that performance, indicating the importance for him of identifying with the various persons on stage. This use of the idea of personhood is very compelling for the discussion of fidelity in this context of live music production. In this way, Randy described not only the needs of individuals as distinct aspects of their identity, but folds the expectations of communities affiliated through musical genre into this description of personhood—or in his use of the word "person(s)" —in describing what sorts of parameters—beyond microphones, sound pressure levels, etc.—an engineer negotiates in doing his work.

One aspect of this gig that exemplifies the expectations of the various persons at this production is microphone placement. The orchestra, and members of its art world as it relates to microphones, are used to a minimal number of microphones placed overhead or above the orchestra, typically near the conductor. Randy indicated that the orchestra's "people" are used to this pair of microphones in a number of arrays, sometimes pointed towards each other,

sometimes pointed away from each other. (Typically an orchestra is recorded in ways that emulate the stereophonic spread that might be experienced by a person standing at the conductor's podium, listening from left to right to the various sections of the ensemble). However, in the setting of live sound reinforcement, such a minimal number of microphones would require an engineer to amplify the two microphones to a level of intensity that would pose serious problems for the Pink Floyd concert for which Randy was preparing.

In front of the orchestra would be the rock band that included amplifier speakers for the bass guitar and electric guitars, a drum set, each of which requiring microphones, as well as monitor speakers for those musicians. Randy described the juxtaposition of these performance conventions as necessitating technological accommodations for the two ensembles as nearly impossible to achieve on the same stage, in the same piece of music. At this point in the interview, Randy described the challenges associated with convincing members of the orchestra and rock group that they need to accommodate each other with technological needs. The lengths to which Randy went to accommodate two very different ensembles on one stage included placing Plexiglas acoustic baffles around the drum set of the rock band. I was struck by this proposition.

Containing the sounds of the drum set is a classic challenge for most sound engineers, whether in the live setting or in the recording studio, in any genre that includes drum sets. The high sound pressure levels that emit from drum sets often bleed into other microphones in the same space. In the recording studio setting, engineers place baffles around drum sets that they typically call “Go Bos,” or go betweens. They are typically made of flat pieces of wood wrapped in carpet or foam. In a live sound setting, Plexiglas is desirable in the ways that it can help in

suppressing the drum sound from bleeding into other microphones while allowing the audience to see the drummer in ways that are necessary in live performance, but not in the recording studio. As a joke, I asked if in addition to wrapping Plexiglas panels around the drum set almost in a circular fashion if Randy had ever considered putting a Plexiglas ceiling panel on top of those Plexiglas walls. And to my surprise, he responded by indicating that they had tried it, and that it took a number of years and several performances for Randy to convince the drummer that it would be a good idea. Randy indicated that listening to a recording of the performance was what convinced the drummer to go along with Randy's plans for the baffles.

At this point in the interview, this example of Randy's interaction with the drummer of the rock group serves as a striking example of one of the many consistently recurring sites of contestation between sound engineers and musicians. On one hand, the baffles help in allowing the engineer to produce a balanced sound from the stage for the audience. On the other hand, the baffles constrict the sound from the drummer. A musician who performs inside of baffles has difficulty hearing not only himself, but his fellow musicians on stage. This example indicates the importance of developing relationships between engineers and musicians with many years of trial and error, which gives them the opportunity to convince one another of the importance of their efforts in live performance.

In the past, Randy has worked at these shows that combine rock bands and orchestras. And the orchestras he had worked with had been comprised of older musicians. Randy explained that in these instances the reactions of older musicians tend to be those that pose challenges for the merger of the rock band and the orchestra. However, in the more recent performances, promoters have hired younger orchestra members who are more versed in this type of

collaboration and range of musical styles. It is for this reason that Randy notes that younger musicians in the orchestra pose less of a challenge in terms of being amenable to Randy's suggestions for microphone placement and balance between the two ensembles.

Randy to me explained that it was easier for him to work not only orchestras that are comprised of young instrumentalists, but with pop orchestras, sometimes also called "pops" orchestras. Such groups, which are familiar with playing popular repertoires, are used to participating in these musical collaborations on a regular basis. He then told me the story of working at one of these types of performances in San Diego, where the budget was large, and the promoter, the ensembles, and the production staff were used to this sort of collaboration. He described the opportunity they posed in terms of not only being amenable to his ideas for multiple microphones on all of the instruments, but even expecting him to implement these decisions.

Randy then said that he could invite members of other productions that had challenged his ideas for multiple microphones to the performance in San Diego in order to finally convince them of the effectiveness of his approach. In terms of our discussion of social fidelity in doing live sound, Randy used this example to indicate that he finds that it is most effective to show members of the live music production what he's talking about, and that showing them such evidence works as a mode of establishing trust. This recalls his statement at the opening of this section, where he stated that it was important to "make [musicians] believe that I get it."

He reflected that this is, on one hand, a positive situation: he can indicate through direct practice that he knows what he's talking about; that he is in fact an expert. But on the other hand, his remarks suggest that there isn't an immediate trust based on his own word at the inception of

any particular production, and that he has to wait to show members of a new production his ideas in practice. This emphasis on showing the idea in action rather than production members (musicians, promoters, producers, managers) taking Randy at his word, exemplifies the social position of live sound engineers with regard to their fidelity—the trust and confidence between engineers and musicians, an example of "fidelity" that moves beyond sound equipment to the interactions among people.

This exemplifies how sound engineers are music makers with the capacity for artistic choice, not only with respect to the technological reproduction and amplification of musical sound, but also with respect to their agency or lack of agency in achieving artistic quality and musicality for the events on which they work. Between bites of our sandwiches, I asked questions about Randy's role at these productions. From David Kerzner, Associate Professor Sound Engineering Arts at William Paterson University, under whom both Randy and I trained as undergraduates, I know that Randy typically works as a kind of house mix engineer, the sound engineer that mixes the microphone signals from the stage, primarily for the audience. However, I am also aware that he often works in other capacities at live shows. He confirmed this understanding I have about his labor, indicating that he, at times, works as a stage manager, and sometimes as a tour manager or a monitor mix engineer. He said that this depends on the experience of the promoter, especially in cases where he arrives at a venue with the understanding that he's a mix engineer, and then finds himself making the decisions of a stage manager.

One of the interesting things that he brought up in relation to responsibilities at these performances relates to the Pink Floyd performance he discussed. He indicated that the promoter

and the manager had specified a 72-input Digidesign[9] console configuration. He said this poses a particular challenge for him in that the many page settings for all the various microphones on the digital console, or at least in its graphic user interface in its computer screen, would entail having to flip through multiple pages of the interface between sets of inputs to get to one section of the orchestra, or another section of the rock band. He said that with so many inputs, it's very difficult for him to jump between, for instance, the percussion section of the orchestra and sound sources in the rock band in swift and efficient motions. He told me that he had specified another engineer to join him at the large mixing console to assist him in dealing with this complexity.

I also found it interesting that Randy described the process of encouraging the production to hire another engineer, as a technical "specification." Typically when an engineer specifies something, it refers to a nonhuman thing. It is a piece of audio equipment such as a microphone, configuration of cables, speakers, consoles, etc. That Randy specified his need for another engineer—and in such a way that is in line with how engineers "spec" certain pieces of gear—also contributes to my understanding of how Randy participates in an art world of live music production that at times treats engineers as objects to be specified – as instruments rather than persons.

In conjunction with his earlier description about the difficulties and complexities involved in establishing trust among performers, managers and promoters, this example of the engineer as a functioning agent shows the complex labor position of live sound engineers at these concerts. After another pause at our sit down lunch interview, Randy volunteered some

---

[9] Digidesign is a company made ProTools and its hardware interface, subsequently branching out into making consoles.

recent thoughts regarding transparency and fidelity, indicating that he believes that transparency and fidelity are inextricably tied to musical genre. He said:

> You know, I was thinking about the whole idea of transparency. That term is kind of a mysterious little term. We all understand what it is, but how do we define it in some sort of technological sense. What does it mean? I was thinking about that, it really depends on the genre. It's not specific to any particular genre, the way we can define that. It also depends on the room where you're listening to it, or if it's outside, the lack of a room, the acoustics. It all depends on those two factors. I thought about the compression driver versus a ribbon driver. It's interesting because I mixed wooden drivers for many years. For certain styles of music, it sounded transparent. For other styles of music, they said it sounded dull. I couldn't figure out for the life of me what worked differently for a long time. I didn't understand the difference. So I'm measuring the frequencies, it's flat. 20 to 20. It's all there. But then I realized there's less distortion in the ribbon drivers. So putting the jazz and the classical people, it's what they're looking for. They're more sensitive to the distortion, that it's negative, than in rock and roll. That's a positive. So there's more distortion in the upper mids and highs in the compression because of what it's doing. The compression chamber, limiting the SPL's. But that's what they wanted to hear. Nothing to do with SPL,[10] or frequency response. It was putting 115 decibels. That's pretty loud. 20 to 20. What's the problem? You know? It's distortion. I thought it was odd that the distortion led to them determining whether or not it was transparent, or high fidelity, or not. That attribute is bizarre. But at the same time, I get it. They want it to sound aggressive, and the ribbon drivers won't do it (Taber 2011).

Over the past few years, Randy has consistently specified loudspeakers that include ribbon tweeters. Tweeters are the transducers within a loudspeaker cabinet that reproduce high frequency sounds. Randy discussed the ribbon tweeters, a particular type of tweeter that uses a vertical strip set between two vertical magnets, in contrast to compression tweeter that uses other technologies and configurations. He described the responses he receives from individual musicians at concerts where he uses the ribbon tweeters as very different depending on the genre of music. In his experience, audience members who attend jazz and classical concerts find the

[10] Sound pressure level.

ribbon tweeter's reproduction of high frequency sounds to be highly desirable. However, at rock concerts, audience members and listeners who are members of the production find the ribbon tweeters to be less than desirable.

In the course of his work at those various concerts with the same ribbon tweeter speakers, Randy wondered if the ribbon tweeters produced high frequencies with different amplitude as compared to their compression driver counterparts. Randy indicated that these two types of tweeters actually have a negligible difference with respect to the high frequencies they reproduce, except that the compression driver reproduces certain amplitudes of particular high frequencies with distortion. Randy finds that people who had a problem with the ribbon tweeters in the rock context have an expectation for the high frequency distortion that the compression driver tweeters present, and that the jazz and classical audiences appreciate the non-distorted high frequency reproductions of the ribbon tweeters.

This interview allowed me to introduce myself to Randy, introduce the project, and describe how his work provides a rich point of entry into my research questions. And it also began our dialogue about how fidelity emerges not only technologically but also socially in the engineering of sound in live popular music productions. The discussion of his work on the upcoming weekend with the orchestra and the rock band was very helpful in establishing our shared questions about fidelity and musical genre as well as our mutual understanding of the challenges of working as a live sound engineer in these particular genre-specific production settings. Our conversation established an equal regard for technological considerations not only of fidelity but of expectations and desires that are culturally constructed through genre categories, and the effects that these technological considerations have on the social expectations

of musical workers such as Randy, and Randy's expectations of musical workers. By the end of the interview, we concluded our discussion of these anecdotes and examples of fidelity and began to discuss his upcoming work schedule. I now turn to the first of three live sound engineering events at which I observed Randy's work in a production context.

Randy Working at Tarrytown Music Hall and the Pat Benatar Sound Check

Arriving at Tarrytown Music Hall

On October 5th, 2011, I got in my car and drove to Tarrytown, New York, where Randy was be a system tech for a rock concert given by rock singer Pat Benatar. My journey took me up the West Side Highway, which turns into the Henry Hudson Parkway and then into the Saw Mill River Parkway. All along the way, I saw the urban topography transition from the high-rise low-income housing and light industry of the Bronx into the residential neighborhoods of Yonkers, and then into a wooded area with trees lining the highway.

In Tarrytown, a quaint town made famous in the writing of James Fenimore Cooper, I passed rows of midcentury homes and small shops until I got to the old Tarrytown Music Hall. After parking behind the venue, I put fresh batteries in my recorder, grabbed my camera bag, and made my way out of the car, walking up a very quiet, almost residential street towards the music hall.

In the lobby of the music hall, there was an old carpet, a row of three or four small ticket booths, and a number of old posters of previous acts that had performed there over the years. I approached the box office and told the woman working there that I was there to see Randy Taber,

the system tech for that night's show. She appeared not to know who he was. When I told her he was a sound engineer, however, she remembered. As she went to get him, I saw a crowd of young children burst out of the doors to the auditorium, no doubt students on a field trip, led by adults who were apparently their teachers.

When I saw Randy walking around inside the auditorium, I remembered he had told me that he would be doing sound for a children's play on the morning of the same day as the Pat Benatar concert. By the time of my arrival, he was breaking down the venue's equipment, a mid-size analog mixing console at the front of house mix position. We greeted each other, and he told me about the play that had just finished, which he described as a bunch of kids and a number of omnidirectional wireless mics. Having worked in many similar situations with the Orthodox Jewish girls' school shows (see Preface), which necessitated dealing with the juxtaposition of small children and wireless mics, I immediately recognized the hectic acoustic nightmare posed by children coming on- and offstage and unclear sound cues. I also knew well the inevitable talking from offstage that enters the loudspeaker system in the auditorium in these situations, and the guilt an engineer feels for not being able to control the sound better. Randy was clearly glad that it was over.

As we were talking, the venue's manager showed up, and Randy introduced me to him, explaining that I would be there to observe him operating as system tech for the Pat Benatar concert. We talked a little about my project, and the venue manager mentioned that would be great for me to see what would be happening later on with the Pat Benatar show, which he said was much more representative of what takes place at the music hall than the children's performance.

For that night's show, the venue manager had been working closely not only with Pat Benatar's road manager, but also with local rental houses, in particular SIR, a New York City-based audio rental company, to specify and rent equipment that would be brought in for the performance. Randy and the venue manager worked to transition from the children's performance towards getting the venue ready for the rental company to deliver the sound equipment and the back line instruments, including the drum kit, piano, bass amps, and guitar amps. I assured Randy that I intended not to get in the way—that I was primarily there to observe how his day typically unfolds at these sorts of concerts. Then I made my way to the back row just next to the front of house mix position, where Randy would set up the mixing console alongside Pat Benatar's traveling front of house mix engineer.

I set up my tripod a few seats away, put my Nikon D5100 SLR camera with a fish eye lens on it, and set the tripod and camera at a height slightly above where an audience member's would interrupt the sight lines. Tarrytown Music Hall is a union hall, where making video recordings both of the setup and the performance is typically forbidden, but my goal was primarily to take still photographs of the rental crew loading in the ATA-style[11] tour cases. The shot was wide enough to capture the cases coming in one of the back exit doors in the auditorium through which the rental company workers and stagehands would roll the cases down the aisle and up to the stage, as well as the moments when Randy and the traveling engineer would erect the table for the front of house mixer and set it up. Not wanting, however, to seem like I was spying on the scene, I set the tripod and camera at about four feet off the ground, wrapped my coat around the tripod legs, and put my bag on the arm rest of one of the seats, making the

[11] ATA cases are the common brand of equipment cases used in professional popular music tours.

apparatus look like just a pile of stuff in the back row of the auditorium. I put my recorder on one of the aisle dividers just behind the back row and the front of house mix position, and placed my small Tascam recorder near where Randy and the other engineer would be working.

Set-Up

Before the SIR delivery trucks arrived, a number of the stage crew members entered and congregated on stage right. It was a cacophony of people—mostly white men, with the exception of an African-American stagehand. Randy and the stage manager were among the crowd, discoursing on a number of topics, including previous shows, the gear "specced" for this day's show, and the discrepancies between new hardware and the lack of software or firmware updates for it. This conversation went on for more than an hour and a half, until SIR trucks showed up on the sidewalk, and dozens of red SIR-marked ATA wheeled cases were rolled out of the truck, into the Music Hall, and onto the stage by the delivery crew and the stagehands—hard, sweat-inducing work that took approximately an hour and a half. These cases contained guitar amplifiers, a drum set, stage effects, lights, and even a baby grand piano. One of them held the Digidesign console that Randy began to set up.

Soon after the cases arrived, William, Pat Benatar's traveling mix engineer (who I was interested to note was only around twenty-five years old), joined Randy and the stage manager at the mix position, and they started to assemble the aluminum sled, or sleigh, that gently rolls the console up from a vertical position to its elevated horizontal position. It took all three of them to make sure that the $80,000 digital console would not slide or break in the process of setting up the table, or lifting the mixer onto it. They then began wiring the console and its rolling snake box to the venue's snake. In addition to these connections, they wired a series of inter-connecter

patch cables between the console and signal processors in the venue's rack, including limiters and graphic equalizers that connected to amplifiers and loudspeaker cabinets near the stage.

Randy, William and the stage manager worked on this for roughly an hour. During this time, the stage manager was steadily checking in with various members of the production team at both the back and the front of the house. Over this period of time, whenever I looked to the stage, I saw more elements becoming finalized: the stagehands had moved the back line instruments and equipment into place, had aimed loudspeaker cabinets for the house and monitor cabinets for the musicians (of which there were only a few since Pat Benatar's musicians use in-ear monitors), and had set up microphone stands connecting microphones to the snake at the back of the stage.

Pat Benatar's manager William seemed to wear two hats, as both her manager and monitor mix engineer. While Randy and William were working on the settings for the front of house mix, Benatar's stage manager set up both the in-ear monitor wireless body packs and the mix for the musicians. He also worked on setting up and checking Pat Benatar's wireless mic. What was consistent in both William's and the monitor engineer's setup activities was their shared focus on the setup of the hardware connecting the digital consoles to the various outputs and signal processors. In addition, both of them carried USB drives that stored the digital settings for these consoles, making the software configurations a much easier process. This arrangement allowed the engineers to simply connect the specified digital consoles at each venue of the tour. Nevertheless, there was still a lot of wiring to be done across the few hours of the setup, and there was a flurry of men working, still moving cases from the street onto the stage, and connecting pieces of gear. It was hard to know where to stand physically in the space; all I could

do was to observe the setup process, which felt awkward, since I was used to setting up this type of configuration myself. Indeed, even in my previous fieldwork project, documenting the work of live sound engineers in New York City at world music concerts, I was able to participate in the setup and breakdown, particularly at Symphony Space, where the union labor rules were not as strictly enforced. Here, however, with much more going on, I couldn't help out, though I offered to do so, even knowing that the answer would be "no."

Lunch

At a certain point, it was time to have a lunch break. The stagehands stopped what they were doing and congregated at the foot of the stage, where a six-foot plastic table had been erected and spread with a variety of foot-long hero sandwiches and soft drinks. Although the dozen or so stage hands made their way to the table and started eating, Randy declined the offer of food, explaining that he had eaten before the children's play, and still had some food left in his bag. As an observer rather than a worker, I was not offered lunch, which I understood; I did make my way to a small cafe nearby and had a sandwich.

Pat Benatar's Entrance and Sound Check

As I walked back to the venue, I saw a large black SUV parked in the space where the SIR moving trucks had been earlier that day, and saw Pat Benatar and her assistant get out and walk into a back door near the stage of the venue. I went back into the venue near the front of house mix position, and saw that her band was already onstage fine-tuning their amps and checking them one at a time. As the musicians were setting up their guitars, the drummer began

checking each drum, starting with a kick, then moving from the snare to the toms and to the high hat. The monitor engineer started to distribute the in-ear monitor packs to the musicians. At that point, Benatar entered the stage with her monitors in, and she immediately went to the microphone to test the microphone-and-monitor mix.

Soon after this, the musicians began performing the introduction to one of the songs they would play that night, but none of their sounds were amplified in the hall. William and Randy were still fine-tuning aspects of the system—not the sonic characteristics of the program itself, but accommodations the program would need in the specific acoustic setting of the hall: In spite of the fact that each show's settings were saved onto the flash drive, a few settings would have to be changed at every performance for the particular acoustic dimensions of each venue. The musicians were playing and Benatar was singing to test their in-ear monitors, but all I could hear from the back of the auditorium were the drums, a few scratches of guitar, and Benatar's unamplified voice, which sounded weak at the microphone. It was like a private sound check: silent for the audience, just loud enough for the musicians and the small ear buds that fit inconspicuously into the musicians' ears. After about five or ten minutes, William was ready to test the input signals through the house speaker system. With the advent of the digital console technology that allows engineers and artists to save particular settings, there wasn't a lot to discuss between the engineer and the artist except the sonic aspects particular to the venue.

A primary example of the sort of discourse which unfolded during the setup was the checking of Tarrytown Music Hall's sound pressure level decibel limit. This limit is set for the purpose of protecting the structure of the historic building, so that sounds above the limit do not damage the infrastructure, and for complying with the noise ordinance of the Village of

Tarrytown. This limit is 100 decibels SPL at the front of house mix position. It was clear that Pat Benatar, the tour manager, and William were aware of this limit, and they talked about it before they started testing signals through the house system. In addition to Benatar and her live stage musicians—lead guitar, rhythm guitar, bass guitar, drum set, and piano—a pro-tools synthesizer track would also accompany the performance. The combination of these prerecorded tracks with the musicians' efforts on stage worried everyone in the venue because of the sound pressure level limit. With this in mind, the production team decided to test the system with one of Benatar's hit songs from the 1980s, "Love is a Battlefield."

Pat Benatar On Stage

Benatar was on stage, microphone in her hand, monitors in her ears. She began testing her mic, and waited while the guitarist, drummer, and bass player began the introduction to "Love is a Battlefield." William cued up the midi tracks in a pro-tool session. Everyone was a bit concerned. They knew that the sound pressure level from these prerecorded tracks, as well as the intensities of the guitar cabinets and drum set through the speaker system, would inevitably be louder than the Music Hall's decibel level limit, but they proceeded nevertheless. The first thing we heard in the space was a large, deep, intense, driving ostinato bass line. One by one, the guitarists entered. The levels were hot. One could hear the guitarists' picks and fingers slide across the frets of their instruments. We heard all of the effects, distortions, delays, and reverbs that the engineers could apply to the signals. Beneath all of this sound was a defiant, attention-grabbing kick drum pulse, accompanied by strikes on the loud snare drum on each cadence in the ostinato of cymbals clashing.

And just when I thought it was loud, Pat Benatar's voice entered. William's saved settings from their previous performances included heavy compression on her vocal track, as well as a fair amount of reverb. Her voice sounded at once intense and far away, the effect of the combined compression and reverberation. She didn't start immediately singing the lyrics of the song; instead, she chose a vowel sound, and started to sing an improvised melody, testing her levels in the monitors and in the house solely based on the resonant formants of her voice amid the other instruments in the background tracks. Finally, she started singing the words of the song.

During this process, William double-checked the balance of the instrumentalists on stage, making sure that Benatar's voice soared above them. Background checks came in and out of the mix. The pounding bass line was not only audible; it was palpable, felt in subsonic thumps. Nevertheless, the bass player wasn't alone in this low range of the frequency bandwidth; the background tracks also made very loud low-frequency contributions, a kind of subsonic pounding that resonated octaves below the bass guitar. The sound was all-engulfing: the stagehands interspersed throughout the venue, as well as the engineers and managers, focused intently on the stage, nodding their heads to the inescapable groove.

Also nodding up and down to the driving beat, as if agreeing with the argument the music seemed to be making from the stage, was William, who stood behind the Digidesign venue console, making slight tweaks to the parameters in Benatar's voice track and blending and balancing the instruments' sound signal from the stage and the background tracks. Then, all of a sudden, Benatar waved her hand, and the instrumentalists stopped performing. William, taking his cue, quickly pressed stop on the pro-tools backing track. Benatar, at center stage, held her

hand over her eyebrows as she was showered with an onslaught of lights, and. She asked, ""How does it sound?""

William replied, "We're far above the SPL limit."

Benatar asked whether it really was a strict limit. Everyone in the hall shouted at the stage simultaneously that it was. Benatar wondered aloud, "Is it because of the building, the age of the building?"

No one responded. She shook her head in frustration and said, "Okay, let''s do it again," instructing William to "just keep my voice on top of everything. Bring the level down as much as you can, but keep it intense."

I was struck by this request; it was a tall order for William to engineer that. He began feverishly moving the knobs around, changing the scenes in the digital console display. The band started again. This time I noticed the lower frequencies and subsonic tones from the bass guitar tracks and the recorded pro-tools tracks sounded much tighter through the subwoofers. A fair amount of the lower range of the electric guitars, from around 250 to 500 Herz, was now missing. The drums were still fairly intense. Now Benatar's voice sat firmly above its accompaniment.

After this secondary check, I noticed that William had put on headphones, and was speaking into a Shure SM57 microphone, talking directly to Pat Benatar through her in-ear monitor. Their exchanges were now private. The sound check persisted; everyone started and stopped playing. I half-heard William say something unintelligible, laughing about a joke made from the stage. Benatar spoke through a mic that was muted from the speaker system, but clearly routed to William's headphones, and probably the monitor mix engineer's headphones as well.

The three of them continued a private conversation through the microphones and headphones, and moved on to the next song in the set.

Pat and William: The Musician-Engineer Encounter

After a while, when it became clear that most of the work had been done, Randy, the managers, the stagehands, and I started to sit down in the audience seats, watching the sound check in progress. At one point, Benatar put her microphone back on its stand, took the in-ear monitor buds out of her ears, and looked around for a way to walk into the audience section. I noticed a slight panic among the venue manager, her mix manager William, and the stage manager. William looked up and immediately put his headphones down, making his way toward her at the third row directly in front of the center stage. As if the exchanges between William and Benatar were not already private enough through the headphones and microphone talk-back channels, William's and Pat's move towards this section of the audience marked an intensification of privacy between the engineer and the singer. Everyone around them looked on as if in an effort to overhear what they were talking about, desperately trying to read their hand gestures and expressions, trying to follow what they were pointing to, what they were thinking about, as the musicians onstage continued to play.

Although by then I had by then put away my recorder and camera, this moment—just the two of them looking up at the stage—was evocative enough that I wished I could capture it. So much of the work of live sound engineers, front of house engineers in particular, entails a physical distance from the performing artists, especially the lead singers. During most of the sound checks I've participated in as an engineer, or observed as an ethnographer, I've

consistently encountered this spatial divide between these two categories of social actor and their realms. It was therefore very significant that the two of them stood in this position, listening together through almost an entire song, pointing to various people and pieces of equipment onstage, commenting back and forth to each other. I took out my cell phone, turned on the camera app, and began to hold up the phone, aim it at the two of them, and take a couple of pictures of them talking. After the second quick shot, the venue's manager came up to me and said, "Okay, you can't record anymore. No more photographs or anything." I replied that I understood.

Hiding

After talking for a while, Benatar walked back to the stage, and William ran back to the front of house mix position. Before Benatar picked up the mic to sing again, she appeared to make a comment to the side of the stage, and, soon afterward, her road manager came out into the audience and requested that everyone—all of the stage crew, venue management, ushers who had started to prepare the venue, janitorial staff, Randy and myself—leave the audience seats. In fact, he was so emphatic about us moving quickly that all of the stage crew, Randy, and I quickly went to the back of the auditorium behind the partition that separated the back of the front of house mixing console, and the audience section from the front foyer of the venue. The bottom half of this partition included solid flat pieces of wooden panelling, and the top half was made up of windows with horizontal blinds, which the janitorial staff closed.

And there we stood, about a dozen of us, huddled behind the center section of the partition between the two aisles of the venue. We stood directly behind the mixing desk, which

we now couldn't see. I wondered why Benatar's manager hadn't asked us to leave the auditorium altogether—why he didn't want us to wait outside the main doors next to the ticket booth, or even on the sidewalk where the rental trucks had parked. What was the big deal? I wondered. What was wrong with us just sitting in the audience? Did Benatar wish not to see us? Did my taking a photo of William and Pat talking breach a sense of trust between the production team and her singing? Was it my fault? Was it a norm?

After a while, it began to seem like the latter. None of the other production workers were as perplexed or upset as I was; it seemed like standard procedure to them. Whatever conversations they had been engaged in in the auditorium seamlessly continued behind the Venetian blinds, almost as if we were playing hide and seek from the artists on stage. However, it did get a little awkward when a few of them stopped talking, and we started to just look at each other: everyone seemed to think it was starting to be a little bit weird that all of us, grown men, were hiding behind a partition.

Nevertheless we stayed there for about three or four more songs during the sound check. William came behind the petition occasionally to ask Randy a question about the setup. There were no seats and nothing to rest on other than the partition itself and the back wall near front of the venue. The awkwardness of standing at close quarters with a dozen men I'd never met began to be a bit much for me, so I quickly darted into the audience seat section and grabbed my bag and my coat and the tripod, turned to Randy, and thanked him for the opportunity to watch some of this. He replied that I was welcome, and that we should be in touch about upcoming dates. I said goodbye to the manager I had met earlier in the day, waved to some of the guys I'd seen

throughout the day—who clearly didn't know what I was doing there—and walked out the side door of the venue, down the sidewalk, and back to my car.

Leaving Tarrytown Music Hall

Once I got into the car, I made a new track on my field recorder, and proceeded to take down field notes in bullet points about what had happened. In particular, I noted Tarrytown Music Hall's SPL limit, the issues that it posed for Pat Benatar's music, and the implications that limit has in general for that genre of music. I also made some notes about how the production workers and I had to hide behind the partition at the back of the venue. As I drove home, I felt at once grateful about the opportunity to have observed Randy at work, and upset about all of us having to stand behind that partition.

Transparency and Injustice: Pop Music Shop Floor Culture

As I noted in my introduction, and discussed with Randy, transparency as a recurring salient concept in the discourse of sound reproduction technologies of all kinds is central to my questions about live sound engineering labor. Nevertheless, even in my own practice of live sound engineering, I had never seen such an explicit conception of transparency unfold as I had in the sound check. I had assumed that transparency would emerge as a series of considerations to attenuate noisy room resonances, or resonances in guitar cabinets, or too much sibilance in Benatar's vocal mic. I had expected that William's or Randy's efforts to suppress the construct of transparency might take the form of moving loudspeaker cabinets into conspicuous spaces, or tucking cables aside. I had imagined that transparency would primarily manifest in technological ways, as an effort to amplify sound without the audience knowing about the mediations involved

in doing so. While I knew that there would be social examples of transparency as well—that there would be stark divisions of labor between the art workers and the tech workers, in formalist terms—I had mistakenly thought that Randy and William's responsibilities with the inanimate objects that they used to control these signals would have an enhancing effect on their own agency, and would influence the way sound was amplified at the concert.

As I'd experienced myself many times before, I had correctly assumed that the connection between their human effort, their social identities as technological laborers, and their close ties to those technologies would mean that they would have an explicitly subordinate but implicitly sovereign set of engagements with the musical sound that day. At no point, however, did I imagine that the social transparency of laborers at a live popular music production would entail that men literally hide behind a partition. All the same, our position behind the partition, huddled up and crammed together, seemed to me indicative of the social transparency associated with live sound engineering in pop music production. The demand for transparency called for either by Benatar, her manager, the pop genre itself, or the industry, meant that the workers in popular music sound must be invisible, but not too far away. In addition, the fact that none of the workers complained about this request, and, moreover, that they complied with it in a way that made it appear as if they hid themselves behind the partition at every show, indicated that this extreme ideal of social transparency is in fact a commonplace in popular music production, even a standard practice of live pop music shop floor culture.

This culture of invisibility produces a series of conflicts and complacencies on the part of individuals who, at different times, either participate in or resist its norms. The sound pressure level limit at Tarrytown Music Hall, Pat Benatar's well-known music, and William's negotiation

between them, exemplifies the production of pop music in the New York City area: the juxtaposition of loud music in old buildings with gradually-deteriorating foundations is a common problem in the merging of loud youth musics and old localities. William's successful effort, following first and foremost his own knowledge of his needs in his work, and then Benatar's reminder to make the sound levels lower but to maintain their perceptual intensity, shows the work of live sound engineering in constructing a coexistence of loud music and old fragile spaces. William made it possible for the music to be there, to preserve some semblance of the loudness that audience members remember and expect from Pat Benatar, while avoiding a response from the government or local police to stop the concert for exceeding the town's noise ordinance limits. And while the stagehands, the other engineer, the stage manager, and the ethnographer had to leave the immediate visible space and hide, William, the man who facilitated this musical and extra-musical co-presence, was able to stay with the artist and the audience. It struck me that this was both a privilege and a duty.Moving the rest of us to that back corner of the venue, Benatar's manager constructed an immediate visible space that worked to make the audience section and stage a private space that only members of the traveling tour could share, with the consequence of making every other worker at the venue almost fade into the wall.

In the following section, I address another episode of Randy's work that exemplifies a common aspect of New York City live sound engineering labor: engineering the music theater genre at the Hammerstein Ballroom.

Hammerstein Ballroom, Manhattan Class Company Theater: Setup and Sound Check

> Sound check is interesting because—I have to get sounds that make sense for me in terms of reinforcing sound in the house. And I also have to create sounds that are good for the stage. So there are two perspectives, one I need to hear which is what I think the audience will want to hear. And then what the performer needs to hear, which I never know what [in advance]. It's very strange mixing monitors. For example, I'm forgetting what show it was, they wanted mostly high hat monitor, not much else. I thought it was really strange but it helped them to perform. I don't pass judgment on them. Whatever it is they want, that's what they get. I'm kind of indifferent to that (Taber 2013).

On April 30, 2011, I left my apartment and made my way to the Manhattan Center on West 34th Street in Manhattan. I was there to observe Randy at work in the Hammerstein Ballroom, where he would be the mix engineer for the MCC Theater Company's "Miscast" gala, a benefit concert the theater company hosts annually. As a fundraising dinner, the Miscast show reintroduces the theatre company's patrons and new donors to its cast members and other performers from Broadway and off-Broadway, who perform songs from musical theater productions in which they would not otherwise be cast. It's a dinner with fairly high ticket prices, and, judging from the number of crews and workers, equipment cases, and the number of hours dedicated to setup, the production budget seemed substantial.

Randy had been at the Hammerstein Ballroom practically all day when I arrived around noon. As I walked up the few steps from the sidewalk on 34th Street into the venue, I looked for the security guard whom Randy had told me to contact on my way in, an African American man named Steve. I found him sitting at the security desk, and told him my name and that I was there to see Randy, the sound engineer. He pointed to the next set of doors and said, "He's in the Ballroom. You'll probably find him backstage." As I made my way into the Ballroom, I was

immediately struck by its large size.

I had heard about the Hammerstein Ballroom for years, both about the array of pop music stars who have performed on its stage, and the large crowds attending concerts. The ceiling was impossibly high, and there were three balconies extending upward towards it. The incandescent house lights that shone on the walls and ceiling accentuated the deep gold and red and the oddly curved box seats in the balcony areas. Standing at the back of the Ballroom as I looked towards the stage, I saw dozens of workers moving things around and yelling to one another, as well as a number of workers in the balcony sections and on the loading dock just behind stage right.

My first task was to find Randy. I looked all around the stage area. I walked forward into the Ballroom's orchestra section. I passed by the many workers who were setting up the audience and stage areas for the evening's production. But I didn't see Randy. I got closer to the stage, and looked back into the wings, then turned around and looked back towards the mixing console that was in the front row of the first balcony, but he wasn't in either place. Maybe he was on break or outside? I waited. I walked around a bit towards the middle of the space. Then I turned around again, and looked back towards the stage, trying to determine what made this stage different from other stages I have observed or worked. I noticed that it was a rather wide stage, with many lighting tresses hanging above it; I also noticed that the underside of the stage was exposed, and I was able to see a number of support beams holding it up. As I peered at the inner workings beneath the stage, I noticed a light shining on the inside of an amplifier rack. It was Randy. He had been lying down on the ground underneath the stage with a Mini Mag flashlight in his mouth, making a series of interconnections between leads from the microphone snake and speaker cables that he would later run throughout the stage.

After a minute or so, Randy came out from behind the rack and appeared at the front of the stage, standing up. Unlike many of the workers around at this time, who wore an array of casual work clothes of different colors, Randy was wearing all black: a black t-shirt, a black work belt with tool accessories hanging from it, black pants, and black sneakers. He was also covered in dirt collected from under the stage. As he dusted himself off, dust billowed from him. We greeted each other at the foot of stage left, directly in front of the large ATA road case behind which he had been working. I explained to Randy that today I would just be observing and recording. At the same moment, a man walked by, and Randy said, "Oh, let me introduce you to Robert."

Robert, a tall white man wearing a blue windbreaker, had turned around to respond to someone yelling a question from another part of the room. Robert was the production manager for the Manhattan Center, and the coordinator of the various crews who work in that space with the production managers of any touring groups that utilize the space; since work takes precedence, Randy was unable to introduce us. Randy himself was fairly busy at that point with the amplifier, so I said that I would not get in the way, and that I would be up in the balcony, near the front of house mix position.

I did, however, attempt to ask Randy just a couple of questions. I wanted to know, first of all, how long he had worked at the Ballroom. He told me he'd been hired directly by Robert, the production manager, years ago, and had since worked there on many occasions. In fact, Randy was so involved with the production activities at the Manhattan Center that he had, on numerous occasions, specified equipment—that is, directly advised the venue what equipment to purchase for specific productions—in addition to having built numerous installations for the space.

Recalling the problems I had encountered attempting to record at the sound check for Pat Benatar at the Tarrytown Music Hall, I asked Randy whether the Ballroom was a "union house." Randy assured me that today's setting was a much better environment—one in which I could record—and that the Manhattan Center was actually owned by a church. His implication was that the owners did not always strictly follow the union's rules. By this point, it was clear that Randy needed to turn back to his activities around, above and under the stage, so I thanked him again and made my way back to the front row of the first balcony.

Hiding

Because of what had happened at Tarrytown Music Hall, when production workers were ordered to hide behind a partition between the front of house mix position and the doors to the audience section, I was especially mindful of union rules at the Hammerstein Ballroom, and made every effort not to infringe upon regulations for outside observers or recording. Because it had also been difficult, in Tarrytown, to observe Randy and the traveling engineers' work by just standing near them while they were working, I now positioned myself a few rows back from the mixing console and towards the stage left side, up in the balcony, where I could view Randy more easily.

Once again, however, I was essentially hiding myself, as an ethnographer who was recording the labor effort of the production while not contributing it. As such, I was becoming aware that the activity of hiding was a central feature of my ethnographic project. Indeed, throughout the course of my observations of Randy Taber's work, both he, the live sound engineer, and I, the ethnographer hid in very strategic ways, while each of us engaged in his

respective form of technological reproduction. Randy hid when mixing and amplifying sounds during a performance, and I hid when recording Randy's work to set up the processes, communications, interpersonal communications, and technological configurations for his sound reproduction during live events.

Indeed, Randy's all-black attire marked hiding as his specific labor condition for this production, as it does for many sound engineers at many such events. Strikingly, Randy was one of the few people all in black; many of the other production workers, including lighting technicians, stagehands, janitors, and caterers, were dressed in a variety of colors. These workers would perform the majority of their work before the actual production begins, and before the entrance of the audience; some would return after the conclusion of the event.

Randy, on the other hand, would be in the space before, during, and after the event; thus, his black attire functioned as a way to hide his appearance to the audience, contributing to the social and technological condition of production transparency at this benefit gala, where he would blend into the black void beyond the lighted stage at showtime. Out of respect for these conventions in general, and for Randy's labor conditions in particular, I was also dressed in black —a black polo shirt and black jeans with black shoes—in order to similarly mask myself in the instance that I decided to stay during the show, or even if I were asked to assist (that is, if my feelings of discomfort about this encounter, based on what had happened at my previous observation, subsided).

Sitting in the balcony, I began to set up my camera tripod. I affixed my Nikon D5100 atop it, and I put my Tascam DR40 sound recorder on top of the camera, connected them, and

brought out my telephoto lens in order to make visible the activities onstage. I was using the microphones on the Tascam recorder to feed sounds to the Nikon HD video recording. I was unable to monitor the peaks of the sound level in the Nikon's video recording, I remembered certain basic settings for this connection, and I put my faith in that memory; I was too busy at that moment to record a segment and listen back to make sure I had the right input level on the audio side.

Randy seemed to have an assistant today. Nelson was a white man in his late twenties who, like Randy and me, was wearing all-black attire. I did not have an opportunity to meet and talk with him, but I saw, through my viewfinder and the Nikon's telephoto lens, that he and Randy were working in tandem. Was Nelson Randy's assistant, I wondered, or did they work in an egalitarian way? Was Randy Nelson's boss? Did Robert hire Nelson and Randy to amplify sounds for the MCC event as equals? None of this was immediately clear to me at the moment.

I saw Randy and Nelson meet at the foot of center stage with two pieces of paper. They were looking at the "rider" for the performance—the basic document that listed the equipment for the performance, which the MCC Theater company had most likely given to Robert, who had in turn most likely passed it on to Randy and Nelson. They were also looking at the "stage plot," which indicated where all the equipment should be placed. I suspected that my microphones on the TASCAM would not pick up what Randy and Nelson were saying about these documents, since I was roughly 100 yards away from them; I could only observe their expressions while talking about the rider and the plot, and attempt to assess the quality of their discussion.

At times, both of them peered at the pieces of paper on the foot of the stage. At other

times, they looked at each other. Sometimes Randy moved his hands and arms around, gesturing towards certain positions on the stage, and Nelson did the same. After a few minutes of this, they split up. Randy made his way to a stack of equipment cases for speaker cables, and Nelson began to lift and carry large speaker cabinets onto the stage.

Next, the two of them lifted, positioned, and connected 70-pound loudspeaker cabinets throughout the stage area. They stacked pairs of loudspeaker cabinets on the left and right sides of the stage, in a stage-mounted formation. They also placed loudspeaker cabinets across the front of the stage as front "fills". These were loudspeakers that moderately amplify sounds in the so-called dead space between the main speaker cabinet clusters on the far right and left sides of the stage to service audience members seated in the vicinity

A short time later, I saw Randy lifting and positioning similarly large wedge floor monitor loudspeakers for the musicians who would arrive an hour or two later. Randy constantly moved between the stage surface and its underside, aiming speaker cabinets and making connections inside the amplifier rack. Nelson continued to help Randy finish the multiple interconnections between loudspeaker cabinets and the amplifier rack. He also began to run microphone snake cables on the stage.

Randy returned to the front row of the first balcony where he had already set up the Yamaha M7CL digital mixer. There, he connected the snake cable that ran to the stage, as well as a number of short signal cables that connected the numerous DVD and CD playback devices to the mixer. Randy was working back to back with a projectionist, who hung over the balcony's banister rail, adjusting and focusing the projector's lens. At different moments I heard them

talking and laughing about the DJ who had performed during their previous gig in the Ballroom.

"Yes, I can do that, no problem": Randy Building Trust with the Director

In the middle of their conversation, the production manager, who was directing much of the rehearsal, and who would be stationed at the producer's desk behind the front of house mixing position, started to ask Randy a number of questions about what equipment he could connect to the mixing console. Randy repeatedly said, "Yes, I can do that, whatever you'd like." In his exchanges back and forth, between joking with the projectionist and responding to the MCC production manager's requests, Randy seemed to be maintaining his concentration on the numerous interconnecting cables at the back of the Yamaha console. Meanwhile, a pair of lighting crew members gingerly pushed the base of a fully-extended hydraulic genie lift, while another crew member, standing in the carriage at the top of the lift, slowly and deliberately aimed spotlights toward the stage. A stagehand with blue work jeans and a blue sweater that read "Crew" on its back kicked and unraveled a long roll of red carpet from the front of the house to the foot of center stage, only to be instructed by the production director that a plastic runner needed to be put down first.

At this moment during the setup, I decided to open up my case and connect my headphones to the jack on the Tascam. Although I was making video and audio recordings to aid my writing process after this field experience, in the name of liveness, I wanted to experience the sonic dimensions of labor through the Tascam and through my headphones as a soundscape. The Tascam DR40 contains two cardioid or directional microphones that in their extended positions

form a 120-degree angle between them;[12] despite its small size, the DR40 Tascam allows users to record a wide stereo field. I would use this function to record the soundscape of the workers and their activities in this enormous space. Between headphones, my position of listening was at the center of the stereophonic soundscape, where I was able to listen not only to the numerous sounds between the recorder's left and right, but also to sounds resounding between the two microphones and occurring in the gray areas between left and center, and center and right.

In addition, the wide array of these two microphones on the Tascam allowed me to stereophonically record resonances of sound that occurred in the foreground and backgrounds of the sonic reproduction.[13] Through my sound recorder, installed at the top of my Nikon digital SLR camera on the tripod erected to roughly three to four feet adjacent to Randy's mix position at the center of the first balcony, I could hear not only the sounds resonating across the stereo sonic spread of this soundscape, but I could also hear sounds that were both close to and far from my perspective.

The cavernous space of the Hammerstein Ballroom, which lacked the kind of sound-absorbent materials such as foam or heavy fabric that would usually muffle the sounds made by the workers, sounded rather empty and hollow. Loud transient sounds seemed to echo.

---

[12] This is similar to the French ORTF stereo pair configuration.

[13]Stereophony was a mode of sound reproduction technology developed by Charles Blumlein in the 1930s. It requires two independent audio channels that represent sound signals from two separate microphones that would eventually be played back in a system of two independent headphones or loudspeakers. Strategic placement of the microphones during a stereophonic recording can emulate the two-eared human audible perspective of listening by making the two independent microphones either close or far from each other. By doing this, the recordist adjusts when and how much sound differently enters the two independent microphones. Perceptually, the listener will hear these differences in loudness and temporality as sounds that appear to resound to the left of the listener, in the center/front of the listener, and/or to the right of the listener. Given this adjustment of sonic amplitude and sonic temporality, stereophony not only represents the positions of sounds from left/center, to right, but can also allow the listener to locate sounds in a distant background or a proximate foreground. I used stereophony in this way, at Hammerstein Ballroom, to position sounds of labor in the venue.

Eventually those sounds—as well as other sounds I heard throughout the soundscape in my headphones—inevitably reverberated for what seem to be multiple seconds. I heard the stagehands on the stage, off into the distance, and also to the right of the recorder and the camera and the tripod that I aimed towards the middle of the orchestra section. I heard the stagehands moving, dropping and opening large road cases, and slamming the cases to the stage floor. I also heard them erecting platforms for the drum set on stage. The corners of the large plywood boards hit the stage floor as stagehands slid short, stubby aluminum legs into them.

These were the loudest sounds that I heard. They excited much of the acoustic space in the hall. They recurred frequently, and seemed to resemble a polyphonic hocket—one that was not only rhythmic, but also produced long sustains of high frequency transients, and other sustains of deeper, almost subsonic frequency. Closer by, I heard caterers and janitors setting up round banquet tables and serving stations. I heard the tables rolling across the floor, which was covered with a flat black array of plastic base patches, taped down by gaffers. I could even hear the stagehand kicking and unrolling the red carpet from the middle of the venue from the front of house to the center stage. Throughout all of this, I consistently heard talking, to the left, to the right, near and far, from everyone, but seldom clearly enough to understand what anyone was saying.

More deliverymen showed up from a truck backed up to the loading dock at the far rear of stage right. They rolled in, unboxed, and assembled a Steinway grand piano, which they then play-tested with a glissando. Later, I heard a piano tuner insistently playing and repeating single pitches and playing octaves across the instrument's registers. Amidst all this, I also heard lighting crew members unravelling thick, heavy, lighting cables, and using the lift to aim and re-aim

clusters of lighting canes above the stage. Closer to me, to my extreme left around Randy's position near the console, I heard production directors, lighting programmers, and the projectionist set up their stations behind Randy and the front-of-house mix position in the front row of the balcony. They moved laptops, lighting boards, DVD playback devices, computer monitor screens, and communication headsets. All the while, I heard them talking about what they were doing, and even caught mentions of Randy's split attention between the wiring schematic in his mind, the projectionist's jokes about different gigs, the production manager's endless list of requests, and Randy's multiple repetitions of "Yes, I can do that," and "No problem."

Meanwhile, Randy and one of the stage managers collectively tested the wireless microphones on stage. The manager tested the battery power of each lavaliere microphone and transmitter, while Randy adjusted the gain and fader position and the signal level of each of the microphones. The stage manager said, "Testing, one two, one two," while Randy feverishly adjusted the knobs and faders on the Yamaha digital console. Randy had a pair of headphones around his neck, with one side covering his left ear, while his right ear, naked, listened to the room. He had a Shure SM58 as a talkback microphone in his hand while mixing behind the Yamaha board, and spoke to the manager through the latter's in-ear monitor. Randy's speech to the manager was unintelligible, while the manager's speech to Randy was clear, since his voice transmitted through the loudspeaker system. Throughout these exchanges, while the manager tested the mic and Randy made adjustments and quietly commented on certain settings through the microphone, I noticed that the quality of the dialogue between these two workers was peculiar to the activities of testing the microphones. Randy's participation in this dialogue—

restrained, even hyper-professional—was qualitatively different from his more lighthearted exchanges with the projectionist, which led me to speculate whether they had a tense relationship dating back to a previous production.

After testing multiple wireless microphones, the stage manager made an announcement through the loudspeaker system: "So folks, it's noon and we start rehearsal in exactly one half-hour. Tech, there's food available. If you're able to take a break, grab it now. For those who need to complete what you're doing, please do, and we're going to work straight through to 5:30. We are doing a dinner break for the show crew as well. Thank you."

A dozen or so stagehands made their way to one of the round tables in the audience to eat sandwiches delivered on large trays from a local deli. Nelson left the area around the stage and came back to the front of house mix position to check in with Randy about what he had done and what he should do next. Loud bangs and crashes from the stage area prevented me from hearing his reply; Randy pointed at the stage to indicate to Nelson where he needed to reconnect snake cables.

They both departed the front-of-house position and made their way to the stage. Nelson connected the podium mic, taping its cable on the very edges of the podium's transparent Plexiglas. Randy installed the Earthworks piano microphone. At first, Randy's decision to install this microphone himself mystified me; it had become clear by this point that he delegated all the onstage microphones to Nelson, choosing instead to interconnect the equipment, both under the stage and at the mixing console, himself. However, it soon became clear to me why he undertook this job himself. The Earthworks piano microphone costs roughly $3,000; it's

extremely delicate, and contains two small omnidirectional microphones that suspend directly above the strings and hammers of the grand piano. The engineer who installed this microphone would need to place it in such a way to glean the most signal and to avoid feedback, especially given its omnidirectionality (ability to accept sounds from multiple directions, including from the loudspeakers). If Randy did not place these microphones properly, the unit's omnidirectional characteristics could produce feedback during the concert.

I had little doubt that this was the most demanding piece of technology onstage, one that required a great deal of attention and expertise to deploy. Randy's decision to install it himself suggested that Nelson was his assistant, or was even functioning as an apprentice whom Randy did not yet fully trust.

Sound Check at the Hammerstein Ballroom and Time Alignment in Randy's Sound Engineering Labor

Now that the stagehands and lighting technicians, as well as Randy and Nelson, had more or less set up the stage plot's parameters, the choreographer and three dancers entered. The choreographer taped small squares of gaffer's tape to the bottom of the dancers' shoes. I suspected she did this to soften the transient sounds for the microphones that would collect them beneath the stage floor. In the meantime, Randy and the stage manager began working together again to set up a monitor mix for the musicians on stage. Through a microphone, the stage manager said to Randy, "Now let's get handheld one into the piano and drum monitors." Randy did not verbally respond, but pressed a button on the Yamaha touch screen which simultaneously

moved the position of multiple faders, shifting their function from adjusting the channel strip's main output to adjusting the channel's output to the monitor aux sends. He then manually slid them to new positions. The stage manager said into the microphone, "Hey hey hey, hey hey hey, check, check. Less number one in the piano. Good, good, good, good. Okay. He seems to be happy. Let's move on to drums. One, two, hey hey hey. Hey hey hey hey." Randy again slightly and intermittently tapped a fader up and down. The stage manager said, "Good, good. So we're approximately there. Just use that as a guide."

Shortly after this, I heard a lead vocalist speaking and singing offstage. At this point the house lights were dim, and the lighting technicians were beginning to test the floodlights and spotlights. As the vocalist entered the stage, he said, "Hello, hello," then started to sing and speak in short phrases—"Danke schön," "Ha ha ha, ha ha ha,"—to allow Randy to adjust the level and further process the microphone signals. Randy began to graphically draw an equalization curve on the touch screen of the Yamaha mixer, and adjusted the threshold and ratio of the mixer's compression on the singer's input channel.

During the course of this interactive work between Randy and the vocalist, the stage manager once again spoke into a microphone, indicating that it was time for a tech rehearsal. The singer exited the stage, then returned to rehearse Cole Porter's song "Anything Goes." As he sang and danced, accompanied by a pianist and a drummer, as well as two tap dancers, Randy continually adjusted compression ratios, equalization contours, and fader positions in his crafting of the mix for the scene.

As the tech rehearsal continued, multiple performers entered and exited the stage,

checking the microphone levels and performing songs, while Randy continually made adjustments at the next position, while at the same time the production manager and members of different crews feverishly worked, talked, and yelled at each other. I was overwhelmed. The intensity of this setting reminded me of the live sound gigs that I used to dread. I walked over to Randy at the mix position and told him that I had observed enough for the day, and headed out to 34th Street and home.

As I observed Randy working at the Hammerstein Ballroom, I noted the ways that live sound engineers are often required to translate a musician's terminology into engineering instructions during sound check. In order to assert his or her imagined, ideal sound, a musician may offer descriptive words that often do not map clearly into specific adjustments that the engineer should make. As Randy recalled later:

> It's hard to translate sometimes the terminology [that musicians use during sound check]. They use very vague, descriptive terms that are nontechnical terms to say what they want. For example, they'll say "boomy," "too bright," "too dark," "too squawky," all these strange terms, and I have to figure out "What does that mean on the board? What do I have to do?" So that's where it becomes challenging (Taber 2013).

I asked him how he handled these vague or impressionistic requests from musicians on stage. He described his process as follows:

> Well, the first thing I would do is turn the mains [loudspeakers] off completely for a monitor sound check and make sure they get what they want. But then it's imperative that we turn the mains on so they understand how it affects stage sound. And they'll probably make some adjustments. But there's sometimes where I've cut certain [bass] frequencies in the mains to make the monitors sound better. . . . A lot of times I'll send a sound wave sweep through the subs, and I'll ask the performer to stand where they're going to perform on stage and tell me which frequency bothers them. Certain notes will resonate at the center

> of the stage more than others. . . . . Usually they'll say stop, and I'll reduce that frequency and move on. It's not—for me it's not that big of a deal to cut those frequencies out. It's not as if the audience will have poor sound experience. . . . . It's more important that the artist is comfortable first. Because if they're comfortable, then everything else is fine. They have to be comfortable and happy with the sound (Taber 2013).

Randy's work to support musicians' artistic ideals in the midst of time pressure, unclear terminology, and conflicting listening interpretations is an important aspect of his labor as a live sound engineer. The skill to interpret vague terminology into sound specifications, while balancing the audio needs of the audience, however, is a common skill among live sound engineers.

Time Alignment in Randy's Sound Engineering Labor

The soundscape at the Hammerstein Ballroom was a cacophonous labor space, a rich collection of different sounds, resonating in some cases simultaneously. The loudness and complexity of these sounds marked out a specific place in time, where workers were able to thrive in the sonic space of the venue before the presence of the audience and the dominant ideologies of modern live production would step in to silence them.

My second fieldwork experience following Randy Taber was an example of one of the most manual-labor-intensive moments typical of the work of live sound engineering. In contrast to Randy's work as assistant tech for the Pat Benatar concert at the Tarrytown Music Hall, his work in the MCC Theater Miscast gala production at the Hammerstein Ballroom was much more explicit, formalized, interactive, and physical. Many production workers at MCC shared the direct expectation that Randy accommodate their needs, while, in Tarrytown, Randy's sole

responsibility was assisting the touring engineer.

Lying on the ground beneath the stage at the equipment rack, lifting the heavy loudspeaker cabinets throughout the stage, and carrying bundles of heavy cables back and forth between the stage and the front of house mixing position comprised only a small part of Randy's physical labor demands. In addition, his work with Nelson and his collaborations with a wider range of production workers, including the other managers, the projectionist, the lighting technicians, and the stagehands, underlined the discursive responsibilities of the live sound engineer in larger production contexts.

I showed Randy my field video during an interview, several months after observing his work at the Hammerstein Ballroom. We spoke about how large the space was, which required a large number of speakers and monitors, as well as careful time alignment. Sound engineers alter the temporarily of earlier and later resonances of sound—between sound source, monitor and main speakers—so that there is no distortion. Time alignment alters the temporality of an audio signal, and achieves better results than the EQ (equalizer) knob, while eliminating the introduction of sonic colorations. For example, when there is a bad physical placement between the monitor speaker and the main speaker, without any temporal adjustments, a phase difference or latency interval between the time of the sound escaping the stage speaker, lagging behind the time when that sound escapes the main speaker, can produce a coloration at a specific resonant frequency of the transduced copy of a musician's original sound (which slightly precedes the signal from both signal). Some amateur sound engineers attempt to synchronize the frequencies by adjusting the EQ knob on the mixing console in order to homogenize the sound, effectively ameliorating the problem by making tonal adjustments after it has occurred. Randy, on the other

hand, as a professional live sound engineer, tries to avoid using the EQ knob on a console, because, while it can reduce the color in copy, it also adds certain colors which take away from the transparency of the sound that engineers like Randy strive to achieve.

When setting up, Randy will physically move a monitor (perhaps closer to, or further away from a musician)[14], so that the so-called naturally occurring phases from the monitor speaker and the main hanging speakers will not produce a coloration, or electronically, he will press the "phase" button on the mixing console. The exact moment when a musician's sound goes through the microphone will be microseconds delayed, compared to the version that went to the main speakers. When watching a replay of his setup at the Hammerstein Ballroom on my field recording, he explained how he "plays with" time alignment:

> We have a distributed system for the balconies which I installed—or I should say I time-aligned—several years ago. So we have four speakers . . . underneath the promenade, four on the first balcony, four on the second balcony, and two on the box seats. And then four on the lower box seats. There's a lot of speakers. They're all time-aligned to the main line that we're hanging in this video here. Everything is time-aligned to the proscenium in the house. And then I then time-aligned the entire system based on where we hang the speakers in the air. That would be my new zero point. . . . And the front fills. . . . I tend to time align those back to the main array as well . . . . As I said, with time alignment, sometimes if it's really bothering them I will take some time to send impulses through the system to time-align the main speakers to [the performer's] microphone. So that the onset of the acoustic wave form from their vocals is happening at the same time as the onset of the wave form from the main speakers in terms of phase. So I'll spend a lot of time doing that. Just doing a little—making the film, you have that little clip. You snap that through the microphone. It sends an impulse through the system and you measure the arrival difference of the two wave forms (Taber 2013).

---

[14] Randy explained in an earlier interview that the: "First thing I always adjust is always time, because a lot of times people will hear discrepancies in the sound system in terms of frequency, but they don't realize the source of the error is time, not frequency. Repercussion is a frequency misalignment. But the source of the problem is time. So I always start there, and then use it as a last resort. Anything else, adjust first. Mic placement, quality instrument sometimes . . . . You'd be amazed how that can change the sound dramatically"(Taber 2011).

In his work at Hammerstein Ballroom, in other words, Randy did not simply fix sonic anomalies with equalizers. He thought of the physical placements of transducers (mics and speakers) and the use of electronic delay in order to adjust when sounds would emit from or enter into these transducers (mics, monitors, speakers and main loudspeakers), as anomalies in phase.

Following the phenomenological approach of anthropologist Thomas Porcello (itself inspired by the work of philosopher Alfred Schutz as discussed in the introduction), I consider Randy's adjustments of temporality to be analogous to the adjustments of his own changing labor status in the course of mixing. Porcello engages with the phenomenon of time alignment in his advocacy for experimental ethnographic writing, insofar as the live sound engineer's time alignment, and his/her adjustments of it, are comparable to Schutz's description of the phenomenology of time as experienced in the course of musical performance.

Moreover, Randy's shifting status across time also resonates with anthropologist Steven Feld's ethnographic descriptions of musical experience as a process of *becoming*—ontological shifts of being that are predicated on the experiences of time across the life-cycle (Feld 2012 [1982]: 43). Thus, informed by these ethnographic considerations of time and the place of the engineer —in my example, Randy Taber—within it, I argue that there are three significant moments that change the very being of the engineer as a laborer. They are the specific temporal moments of mixing which occur: 1) before signals pass through the mixing console; 2) when the signals are affected by the engineer's manipulations of them with the fader, and; 3) when, later, those affected versions of the sound leave the mixing console, only to feed back slightly later to

the engineer's ears via the system. Viewed as a chronology, these discrete moment effect a shift that transforms the labor of the live sound engineer.

Faith/Trust/Fidelity

Randy's work at the Hammerstein Ballroom shows the ways that live musical theatre poses more challenges to the live sound engineer than the relatively straightforward dimensions of amplifying sound for a single-headlining pop music act like Pat Benatar. Observing Randy working with and speaking to the additional workers at the production for the gala, I understood that doing sound in this venue presupposed the existence of multiple interdependent manifestations and levels of trust and mistrust, as well as multiple interlocking hierarchies of authority, among the numerous workers at Hammerstein Ballroom.

The dynamics between Randy and Nelson especially exemplified these myriad strands of hierarchy and trust. The way, for instance, that Randy indicated the missed or broken connection in channel 2 onstage to Nelson—with a pause and a slight smirk—as well as his decision to set up the Earthworks piano microphone himself, seemed to indicate his slight but visible mistrust in Nelson's abilities, although Randy also apparently trusted Nelson to perform other tasks. Nelson, in turn, seemed to trust Randy's instruction and leadership in decisions about how to execute the plans of the rider and the stage plot.

At the same time, Randy's interactions with the production director in the balcony emblematized the production manager's trust in Randy to fulfill the production's needs. In addition, Randy's interactions with the stage manager during the wireless microphone tests, as

well as during the crafting of monitor mixes, exemplifies a particular, perhaps more complex condition of trust between workers at this production. When viewing my field video, however, Randy remembered tension between the two of them:

> Oh yeah, now I remember this [previous] job [at the] MCC Theater. That guy on the stage, we didn't get along the first time. This was three years ago I think. And we got along really well on this job actually. We had a conversation after the last event [when we] kind of discussed what the problem was with communication. . . . .We both remembered and kind of laughed about it. In retrospect, it's silly to get so upset about things. Everybody does. But it's important to get along with the clients. You know? (Taber 2013).

In fact, the extent to which Randy and the stage manager were matter-of-fact with each other seemed to mark their collective effort to ensure that their discursive exchanges would not problematically extend into interpersonal conflict. Indeed, their perpetuation of this particular discursive characteristic appeared to be a condition upon which they relied, trusting that they would not offend each other again. Their trust was apparently mutual.

I use the term "trust" (and the related and audio-specific metaphor of "fidelity" in sound reproduction) here in ways that both connect and resemble the condition of faith between workers at the production; as seen in the encounters between Randy and the stage manager, that trust occurs at the level of discourse practice as well. I saw that the production manager entrusted Randy to fulfill the production's needs, demonstrating his own faith in Randy. Did Nelson, I wondered, have similar faith in Randy? Did Randy have faith in Nelson? Their discourse did indeed seem to show a level of faith that extended beyond their mutual trust as professionals in a particular work setting. With the notion of this shared faith, I draw analogies to the idea of fidelity, to show that the social and discursive conditions of expectation among these sound

workers operate in similar ways to their technological construction of fidelity in the theater: in other words, their faith in their interpersonal and discursive practices was analogous to their faith in the technologies with which they worked. As the ethnographer in this setting, I pursued a similar set of questions of fidelity regarding my own acquisition of fieldwork data, in comparison to my more direct experience of the labor patterns at the Hammerstein Ballroom.

Throughout my observations at the Ballroom, I encountered a wide range of sounds and activities. When I experienced the live soundscape through my sound recording device and headphones, I heard a representation of the sounds of labor that was both similar to and different from my experience without headphones on. While this sonic ambivalence was familiar from my own experiences engineering. it was not the primary dimension of fidelity that I encountered at the Hammerstein Ballroom. In fact, the distortions of the Tascam microphone, its digital-to-analog conversion technology, and the frequency response of my headphones were only a few of the contributing factors that distorted my own perception of the representation of sound in that space.

These distortions mediated my experience of the soundscape through these recording devices, and made me consciously aware of the similar processes that Randy was reproducing during the sound check. The synesthetic experience that I perceived with my eyes and ears in the space allowed me to associate the multiple sounds I heard with particular actions and sound sources that I could see. This merging between what my eyes and ears apprehended produced a particular fidelity, recognizable to me in my own reproduction of these sound sources. This process was analogous to the division of inputs on the Yamaha digital mixer that Randy was using—inputs that similarly divided the multiple microphones and sound sources on stage.

Conversely, when I listened to the soundscape through my headphones and the Tascam DR40, especially when I closed my eyes, my sense perception changed. Now, I heard polyphonies, hockets, transients, sustains, and decays in a unified sound which the recorder spatialized between left and right, front and rear. Without looking at the sound sources, I heard a *mix,* which is to say I encountered the reduction of multiple sounds into a fairly stable sound product. Similarly, after Randy's and the stage manager's sound check of each microphone during the rehearsal of "All of Me," I heard a similar homologized and unified sound product through Randy's mix of the various input signals and the amplification system.

As an ethnographer listening to (rather than looking at) a live soundscape, I found myself involved in a similar process to that of Randy, the live sound engineer, who was checking microphones and developing initial mixes of their signals. Indeed, it seemed to me that Randy and I were, in effect, by intention or by the distortions of our respective sound reproduction technologies, reproducing or producing reductions of the divisions of labor, or at least of its sonic effects. We were both starting with independent sound sources, and then, in our technological practices of reproduction, both either intentionally or unintentionally reducing these multiplicities into a smaller set of regularized and measurable parameters. However, while Randy's participation in these activities aligned with music-industry values for the reduction of these sounds—and the labor of the musicians who produce them—into a mix, I, as an ethnographer listening back to the sound recording of the labor soundscape, worked to *expand* that which the recording process reduces, in order to tease out and identify the various workers at the Hammerstein Ballroom.

I encountered these similarities and differences between Randy's activities with setting up and mixing, and my own activities with field recording, as representative of the multiplicities of fidelity in sound reproduction technologies. These types of observations, both of the fields of practices of live production workers, and of the practices shared between those workers the ethnographer, contributed to my analysis of the similarities and distinctions of technological and social forms of fidelity within contexts of sound reproduction.

Randy Working at City Winery at a John Sebastian and Jimmy Vivino Performance

Arriving at City Winery:"They Didn't Know Who Randy Was"

On Friday, September 14th, 2012, I got into my car and drove south on the Henry Hudson Parkway. From the West Side Highway, I made a left on West 18th Street, drove a few blocks, and made a right onto Seventh Avenue. I was on my way to City Winery, a then fairly new and upscale restaurant and performance venue on Varick Street between Houston Street and Canal Street, which features a variety of live musical performances multiple nights a week.

Randy was mixing there that night for a show by popular music artists John Sebastian and Jimmy Vivino. As I drove south on Seventh Avenue, I approached the densely-packed neighborhood of small shops, bars, and restaurants in the West Village, and I decided to find a parking spot as soon as possible, since finding parking on a Friday night would be a difficult task. I found a spot just near The Garage, a restaurant and jazz music venue, but, in my haste, I didn't realize that I was still quite some distance from City Winery. Rather than get back in the car and try my luck, however, I decided to continue on foot, and walked down the east side of Seventh Avenue on my way to the restaurant.

Teenagers and young adults of college age, as well as a smaller number of middle-aged pedestrians, filled the sidewalks. I passed dense crowds of *al fresco* diners, hearing music, conversation, and the clatter of utensils, plates, and drinks as I went, mixed with the sounds of speeding cars and trucks passing on Seventh Avenue. After crossing Bleecker Street, however, the street abruptly quieted. Now, only a few restaurants and small shops—most of them closed—appeared at intervals along my path. With fewer storefronts doing business, the sidewalk was dimly lit, even dark.

Below Houston Street there is a bend in Seventh Avenue as it slightly turns left and becomes Varick Street. I passed the always busy McDonalds just before crossing Houston Street, and passed by the famous live music venue Sounds of Brazil, an ominous-looking corner building with no windows, outside of which a few patrons stood in line ready to drink, eat, dance, and/or listen to popular musics associated with the global south. Just after passing SOB's, I saw the inevitable pileup of cars accumulating on the right side of Varick Street, waiting to leave the city by way of the Holland Tunnel. City Winery was just south of this area, on the west side of Varick Street.

The restaurant was housed in an old red brick industrial building, its corner entrance marked with short awnings and elegant oak doors with long wrought-iron handles. Menus and performance promotional posters were framed inside the doors. Large potted plants and a cigarette receptacle lined the steps up to the doors, outside of which a crowd gathered, waiting to get to their seats, while inside, hostesses slowly welcomed a line of people to the musical performance, which was scheduled to start in approximately half an hour after my arrival. Randy had invited me to observe that night's performance a few weeks earlier.

When I had previously observed Randy's work at Tarrytown Music Hall and the Hammerstein Ballroom, I had met him during setups and sound checks. With the exception of a few security guards, no one had obstructed or even questioned my entrance to the venue. Now, however, I attempted to cut the line, and walked right up to the hostesses and explained that I was there to meet with Randy. Of course they didn't know who Randy was. Although this was not the first time that Randy had worked at City Winery, the workers at City Winery are used to a number of different sound engineers working with the restaurant's equipment multiple nights a week. Remembering this, I decided to tell the hostesses instead that I would be working with the sound engineer tonight.

City Winery as a Venue

They let me enter the dining room. As I had done before, upon entry I took note of the environment of the venue, observing the technical and acoustic parameters that the engineer would negotiate, as well as the aesthetic dimensions of the venue that would affect listeners' consumption of the musical sounds and sights. Although the ceilings were high for a restaurant in that part of town, City Winery had the lowest ceilings of any of the venues in which I had observed Randy work, with ceiling height being always a significant factor for a live sound engineer. The incandescent lights were dimly lit, barely producing luminescence, but projecting a warm amber hue that reflected off of the wine casks, bottles, and other paraphernalia that adorned the oak-paneled dining room. Looking up again between these lights, I noticed an array of slowly-spinning ceiling fans and fashionably rough-looking four-by-four timber columns throughout the sprawling dining room. The floor appeared to be concrete or cement, also

presenting a notable challenge for an engineer given its high reflectivity of sound.

By that point in the evening, about a hundred people were gathered at tables throughout the dining room, speaking, yelling, laughing, and clinking utensils and wine glasses. I looked over to the bar, and saw a pair of bartenders quickly moving between guests, bottles, glasses, and a cash register. Servers wearing black walked briskly through the dining room, taking orders and serving food and beverages. Bussers, also wearing and seeking to be transparent while laboring in the setting, quickly removed dirty plates and glasses. Through a small window in the double doors to the kitchen, I could see cooks and kitchen workers wearing white jackets walking back and forth under bright fluorescent lights. When the servers passed in and out of the kitchen through these swinging doors, I saw these mostly Central American kitchen workers occasionally gazing at the predominantly white, middle-aged, middle-class assemblage of diners.

I saw Randy standing behind the venue's Yamaha M7 CL digital audio mixer, the same model he had used in the Hammerstein Ballroom. This particular mixer, as Randy set it up at City Winery, included the optional meter bridge, an add-on piece of equipment that graphically displays the input and output levels that enter and exit the mixer. Randy the engineer, the Yamaha mixer, and I, the ethnographer, met at the front of house mix position, which was close to the center of the dining room, beside a large pillar. Randy began to tell me about his day, specifically how simple and straightforward his setup had been earlier that afternoon. Suddenly, a younger white man in his twenties walked up to Randy with what seemed to be an array of concerns and questions. Standing directly between us and interrupting our conversation, he actually appeared frantic. The din of the dining room prevented me from hearing what they were talking about. Why did this man come up to us in this way, completely disregarding me? How could Randy let

him do this? He seemed to be an event manager who worked with City Winery at the performances. Understanding the pressures of live performance and mixing, I used the time that this man's back was turned to me and while he ranted at Randy—approximately seven minutes—to make more observations of the people at the tables.

Sebastian and Vivino

White, middle- and upper-middle-class men and women in their mid-60s appeared to make up the majority of the audience that had come to see John Sebastian and Jimmy Vivino perform. I looked toward the venue's small black stage, with its backdrop of wine casks lit as lamps, and saw two chairs and two vocal microphones on long, laterally-stretched boom microphone stands, which would position the microphones at the seated musicians' mouths. A pair of direct boxes connected to microphone cables on one end, and a quarter-inch instrument cable on the other lay at the feet of each chair. Once Sebastian and Vivino connected their acoustic guitars, equipped with transducing pickups, to these instrument cables, the direct boxes would convert the guitars' high impedance output signals to low impedance output signals that could more easily travel through the hidden microphone snake that terminated at the Yamaha mixer which Randy operated.

At the end of Randy's encounter with the nervous manager, the two of them left the front of house mix position and briskly walked to a door toward the back of stage right. I assumed that they were going to speak with the artists. At that point I was alone behind the mixer, in a relatively small space in the middle of the bustling dining room. While looking for a place to stand, I saw an unoccupied chair at a table. I asked the people at the table if the seat was taken.

They said no, and encouraged me to take it. I brought the chair back to the mix position, and placed it to the right of Randy's swivel office chair with arms. Sitting in my chic and uncomfortable wooden dining chair, I took the Nikon camera out of my bag, ready to record video of Randy's mixing.

Randy returned to the mixer and told me that he had just fixed an issue with the venue's distribution system, which amplified audio signals to different loudspeaker zones throughout the restaurant. In the few minutes left before the downbeat of the performance, Randy explained to me that he had acquired a new appreciation for these smaller-scaled gigs. He had been working long enough on the New York City live music production scene, and had a dense enough schedule, that he could choose the size of the productions that he worked on. At the moment, he told me, he tried to work on larger productions only if he knew in advance that he would like the music performed. He explained that he was transitioning towards what he called low-stress corporate gigs and installations; his upcoming jobs ranged from managing productions at the Hammerstein Ballroom to doing sound with a single wireless microphone for a yoga instructor and 500 participants, to an outdoor loudspeaker network installation for a pumpkin patch soundscape production in Upstate New York. Then the house lights dimmed, and John Sebastian and Jimmy Vivino entered the stage with guitars in hand. The audience applauded.

Earlier that evening, before Sebastian and Vivino entered the stage, Randy had prepared the Yamaha mixing console for the performance, making specific adjustments to accommodate three important resonances and equalization profiles: 1) the room, or architectural, acoustics; 2) the intelligibility of the musical sound to the audience; and 3) Randy's own interpretation of John Sebastian and Jimmy Vivino's overall musical sound, combined with his understanding of the

musical sounds associated with the genre in which they perform, broadly characterizable as "folk rock."

Within this Yamaha digital mixer, Randy adjusted settings that would historically take the form of external signal processors, or what engineers call outboard gear, to adjust these resonances. He used equalization and its ability to control the amplitude of frequencies across the bandwidth of human hearing, input gain, and fader position to amplify or attenuate the amplitude of input signals, in addition to compressors (which decrease the dynamic range of specific input signals, such as those from the vocal microphones or guitar inputs), in an effort to amplify the music within the competitive sonic environment of the bustling restaurant. Randy's aim was to respect the audience's need for lyrical and sonic intelligibility, and to do so in ways that would be recognizable in relation to the industry-established sounds of those artists and their genre.

In addition to these preliminary mixing activities for resonance, Randy also assigned certain faders from the console's surface to correspond to the four sound source inputs from the stage. For Randy, this was primarily a decision based in ergonomics. With only two instruments and two microphones to mix, he chose four of the centermost faders on the mixing console surface that would allow him to sit behind the center point of the console with his weight equally distributed in the chair, his upper-body weight distributed across his left and right elbows, as his hands rested evenly on the console surface. This position allowed him to quickly and easily be able to access the board should sudden changes be required during the performance.

The four faders that he assigned were adjacent to one another. From left to right, the first fader corresponded to John Sebastian's guitar input; the second fader corresponded to Sebastian's vocal microphone; the third fader corresponded to Jimmy Vivino's vocal microphone; and the fourth fader corresponded to Vivino's guitar input.

Now, immediately after the two musicians had entered the stage, Randy was already mixing. His elbows were resting on the front edge of the mixer. He placed the index and middle fingers of both hands on the front edges of the faders, with his thumbs on the bottom under-edges of each fader. His left hand grasped the faders for John Sebastian 's guitar and vocal microphone inputs, while his right grasped those for Jimmy Vivino's vocal microphone and guitar inputs, respectively. Before the artists could even begin speaking, singing, plucking, or strumming, Randy put the four faders into the unity gain position on the console surface. This would be the position on an analog console in which the fader position most transparently channels the console's input through to the output, without attenuating or amplifying, and thus potentially distorting, the quality of the sound signal. It is also the position on an analog mixing console in which the most nuanced adjustments can be made across the range of the otherwise logarithmic scale of the fader's path. Unity gain marks a position in the fader's throw where the engineer can make very small, slight, and subtle adjustments to the amplitude of musical sound, without many participants, musicians or audience members, at concerts realizing that he is doing so. Thus, the area around unity gain is a site in which the engineer's adjustments are the most transparent in the act of mixing. Unlike its analog counterparts, however, the Yamaha digital console does not add noise beyond unity gain in the fader's path. The fader's position on a digital console affects a

voltage-controlled amplifier, or VCA, that alters number values within streams of binary code, which in turn adjust the dynamic of a digital pulse code modulated audio signal.

Nevertheless, the Yamaha was designed to be similar in its logarithmic scale to an analog mixing console's fader path . In other words, if Randy were to use an analog console at City Winery, his movement of the faders to the zero unity gain position of a console would have electronic ramifications that would directly impact the fidelity of an analog sound signal. On the digital console, his movement of the faders to zero unity gain would not have the same direct impact, giving Randy fine-grained control of the input signals when it was time for him to adjust them. As Randy explained while watching my field video of the performance:

> I [tried] to keep [the input faders] at unity, because then my fader movements are more subtle. If it's not at unity, then the fader movements can be more even though the physical movement is small, the acoustical adjustment is larger. So you can't be as subtle with your mixing. . . . You can make smaller adjustments with a larger movement. It's great. As opposed to on a lower portion scale, a small movement means a large change. Plus, I used the central logic section of the board, I could assign input faders there, it keeps everything in the center of the board for me. I kind of like that centralized control. It's by the screen. I don't have to move around. I can focus on just a few things that they had going on. It's great (Taber 2013).

He went on the describe the ways that he engineers sound in the context of his understanding of musical genre:

> . . . . It comes down to the music. You have to know the music. . . . If you can't understand the music, then you don't have any business trying to record or mix it. . . . I know the music, I know John Sebastian's music. I've heard him before. And I know Vivino . . . A lot of people thought of him as a folk musician, but he was really a blues musician. So I know what's supposed to be slightly on top of the mix. Usually for singer/songwriters, it's the vocal. Of course, Vivino would take solos and sing back up harmony. So I knew there was a tiered dynamic relationship there. I was trying to maintain that. There were times where my ears heard that they were not balanced. So I would adjust that. It's usually because of the translation between a stage and a microphone. It's not the performers who are

> off; it's just electronics aren't capturing it a hundred percent accurately. . . . I've heard a lot of his recordings. But also I know popular music in general. So there's a general form that everybody understands. . . . it's not necessarily unique to John Sebastian. I'd say more unique to that specific genre, as any genre of music, there are specific indicators that you know when the music is right or the mix is right (Taber 2013).

Intimacy, Venue, and Engineering Live Popular Music

Taken together, the musical aesthetics and Randy's knowledge of them, listeners' expectations for its sound, and the venue's wide, lateral acoustic space, reflective floor, and low ceiling worked as an aggregate influence on Randy's fader movements, which themselves function both as a representation and as an assertion of these overdetermining factors in his production of sonic intimacy through his mix. As Randy described his mixing in a space appreciably smaller than the large Tarrytown Music Hall and the very large Hammerstein Ballroom, at City Winery there were "A lot of noises, and a very different vibe":

> What do I do about the space? . . . I really believe in reinforcement. So if the room is naturally reinforced in certain frequencies, then I'm going to reduce those frequencies in the main system such that I'm optimizing the sound system for the acoustical space. It's my job. So that's the first thing, to try to compensate the sound system to match what's over-accentuated by the room.
>
> The other thing is that, within certain spaces, people expect a certain sound as well. This tends to be an intimate personal setting, which usually means some of the upper-mids need to be cut back, and the subs can't be so prominent. They'll start to feel overpowered, as if it's no longer intimate. Somebody is struggling to be bigger than the room. . . . .But also intimate means that the high frequencies are very clear, but not distorted. It's very clear so you can hear every articulation. People associate that with intimacy (Taber 2013).

Transparency: A Phenomenology of Mixing

John Sebastian and Jimmy Vivino's spoken and sung sounds, as well as their guitar sounds, transduced through the input devices on the stage into faint electrical pulses that the digital console preamplified to electronic signals, which were then converted into digital audio codes. At City Winery, Randy, with his head and eyes steadily focused on stage, adjusted the frequency and amplitude values of these codes. The vigilance of his gaze at the stage rendered his tactile activities on the mixing console's surface visually transparent to himself; he seldom needed to look down to see what he was doing with the faders, much as an experienced instrumentalist often plays "by feel," without looking at her hands.

Indeed, it seemed as if the digital mixer was as visually and ideologically transparent to Randy as Randy himself was to the other participants in the production. In other words, the mixer for Randy—like Randy for the other participants tonight—was neither fully invisible nor entirely unencounterable. This was especially clear in the degree to which Randy encountered the mixer with his touch: Randy did not *see* the mixer at this time, but *felt* it, perhaps in ways similar to those in which audiences might not see Randy when he works, but can feel his presence, or encounter his presence in the faint peripheral fringes of their listening activity.

During a break between songs in the set, when John Sebastian spoke from the stage about the song he had just performed, I noticed that he had a deep raspy vocal timbre both in his speech and in his singing, and that, in the room and in the amplification system, as well as in the sounds' reflection off the ceiling, walls, and floor, his voice sounded especially resonant near the frequency level of 100 Hertz. In addition, I noticed that the sibilant sounds in his speech were especially present. Having used it many times myself, and recognizing the sounds of its

frequency response, I asked Randy if Sebastian was using an Audix OM series microphone. Randy confirmed that he was.

Just after we finished our exchange about the Audix microphone, I heard John Sebastian conclude his speech by saying, "Well, I highly recommend when you try to look for a second single, always start with a bass player, because the bass player is going to come up with the cool bass line." After the words "bass line," John Sebastian immediately raised and lowered the neck of his guitar, and he and Jimmy Vivino began to play the introduction of "You Didn't Have to Be So Nice" by Lovin' Spoonful— an ostinato of an A major chord, an A major 7 chord, and an A 6 chord, repeated above an A pedal tone, an introduction that lasts several bars before resolving in E major and then B major. The song was familiar to the audience, a hit from a rock band which Sebastian had fronted earlier in his career.

During this introduction, the audience grew more excited, as evidenced by clapping, and a modest outcry from a few tables in the back. As the musicians played, the placement of their left-hand fingers on the guitars' fret boards, and the strums of their right-hand fingers on the guitars' strings, produced specific vibrations that vibrated the bodies of their instruments and the pickups within their guitars, sympathetically inducing faint electronic pulses through the array of wrapped wires around magnets, sending these charges through the instruments' outputs.

As they played their guitars, the sounds transduced into electricity. An electrical charge flowed out of the instruments and into quarter-inch cables that terminated to the instruments' direct boxes, where a transformer reduced the voltage of the electrical signal, which in turn reduced the signal's impedance. The reduction allowed the signal to flow more efficiently from the stage through the mic cable, which connected to the snake cable that accumulated all of the

microphone cables on the stage. The signal thus was sent into the Yamaha digital mixer, where a preamplifier that Randy had already set amplified this faint electricity to the useable level of an electronic signal.

From there, the electronic signal encountered the mixer's analog-to-digital converter. This converter applied "dither," a particular noise that energizes the converter's electronic input signal, in preparation for the signal's transduction from an analog electronic signal into a digital pulse code-modulated audio signal, which would continue to transmit through the console. After dithering, the converter sampled amplitude values for particular units of time; then the converter quantized these amplitude signals to particular allotments of the converter's 24-bit representations of amplitude—streams of binary digits and code, these temporal and amplitudinal values. Finally, what was once an analog electronic signal transduced into a digital audio signal.

What the musicians, Randy, and the audience heard, however, was musical sound, represented, in the circuitry beneath Randy's fingers, by streams of ones and zeros converted into electrons that flowed near the speed of light. Randy's earlier adjustments to the channels through which these streams of data flowed affected the number values of the digitized sound source signal. Randy's tactile finger work with each of the four faders adjusted particular digits in this signal stream during specific moments in the musical performance. In an effort to maintain the specific acoustic, intelligible, and genre resonances, as well as to enact his momentary musical preferences in the mix, Randy shapes these digital values with only a few millimeters of movement upward and downward, a physical motion that remains rooted in the pre-digital technology of earlier decades (as opposed to, say, typing in numerical values directly, which is also possible with digital audio gear). In spite of the near-light speed of the analog and digital

signals, Randy's movements were deliberate. His slowness with the fader was an effort to maintain transparency as he simultaneously asserted both technical control and sonic artistry.

During the final audio transduction that converted the amplified electrical signal into greater compressions and refractions of air in City Winery as the amplified sound of the guitar introduction of the song, emerging from amplifiers into loudspeakers, audience members heard the sounds, and associated them with the musicians they were simultaneously seeing on stage, following the popular music industry's encouragement to sensuously encounter the intimacy of artists they pay to hear "live."

Finally, at the conclusion of the guitar introduction and the tonal progression from the B triad to the E triad, John Sebastian sang the word, "You." As he did this, Randy instantaneously broke his gaze at the stage and looked down at his fingers, almost as if in an effort to ensure that he maintained control of the vocal channel on the console. The words "didn't have to be so nice" escaped John Sebastian's vocal mechanism onstage, and transduced through the front end of system to Randy's mixer. As the song continued, Randy kept the three aforementioned fingers on the four faders, continually shifting their position, especially the position of the vocal channel's faders. The movement of these faders seldom exceeded two millimeters. He'd returned his steadfast gaze back to the stage, and moved the faders lightly but consistently, never letting go of them. I could barely tell he was moving them at all, except for the faint muscular movements at the backs of his hands. Nevertheless, I knew Randy was moving the voice faders primarily to compensate for the slight differences in proximity between Sebastian's lips and the microphone's grill, which required his visual attention to anticipate as Sebastian moved with his instrument on stage.

Like the signals from the guitars during the introduction, the multiply-transduced representations of Sebastian's vocal sound was dependent upon Randy's decisions for those sounds, and upon the mixers, faders, and amplifiers, which determined the loudness of his voice throughout City Winery. Amidst these live transactions between changes in the musical performance on stage and Randy's scientific and musical performance with the faders, I noticed, during the beginning of the song, that Randy's fingers briefly let go of the faders at the end of Sebastian's vocal melodic phrases, and sometimes with breaths that he took while singing, or instantaneously before his vocal onsets. I encountered this tactile activity, with Randy's holding and letting go of the faders, as Randy's effort to analogically represent John's vocal effort with his own muscles and tendons on the console. This juxtaposition of vocalizing and tactile musical activity reminded me of a conductor indicating sustains and dynamics in ways that make the orchestra appear to breathe.

Just before the first repeat of the song's A section, John Sebastian and Jimmy Vivino stopped singing, and began playfully tapping first on the bodies of their acoustic guitars, and then on the grills of their vocal microphones, a playful brief rhythmic cadence. The audience got a kick out of this, responding with yells of approval and clapping on the beat. Just after this moment, Jimmy Vivino shifted his role, from accompanying guitarist to background vocalist, echoing the phrases of the melody. Randy noticed that Vivino was not as close to his microphone as Sebastian was to his, and, amid the crowd participation, I witnessed Randy's most explicit fader movement, one that exceeded three millimeters with the fader that controlled the signals from Jimmy's microphone channel.

Randy further amplified Vivino's microphone signals primarily for the purposes of intelligibility, but also to foreground this musical change and contribution to the variation of the performance, making sure, however, that he did not overamplify Vivino's microphone in an effort to maintain John Sebastian's vocalizing in the foreground of the homophony. More and more signals transduced from the stage through the mixer. Randy's hand movements transduced into numerical adjustments through the fader positions; analog-digital signals converted back to analog signals, and amplifiers continued to allot greater sums of electricity and current through the loudspeakers throughout City Winery in ways that reproduced Randy's social transparency as a musical contributor, and also in ways that reproduced the liveness of John Sebastian and Jimmy Vivino's sound in the circulation of their music as commodities in the popular music industry.

In this chapter I have shown how engineer Randy Taber approaches and conceptualizes the labor of his engineering work as both art and technical craft. In the next chapter I describe and analyze the work of Justin Rathbun, a live sound engineer who works on broadway productions. Several aspects of Randy and Justin's practice, as both art and technical, are in common. However, that Justin engineers in a fixed venue throughout the run of a Broadway show foregrounds a different set of labor experiences than I take up in the following chapter.

Chapter Three: Transparency, Color and Liveness: Justin Rathbun Live Sound Engineering *Porgy and Bess* on Broadway

"I got plenty of nuttin'," are the first words of Porgy's Act II aria in George and Ira Gershwin and DuBose Hayward's opera, *Porgy and Bess*, sung while the fishermen of Catfish Row prepare for work. In the recent Tony Award-winning Broadway revival of the opera at the Richard Rodgers Theater, I heard famed Baritone Norm Lewis in the role of Porgy, and observed the live engineering work of Justin Rathbun, the front of house mix engineer for this production.

I found Norm Lewis's singing of the "I've got plenty of nuttin'" line profound in both metacritical and metaphorical ways. First, Porgy singing about having "nothing" signals a standard trope in minstrelsy: the portrayal of black men as always humorous, and content to be poor. While David Roediger has noted, that "the minstrel stage offered a choice as to whether the character would speak in a 'Black' accent—that is, in an extravagant dialect—or in an 'American' or immigrant accent," the choice of the "extravagant dialogue" expected of black men performed this poor but content character as occupying a low, non-threatening social status (Roediger 1991: 126). Roediger's description of racist, sonic colorations of characters' speech and song performances and their gestures toward blackness and whiteness aligns with my descriptions of the technological and musical mixes of these and other sonic and cultural colorations that live sound engineers amplify.

Secondly, I consider Porgy's "having nothing" as a partial metaphor for Norm Lewis's lack of total autonomous control of his own vocal sound throughout the venue of the Broadway production. While total autonomy is not a degree of control that professional Broadway performers expect to have, the illusion of this vocal autonomy, though industrially constructed, is

expected by Broadway audiences. Who makes "Norm Lewis's" sound? In particular, who (or what) agencies share in the control of his vocal sound as it will be perceived by and intelligible to audiences, and what (and whose) expectations of this sound are they working to meet?

In this chapter, I focus on the labor of Justin Rathbun, a live sound engineer and member of the art world of this production of *Porgy and Bess*. I understand the art of Lewis's vocal sound to be made up of "joint products of all the people who cooperate via an art world's characteristic conventions to bring works like that into existence"(Becker 1982: 35). As the person who mixes and amplifies musical sound during every performance of the musical, Justin is responsible for reproducing Norm Lewis's vocal sound in ways that negotiate multiple joint products and conventions not only about sound, but also about racial imagination, within the Richard Rodgers Theater.

Further, the "joint products" of this production all have sonic colors. By sonic color, I mean to evoke the common description of timbre in music discourse that musicologists, theorists, composers, musicians, and listeners have used to describe the unique resonant characteristics of sound sources associated with music-making, but also to invoke "color" as a broader metaphor for social difference and identity, and indeed to argue that the two senses are intertwined in Justin's engineering of Lewis's voice. The sonic "colors" that result from the interaction of human hearing, genre conventions, equipment resonances, venue characteristics, and the perception of sound as racialized are mutually interdependent products. Here I take up Justin's labor engineering *Porgy* as an example of how the work of mixing and designing sound mediates ideological oppositions of color and transparency, and of heterogeneity and homogeneity, in live popular music and as both sonic and social phenomena at once.

Live sound engineers identify multiple sonic colors in the process of their work before attenuating specific ones, which they have judged to be the most desirable by themselves, the musicians, the other members of the production art world, the audience, the genre's conventions, and the professional standards of the industry in which all of these entities are engaged. This normalization of multiple sonic colors into a comparatively homogeneous sound product follows the ideology of fidelity and transparency that structures expectations of the work of engineers, and that I have discussed in previous chapters. However, live sound engineers inevitably and strategically resist this ideology by creatively coloring musical sound in ways that I describe in the following pages, an that are especially foregrounded in the musical theater setting for live sound engineering labor.

As the only mix engineer of *Porgy and Bess* on Broadway, Justin identifies and adjusts sonic colors, following the expectations of the show's producers, director, sound designer, and audience, as well as his own preferences for the mix or balances of sonic colors in a singular sound. The primary responsibility of Justin's job is to homogenize as many sound colors as possible into a transparent acoustic product, or, stated in another way, to assert the mixture of multiple sound colors as transparent within the cultural constructions of fidelity that shape the experience of live theater performance. However, Justin also strategically complicates simple practices of transparent sound reproduction by dynamically coloring, or not coloring, the sounds that he amplifies.

Justin practices the audile technique that Jonathan Sterne describes as "a reconstruction of the shape of acoustic space," adding that "audile technique [is] not simply a representation of acoustic space; it [aims] actively to transform acoustic space"(Sterne 2003: 93). I observed

Justin's audile technique as a method of sound reproduction labor that allows him to critically listen both *to* and *through* multiple forms of sonic coloration, in the process of amplifying a singular sonic color for the Broadway audience.

Justin describes the primary work of his audile technique as an effort to continually hear the distinct sounds, or colorations of sounds, from the pre-amplified stage, as distinguished from the amplified product from the sound system. The challenge of mixing eight performances of the same show per week for several weeks, while simultaneously constantly listening to an amplification system, contributes to auditory fatigue that intensifies Justin's fidelity to himself and his own judgments behind the audio mixer. Moving beyond its nineteenth- and twentieth-century popularity in discourses about sound reproduction technologies, "fidelity," in Justin's context, is a confluence of his confidence in his listening skills and tactile responses to sonic colors, and his knowledge of the functionality of the equipment that he uses.

How does Justin actively transform acoustic space? How does he use the faders on the surface of the audio mixer to amplify and attenuate vocal sound signals from the stage in ways that technologically adjust, culturally construct, and musically participate in the color of live musical sound products? When does he amplify the exaggerated coloring of the African-American Vernacular English (hereafter AAVE) of Porgy's lyrics that Norm Lewis sings? How do these adjustments excite the sonic colorations, the joint products of microphones, loudspeakers, the acoustic resonances of the theater, and the intelligibility that listeners require, as well as their cultural expectations for the sonic colors of the genre? When does he attenuate these signals in an effort to transmit the ideological transparency of his labor and the professionalism of the Broadway production's sound?

Before describing and comparing some of the sonic colors that Justin encounters with his audile technique and his manipulations of the fader, I will discuss the usefulness of the metaphor of "sonic color" as a framework for sound studies, and for analyzing creative labor in popular music.

Sonic Color

Natural scientists define "color" as the human perception of different emphases of power in specific wavelengths within the visible spectrum of light. In scientific discourses about sound, there are few formal associations of sound to color, with the exceptions, perhaps, of white, pink, and brown used to describe specific iterations of "noise." However, the tendency to use the word "color" when describing sounds appropriately aligns the description of the relationship between acoustic power, (often represented in decibels) and audible wavelengths that correspond to frequencies (represented in the measurement of Hertz).

Scientists and sound engineers like Justin use frequency response graphs to imagine different quantities of decibels in lower- or higher-frequency vibrations. These vibrations or oscillations propagate compressions and rarefactions of air molecules from a moving sound source, which correspond to different wavelengths of sound that resonate within an acoustic space toward a listener. A "flat" frequency response (note that this metaphor, like other common musical terms such as "high and low" pitches, relies on a visual mediation of sound to make synaesthetic sense, just as "color" does) represents a modern engineer's industrial preference for apparatuses that transmit sound. I have described this phenomenon already as invoked by the visual metaphor of an idealization of audio transduction as "transparency." However, contours

(or curves) in the line of frequency-response graphs represent the inevitability of uneven resonances or "colorations" in all phenomenal sounds, acoustic environments, and hearing capabilities, as well as the culturally constructed expectations for listening to these sounds in live or recorded popular music.

I prefer to use "color" in this analysis in lieu of the more common binary opposition of pure origins and distorted copies that pervades modern ideologies of technological reproduction and transduction. The ideology of transparency hegemonically privileges this binary distinction between "pure," original source and distorted reproduction. These distinctions are differentially valued and approached in different genres of music, and under different social conditions. Beyond this binary of original and reproduction, I assert that coloration is a property of the source, the context, the genre, and therefore the engineer's mission to mediate all of these. Engineers use the visual langue of "coloration" to refer to the intersection of timbre, technology, and properties of the musical context. One of those properties is racial constructions of sound as a coloration of sound.

Harvey Fletcher and Wilden Munson's measurement of sound pressure level in relation to frequency, or *Equal-Loudness Contour,*[15] describes a similar coloration of sound to the one that Justin negotiates (Fletcher and Munson 1933). The consistency of each shape confirms, for engineers like Justin, certain general information about the coloration and sensitivities of hearing through which audiences listen. In addition, as Justin explains, this is an area in which his own listening, or "trust of his ears," factors into the coloration of sound. Thus, amplification and timbre are interrelated even at an organic and individual level of perception.

---

[15] Fletcher, Harvey and Walden Munson. 1933. "Loudness, Its Definition, Measurement and Circulation." *Bell Labs Technical Journal*. 12(4): 377-430.

Genre Conventions

Manufacturers of consumer audio products assert sonic norms across many genres of popular music through technical means, for example in providing pre-set graphic equalizer settings categorized by genre (as in the sound settings for the smart phones most of us carry). There are no such factory-established pre-sets in professional live sound amplification equipment, but these standardized colorations serve as models, based on which engineers like Justin either fulfill or resist general audience expectations for genre sound. Justin assigns to specific instruments in the orchestra pit, and to the vocalists on stage, the many inputs of the mixing console that more or less occupy particular ranges of frequency bandwidth. He uses other types of equalizers to effect the frequency resonances of each of these sound sources, in order both to make the sound source recognizable, and to help clear a frequency-based foreground for a lead vocalist. Then, Justin uses faders to continue the work of this foregrounding.

Equipment Resonances

Each device that Justin uses in the *Porgy and Bess* production either transduces, transmits, or amplifies acoustic, electrical, and electronic signals within a dynamic range that engineers refer to as the "signal-to-noise ratio." Certain frequencies of these signals are more likely to undergo these colorations at the extremes of a device's capabilities. These factors overdetermine the sonic color of audio equipment such as microphones, preamplifiers, mixers, processors, amplifiers, and loudspeakers. This is a common coloration that Justin is working to hear and hear through, juxtaposed with the live acoustic sounds sung by Norm Lewis.

*Venue Room Resonance***s**

I argue that each specific venue for live popular music-making is itself an aspect of musical genre. This might seem an obvious assertion; however, especially in metropolitan centers like New York City, live sound engineers do not typically exclusively amplify particular genres of popular music in fixed venues that only produce one genre of live music. Room dimensions, construction materials, and crowd size not only affect the potential for the dynamic range of the music, but also drastically alter the color of music in that space.

Sonic Colors of Race

Sound "colors" that intertwine ideas of race and liveness are common cultural associations in analyses of blackness and popular music. Much of this discourse locates black music-making between the so-called polarities of composition and improvisation, that is, between planned and spontaneous musical creation. In her book *Sound Of Africa!*, Louise Meintjes describes how white studio engineers and black (South African Zulu) musicians, among other members of the art world she observed, co-construct the sounds of "liveness" in their production of musical expressions of blackness. She writes, "Specifically, discourse about liveness in the studio shapes and expresses a particular Africanness. The aesthetic desire for a live-sounding production is refracted through different nostalgias about blackness and nativism"(Meintjes 2003: 142). I argue that similar nostalgias for an idea of pre-technological or pre-modern blackness operate in the imagined landscape of Catfish Row, and of Porgy's singing.

In addition to these ideas of liveness, heterogeneous sounds and sound colors also signify the sounds of black music in contemporary popular music culture, as Olly Wilson asserts:

> The heterogenous sound ideal is reflected in the common usage of a wide range of timbres within a single line . . . . Practically every scholar who has analyzed African and African-American music has noted the presence of a myriad of vocal sounds used in performance (moans, groans, yells, screams, shouts, shifts in sonority), a seemingly inexhaustible repertory of vocal injections used to intensify musical expression (1999: 160).

In Wilson's depiction, this heterogeneity is derived from specific sound sources and products of African and African-American music. Performers such as Norm Lewis, and live sound engineers like Justin Rathbun, negotiate their joint production of such heterogenous sounds in Lewis's performance of Porgy. Referring to Wilson's definition of the heterogenous sound ideal, I observed Lewis "moan, groan, yell, scream, and shout" at the Broadway production. This in turn highlights the extent to which Justin's frequent amplifications and attenuations of the sound reproduction of Norm's vocal lines makes Justin as much a participant in Wilson's heterogenous sound ideal as Norm – indeed, it makes them collaborators in achieving it. Scholars of improvisation as a musical process fundamental to the history of African diasporic musical expression have linked these sound products to specific practices, and, moreover, have asserted that this linkage has shaped society more broadly (Monson 1997; O'Meally 1998; Veal 2007). As George Lewis has noted:

> Improvisative musical utterance, like any music, may be interpreted with reference to historical and cultural contexts. The history of sanctions, segregation, and slavery, imposed upon African-Americans by the dominant white American culture, has undoubtedly influenced the evolution of a sociomusical belief system that differs in critical respects from that which has emerged from the dominant culture itself (1996: 93).

We must therefore interpret Norm Lewis's performance in relation to "the history of sanctions, segregation, and slavery, imposed upon African-Americans by the dominant white American

culture"; but we must also interpret Justin Rathbun's adjustment of the audio fader in relation to these histories as well. In addition, the collaboration between Norm and Justin exemplifies George Lewis's "sociomusical belief system," one that, in this example, radically disrupts the hierarchies and aesthetics of western art music. It is also a system that recognizes and audio fidelities, musical improvisations, and sociocultural solidarities associated with a diverse society and its continual negotiations with difference.

During a performance of *Porgy and Bess,* I was able to observe how Justin's creative labor culminated in choices about these factors of sonic coloration in his amplification and attenuation of Norm Lewis's singing. In watching a video I made of his mixing, I noticed how Justin adheres to the transparency ideology of modern sound engineers *and* how he simultaneously resists it. I heard and saw moments when Justin pulled the fader back to compensate for Lewis's volume—a move that converted heterogeneity in Lewis's singing towards amplitudinal homogeneity. But I also heard and saw moments when Justin added decibels to Lewis's loud singing—a move that demonstrates Justin's participation in the heterogenous sound ideal, and an example of Justin's own coloration of the sound.

Modern understandings of sight and sound sensoria share definitions of "color" as a relation between power and wavelength. When power (in the form of light reflectivity) is added evenly to all visible colors, for example, the result is the color "white." Conversely, when power is evenly withdrawn from all visible colors, the color "black" is produced. In sound, the addition or subtraction of power to a particular sound adjusts the perceived color of the sound as a whole. That is to say, the whole of the sound that Justin amplifies is "the mix." Therefore, when he adds

or subtracts power (in dB of amplification) to Lewis's voice, Justin is changing the color of the mix.

Because live sound engineers are creative and technological laborers who work in the immediate context of live music, there are a number of factors which they monitor in the transmission of musical sounds from stage to audience seats while working; sonic color is one of them. My analysis here of Justin Rathbun's labor focuses on his engagement with sonic color in *Porgy and Bess,* both within and beyond the venue walls of the production.

Encountering *Porgy and Bess* on Broadway

It was a weeknight when David Hughey called my wife, Marti Newland, an ethnomusicologist and professional opera singer. She and David are good friends; they had attended conservatory together at Oberlin and had kept in touch in the years following graduation. After earning a master's degree in voice performance at Manhattan School of Music, David had shifted his career trajectory from a strict focus on western art music, and had now begun singing in musical theater productions as well.

In fact, on the evening of his phone call, David he had put two complimentary tickets on hold for us at the Richard Rodgers Theater. He had been cast as the understudy for the role of Sportin' Life in *Porgy and Bess*, covering for the principal, David Allen Grier, in case the latter became indisposed. Just a couple of weeks before his phone call, Marti and I had celebrated this great achievement with David, who, although he was ecstatic, was also a little unsure of how a classically-trained singer like himself would do on Broadway. His anxiety was tempered by the legitimate thrill of the opportunity to work with Norm Lewis, and with Audra McDonald as Bess.

Nevertheless, as an understudy, he wouldn't know in advance when he would be called to go onstage in the role. Tonight, it appeared, was the night.

Without much time to get ready, Marti and I made our way to the box office and picked up our tickets. We walked into the lobby of the theater, where an usher greeted us and showed us to our seats. As we made our way into the auditorium, we were struck by its apparent age.

The walls were mainly a faded light blue, broken up by a few lines of white paint. The hundreds of seats were covered in a red velvety material that seemed to blend seamlessly with the red carpets covering the aisles. The shape of the space seemed odd to me. It was wide, but not deep. In other words, the distance between the corresponding sections of the audience that aligned with stage left and stage right seemed great, but the distance from the stage to the front of the house was shorter. Not only the orchestra seats, but the also the mezzanine and balcony sections were angled upward sharply, forming surprisingly steep inclines, fortunately accommodated by a tall ceiling. However, at that point I could only imagine what the sonic resonant characteristics would be for such a space.

Our seats were near the front of the mezzanine section, not far from the stage. Nevertheless, perhaps due to the theater owners' effort to include as much seating in the theater as possible, I had a difficult time with the nearly nonexistent leg-room in our row. Having noticed a box seat near stage left with movable chairs, I approached an usher and told her about my conundrum. She paused for a moment, thinking about my request, and said that she would quickly ask her manager. I told her where I was sitting, and in less than a minute she met me there and said that we could change seats. Marti and I followed her back up the aisle into the lobby, up a narrow staircase, into another narrow corridor with a steep walkway, where the usher

opened a thick and heavy velvet curtain that functioned almost as a doorway to the box seat with its two movable chairs. She gave us a pair of Playbill programs, and we sat in our chairs, both happily waiting for the performance to begin. Marti, looking over the edge of the box, recognized a few fellow singers in the audience.

I looked down into the orchestra pit. The few instrumentalists already there, wearing the common all-black uniform of the pit musician, were leafing through their parts, tuning their instruments, or just waiting. I looked around the auditorium, hoping to identify as many loudspeaker cabinets as possible. The first array of loudspeakers I could see was located between the stage's proscenium and the hall's domed ceiling. There, in a long steel truss, I saw a number of full-range loudspeaker cabinets, as well as what appeared to be a pair of subwoofer cabinets. From there, my eyes moved downward to a spot near the front row of the orchestra section, where, in the very crevices of the left- and right-most corners near the stage, I saw large subwoofer cabinets, designed to reproduce very low frequencies with significant power that allows them to be felt as much as heard. All these loudspeaker cabinets were comprised of wood and covered in black paint, mostly the standard flat black that would not reflect any light. By that point, given my several encounters with professional grade loudspeaker cabinets, the appearance of these cabinets was not remarkable. Their appearance and placement near the front of the stage exemplified the form of sound reproduction technology transparency that this production of *Porgy and Bess* apparently required, and that would be typical of most such highly professional musical settings.

Turning my head leftward, away from the stage and the proscenium, I noticed a row of evenly placed smaller loudspeaker cabinets tucked beneath the floor of the balcony, serving

members of the audience who sat in the covered section of the upward-stretching mezzanine. I looked upward and saw that a similar array of loudspeaker cabinets faced the back rows of the balcony, where the audience was at a significant distance from the stage. These ceiling-mounted loudspeaker cabinets, as well as those for the mezzanine section, were mounted to the ceiling surfaces, and did not obstruct the sightlines of audience members in those sections of the hall. In our own box, there was an even smaller flush-mounted loudspeaker, mounted to the low seven- or eight-foot ceiling above our seats. The back of the speaker pointed directly at center stage, while the front of the speaker aimed at the position where Marti and I would eventually align ourselves to watch the stage. It was a small rectangular loudspeaker cabinet with a metal grate in the front, covering what I assumed to be a pair of four- or six-inch woofers separated by a small dome tweeter. After squinting at the box seats across from us, I noticed that every box contained these loudspeakers, with the exception of the front-most box seats, which housed selections of stage lights. I had seen loudspeaker arrays like this in the past; engineers and production teams install them to compensate for the lack of auditory presence for those audience members seated furthest from the stage. I believe that these small loudspeakers for distant audience members are an artifact of the programming of popular music in large auditoriums, and are meant to produce a sense of sonic intimacy throughout the auditorium.

The ethos of earlier forms of music theater resists the idea of installing these supplementary speakers, as do the performance practice traditions of western classical music, whose practitioners train to make their voices or instruments the primary mechanism for sonic intelligibility and presence. However, that night's production of *Porgy and Bess* was not the traditional operatic production of the piece. Indeed, the presence of these supplemental speaker

cabinets signified the extent to which this production of *Porgy and Bess* was not only a musical theater production on Broadway, but also one that followed certain production expectations associated with popular music.

Musical theater performers, promoters, and producers throughout the twentieth and early twenty-first centuries, have made similar adjustments to *Porgy and Bess,* as this work and its many songs have been the basis for performances across genres and media. Beyond these technical implementations I noticed, which contrasted strongly with traditional modes of operatic production for *Porgy and Bess*, I was also aware that the producers of this Broadway show had made certain changes to the work. According to David, who has performed in opera productions of *Porgy and Bess* countless times in the past, the Broadway production omitted certain aspects of the original plot that explicitly exploited African-Americans, with a result that focused the Broadway audience's attention on the more classical, and arguably universal, dimensions of the drama, which more audience members could relate to—especially a twenty-first century audience, which perhaps, more than anything, would value a shortened version of the work.

While continuing to wait for the show to begin, I looked around for more loudspeaker cabinets, but didn't see any. I thought more about the various distances between each loudspeaker throughout the theater, and also the distances of each speaker to the front of the stage. Engineers use these measurements to calibrate the time alignment of the multiple loudspeakers in a performance setting: that is, they delay the amplified sound signal to the most distant loudspeakers in the space. Engineers use the term "delay network" to describe particular zones of speakers that share similar distances, not merely to the front of the stage, but also to the central cluster of main loudspeakers positioned for the audience.

Without a delay network, amplified signals from the front-of-house mix position and hidden amplifier racks would travel through speaker cables in the theater at roughly 0.7 times the speed of light, which is much faster than the speed of sound, at roughly 1130 feet per second. Likewise, without a delay network, sounds from the stage would exit all of the loudspeakers at roughly the same time, and, given the discrepancy of the speed of audio signals through cable and loudspeaker sounds in the air, audience members at a greater distance from the stage would hear an echo, resulting from the duplication of sounds from their nearby loudspeaker combined with sounds from the central cluster of loudspeakers near the proscenium. With the delay network, live sound engineers measure in feet or meters the distance of each supplemental speaker from the central cluster, and use that distance to calculate how delayed the amplified signals for those distance speakers should be. Once they make this adjustment, distant audience members hear sounds from their local loudspeaker at the same time they hear sounds that have traveled from the central cluster. In other words, sounds from distant speakers do not exit those speakers until the compressions and refractions of those sound signals travel to the distant speaker locations from the central cluster. The time alignment of these delay networks at the Richard Rodgers Theater allows sound designers and engineers to temporally homogenize amplified sounds, as well as produce sonic intimacy for audience members in every seat.

After I finished looking at loudspeaker networks, I looked around at the audience members who were filing in or already in their seats. The audience seemed to be primarily comprised of white and black people, most of whom were older than fifty, but with a fair representation of younger people. How were they going to take these adjustments to *Porgy and*

Bess? Would they share in the delight of the artistic adaptations that the producers made to this well-known story? Or would they find it to be overly "politically correct"?

The last time that I was in the audience for a *Porgy and Bess* production was when Marti sang the role of Serena in a concert version of the work with the Huntington Choral Society on Long Island. The performance took place in a large new high school auditorium. That audience was predominantly white, upper middle class, and over 65. On that occasion, I sat in the front row, eagerly looking forward to hearing my wife sing her numbers, especially the aria "My Man's Gone Now." Curiously, throughout that production—especially when the singer who performed the part of Sportin' Life sang—I noticed that many in the audience were singing along with him. Once I could tell that this was going to be the case whenever this man sang, I turned around during Sportin' Life's numbers to look back at the rows behind me, watching people unabashedly singing along.

Afterwards, on the trip back to the city in bumper-to-bumper traffic, Marti and I discussed this phenomenon. Like David Hughey, Marti had performed a number of roles in *Porgy and Bess,* and, like me, she was also a bit taken aback by the audience's participation. I had never seen an audience behave in such a way at a classical music performance, save for a few examples of performances by pops orchestras. But then I reminded myself that George Gershwin, along with his lyricist brother Ira Gershwin and librettist Dubose Heyward, participated, in their depiction of the mythical African-American fishing community of Catfish Row, in what musicologists have described as a conflict between cultivated and vernacular American music, mapped onto racialized categories of "White" and "Black" musics, respectively. The Gershwins stipulated that all professional productions of *Porgy and Bess* be

cast only with African-American singers, and discourses about the opera are rife with accusations of cultural appropriations across racial lines—a tension that is present not only in U.S. productions of the work, but also productions in Europe and Asia. Some scholars argue that the opera's nebulous status between the realms of vernacular and cultivated music accounts for its enduring success.

This raises the question: Does the "in-between" status of this work therefore also blur the lines between cultivated art and vernacular entertainment? And did the behavior of the audience at the Huntington performance exemplify this blurring? Were they as invested in the combined art world of the composition, the libretto, and the singers, as they were in being entertained by performances that, in their scripted gross essentializations of African-American expressive culture, smack of minstrelsy? I remembered all of this as I sat with Marti waiting for the Broadway performance to begin. How would this different audience, at this different production, in this different venue, respond to the art world of a Broadway adaptation of the opera *Porgy and Bess*? Would they buy into the more timeless dimensions of this adjusted plot? Would adjustments in the Broadway version complicate the standard fetishized portrayals of African-American ignorance in the work, making the characters relatable, or at least more relatable to the members of the audience present that night?

More importantly for my purposes as an ethnographer eager to interview this production's sound designers and engineers, I really wanted to know whether, in this setting at the Richard Rodgers Theater on Broadway with Audra McDonald, Norm Lewis, and David Allen Greer, the audience would encounter *Porgy and Bess* as art or as entertainment. In their sonic expectations, would they prefer the sounds of *bel canto* resonating within the walls of the theater,

producing an array of reverberation, delays, and echoes that they would perceive as "opera"? Or would they welcome instead the contribution of these delay network arrays of speakers, producing the kind of sonic intimacy that they might expect from a production of work more clearly rooted in contemporary popular culture? Interrupting my thoughts, while gazing at the audience, I noticed that all the members of the pit orchestra were in position and had finished tuning. The house lights dimmed and the show started.

From the pit, I heard an ascending scalar and stepwise melodic movement in unison from most of the instrumentalists, pitching in range from the bottom to the top of an octave, culminating in a punctuating cymbal crash that decayed to reveal a minor pentatonic ostinato played on the xylophone, as well as by members of the string and woodwind sections. After a couple of repetitions of this pattern, the brass players interjected a fanfare that sounded like a big band shout chorus, playing in unison a fortissimo melody that shifts between a high tonic and a flat seventh, moving between these pitches a whole step apart, and following the syncopations called for in Gershwin's score.

The metric feel of this section of the brief overture is in four, with straight eighth- and sixteenth-note patterns, before the overture shifts into a swing feel when the orchestra introduces particular themes and motives associated with various scenes throughout the three acts. Sitting in the box seat roughly two stories above the pit, I primarily heard direct sounds from the instruments, and was unable to perceive much of this program material emanating from the loudspeaker in our box section. Listening to the orchestra in the theater, I noticed that the sound from the ensemble was "dry," which is to say without reverberation, especially transient sounds from the brass or percussion section. Perhaps it was the red carpet or the felt seats -- or the

presence of a full house of audience members -- that contributed this dryness. The room was not entirely without life or the vibrancy of a live performance, but it did not sound "wet," a term engineers use to describe the sounds of reflections off surfaces like walls or ceiling; in other words, the acoustics of the hall did not compete in my listening with the sounds that directly emanated from the pit toward my ear.

For much of the time during this overture, the orchestra sounded unamplified to me. However, I could detect some amplification of lower-pitched instruments, such as low brass and low strings. I suspect that some portion of the fundamental frequencies of those sound sources was amplified through the subwoofers that I had detected earlier. After a brief moment earlier in the overture during the percussion ostinato, I had wondered to what extent the engineers amplified the xylophone slightly above the other instruments. Given all of this, I quickly became impressed by what could be either the sound design, or the engineer's decisions in mixing the sound from the orchestra. I saw a number of microphones throughout the orchestra pit, but I could not hear exactly which microphones the engineer had amplified. I wondered: Were the other microphones off? Was this preset during the previews of the show? And does the engineer have the various sections of the orchestra channeled to one fader, with one fader corresponding respectively to violins, another fader to the brass, and so on? Or, for this one moment in the music, does the engineer dedicate the entirety of the faders on the console to each microphone in the pit? There was no way for me to know the answers from my box seat. I normally had a knack for speculating about settings like this, but for once I was stymied.

In that moment, I didn't feel like a live sound engineer. I didn't feel like an ethnographer studying and unveiling aspects of sound reproduction at live performances. Instead, I felt as if

the form of sound reproduction I was experiencing encouraged me to encounter the vast majority of production techniques as hidden, as somehow magical, indeed as *transparent.* However, in reaction to this I took this near-transparent sound production of *Porgy and Bess* as a challenge, as if they—whoever they were—were daring me to use every aspect of my audile technique to hear through the mystery and discover how they produced sound here. By the conclusion of the abbreviated overture, members of the cast and chorus had gathered onstage, portraying the bustling life of Catfish Row, and the game of craps that begins the narrative.

Heather Hill, a mutual friend of Marti and David, was also performing that night, substituting for the actress who plays the role of Clara. Clara has the first vocal entrance in the show, singing the famous aria "Summertime." Standing on stage above the orchestral accompaniment filled with swells of minor thirds, perfect fourths, major sixths, and flatted sevenths, as well as sweeping pentatonics and suggestive syncopation, Heather—another trained opera singer—sang the aria primarily in a *bel canto* style, and now I could hear how the voices onstage mixed with the sounds from the orchestra. It seemed well-balanced to me. I could hear every word, as well as each discrete instrument in the accompaniment. I was sure that Heather was wearing a lavalier wireless microphone; only this could explain how the intensity of her voice could preserve such homophony in spite of her stage movements.

This became more obvious to me when, in the course of singing, she turned her head away from us in the box seats, and I could hear slight, very faint colorations in the amplification process. Nevertheless, I could not reconcile my visual and sonic impressions of "Summertime." During the overture, I could see the myriad microphones in the orchestra pit, but was unable to tell from the sound which microphones were actively or more prominently identified through the

sound system. During Heather's singing of "Summertime," I was more successful in being able to explicitly hear her amplified microphone signals. However, I could not see any microphone on her. I assumed the small capsule was hidden toward the front of her wig, while the small cable that connects the capsule to the body pack, and the body pack itself, were hidden in her costume. This disjuncture between the heard and the seen underscores my argument that the achievement of transparency in sound engineering is dependent upon a kind of strategic hiding.

These two instances—detecting the means of amplification in the overture, and trying to detect it in "Summertime"—revealed for me the extent to which *seeing* aspects of sound reproduction technology, but not explicitly *hearing* the effect of that technology, produces a similar type of transparency. As musical numbers calling for different forces and ensembles unfolded across Act One, I continued to hear and see discrepancies between what I could encounter respectively through sound and in sight, as well breaches in the transparency when the mode of production became momentarily recognizable. In each of these cases I was greatly impressed, and began to consider that evening on Broadway to be not only a pinnacle in David and Heather's burgeoning careers, but also an outstanding feat of sound design and engineering across genres.

Until the start of the second act, I paid little attention to the small, low-profile loudspeaker in our box. As the show went on, however, I stopped looking at the stage and found myself first repeatedly looking at the speaker, and then staring at it, trying to discern the distinct sounds that emanated from that small box. This was a difficult task, as soloists and vocal ensembles paced the stage, and the orchestra continued to play throughout almost every moment of the production. After a while, I was tempted to get up surreptitiously and put my ear next to it,

waiting for a transition on stage when the orchestra was playing, and pretending to adjust my blazer. I could actually hear a faint mix of the orchestra and reverb amplify through that speaker. I suspected that the engineer had added vocal microphones to this mix as well. The speaker amplified so faintly that I could barely tell if it was working, leading me to conclude that the sound designers and engineers wanted patrons to hear only a somewhat even mixture of the live unamplified sounds from the stage and the amplified sounds through the central cluster and other supplemental speakers, including this one, in an additive fashion whereby no one sound source dominated.

Then I noticed the reverb. Because of the distance between this little speaker and the stage, the sound must have been slightly temporally delayed. I didn't immediately understand why, in this case, the engineers would add reverb, a temporal effect that further delays the time alignment. Then I recalled my own experiences as a recording studio engineer, using reverb to diffuse proximity as an effect that can push certain sound sources into the background and make a certain sonic space appear to be in the foreground, and I began to settle on the idea that the designers and engineers might have used reverb for a similar reason. This small sound source, this low profile loudspeaker, was only six feet from my head; the singers on stage were approximately 100 feet away. The central cluster of loudspeakers in the ceiling of the proscenium must have been 150 or 200 feet away. Adding reverb to the signal that would feed through this loudspeaker only six feet away contributed to the fact that I hadn't detected its sonic contribution sooner in my assessment of sound reproduction that night.

At this point in the plot, the acclaimed Broadway actress and singer Audra McDonald, as Bess, was holding Clara's baby and singing "Summertime" to him. The orchestra

accompaniment to this reprise is almost identical to the first statement of the aria; nevertheless, this time I heard slight differences in the orchestral sound in anticipation of McDonald's. The orchestra sounded fuller and more intense than before, though not loud in terms of frequency resonances. Rather than producing volume by adding a few thousand Hertz with rolled highs and lows, the sound designers and engineers seemed to have extended the lower resonance of the low strings. I heard more detail in the higher resonances from the percussion and upper string sections. This made the orchestra sound much more present than it did when accompanying Heather, as Clara, singing the same number. It was clear to me that the engineer was producing a particular sound for Audra McDonald's singing, an accompaniment that would almost cradle her voice, setting up a particular homophony that would reveal the unique qualities of her singing and artistry in specific ways.

McDonald sang the first word of the aria, "Summertime," as she entered the stage. She employed vibrato on the first syllable of the word, where she lingered before descending to the minor third on the second syllable, followed by a re-ascent to the fifth on the syllable "time." Her vibrato was quite distinct, always even and consistent, not very broad intervallically in terms of the frequencies that it swept, but almost compact, and with a rate of change that was also consistently oscillating at a rate of roughly 8 Hertz. Her articulation of the consonants and her performance of the pitches throughout the range of the aria did not strike me nearly as much as her vibrato, which made her sound distinct from that of the other vocalists with whom she shared the stage that night. It quickly became apparent to me that McDonald's vibrato one of the qualities that identifies her sound. A quick search through YouTube of her performances the next day confirmed this for me. But that night, the rate and intensity of her vibrato most explicitly

breached the accumulation of transparencies that I had encountered in the production sound. I could hear temporal distortions in the delay network when she sang her vibrato. I could more explicitly hear distortions in the reverb effect of the loudspeaker signal in our box seat that occurred with McDonald's vibrato. It was almost as if her vibrato was a particular mode of resistance to the transparency myth that pervades ideologies of sound engineering and sound reproduction technology.

Perhaps the mix engineer that night adjusted the orchestra sound to counteract the opacities overdetermined in the sound system by McDonald's singing, or maybe the engineer made the orchestra sound a bit more lush in response to McDonald, to highlight her star status. After this moment of revelation I finally sat back in my chair and enjoyed the rest of the program. At the end of the performance, Marti went to congratulate David at the stage door. I told Marti that I would meet her there, but decided to first push my way against the crowd to reenter the auditorium and find the live sound engineer. I quickly jogged up the aisle to the front-of-house mix position at the back of the mezzanine section, and there I met Justin Rathbun, a white man in his late thirties, wearing all black with Oakley sunglasses tucked above his relatively short hair, putting covers on the pair of large Digico[16] mixing consoles after no doubt having been at the theater all day. I introduced myself and thanked him for his work that night. I told him that I thought the mix was fantastic, with great intelligibility and a lot of nuance. In turn he thanked me. I asked if he had run into any problems that night, although, and as I said to him, I couldn't really detect any. To my surprise he admitted that there had been a slight malfunction with the reverb unit that fed the delay network. I had heard that reverb distortion when Audra

[16] The Digico board is the most expensive in the world. It was built for theater productions.

McDonald sang, but kept my giddiness to myself, and quickly changed the subject to introduce my research.

I told him that I was engaged in following live sound engineers throughout New York City, that I was friends with David Hughey, and that I'd been impressed with Justin's work that evening, and I asked him if he would grant me an interview. He expressed an interest in my project and gave me his business card. I thanked him, and told him that I would be in touch shortly. Before leaving, however, I noticed, scattered about among the mixing consoles, computers, and signal processors, several framed photographs of the show's stars, as well as some others that appeared to be pictures of Justin's family. There was also a bobble-head doll, an odd apple, and other things that seemed to belong to him. I was immediately struck by this, as I had never seen personal paraphernalia around a mixing console. In my own work as a sound engineer, as well as in Randy's work, and that of many other live sound engineers, the front-of-house mix position is a temporary position, especially when working at festivals that change venues, for a band on tour, or at one-night events. But it struck me at that moment that this was an office for Justin, like a corporate cubicle or corner office, where he goes to work every day: a space where he only not only works, but which he also adorns with pictures and symbols that are personally important to him.

I made my way out of the theater and onto the sidewalk, but, not seeing anyone there, I called Marti. She said she was on the stage, and that I could probably just walk in. I walked up the steps off the sidewalk on 46th Street, and came upon a security guard, who he waved me into the stage door and pointed towards some steps where I could enter the stage. There I found Marti, as well as Heather and David, and an assortment of other singers we knew who had been

in the audience that night. We congregated onstage, laughing and talking, surrounded by the bouquets of flowers that had made their way to the performers that night. At one point Norm Lewis walked past us from the stage door, and all of us hushed for a moment, until he nodded and we nodded back. Then we resumed the din of our conversation. The crowd eventually cleared out a bit, and Marti and I offered David and Heather a ride back uptown to their respective apartments in Inwood.

On the way home, after telling them our opinions and celebrating the success of their performance as opera singers who were anxious about the demands of singing on Broadway, I asked David if he knew Justin, the sound engineer. When I asked Justin for his card and told him that I knew David, Justin knew exactly who David was, and that he covered for David Allen Greer. But when I asked David if he knew Justin, he didn't. I explained that Justin is the front-of-house mix engineer who mixes at the consoles behind the last row of the mezzanine. David said that he knew who that was, but just didn't remember his name. At that point I asked if there was any way David thought I could do fieldwork with Justin or the other engineers or sound designers at *Porgy and Bess*. David, who by then already knew about my research, thought it would be a great idea, and volunteered to put me in contact with Nevin Steinberg and Jason Crystal, the two sound designers for the *Porgy and Bess* production.

Interview with Nevin Steinberg and Jason Crystal

A few days after attending David's performance, I took him up on his offer to get the contact information for the sound designers of the production. He sent me a Facebook message with the email addresses of Nevin Steinberg and Jason Crystal, and we exchanged email

messages. I introduced the project, and told them that I attended the production had met Justin, the engineer. They expressed their willingness to participate in an interview, and suggested that we meet in the Longacre Theater on 48th Street in Midtown Manhattan.

On April 10, 2012, I entered the theater. Unobstructed by any security or ushers, I made my way through the foyer and lobby, opening the large door to the auditorium. Behind the front-of-house mix position, I saw Nevin and Jason finishing some settings on a digital mixer. Nevin was a tall white man in his forties wearing a blazer and slacks, and Jason, a white man in his late twenties, wore a polo shirt and jeans. At the Longacre, Nevin was the principle sound designer and Jason was the associate sound designer for a drama about Magic Johnson and Larry Bird, entitled *Magic/Bird*. I met them at the theater during the last preview day of the production before opening night. They told me that they had been working there during the past couple of weeks, implementing new equipment and changing settings as the other aspects of the production were finalized.

As sound designers, Nevin and Jason do not stay with theater productions much longer than the first weeks of previews. Seldom do they work on any production after opening night. By that time, they entrust the sound engineers they hire to execute the parameters of their sound design for each production. This was the reason that Nevin and Jason were longer present at performances of *Porgy and Bess*. They left Justin and other production assistants to do sound on their own.

After our brief introductions, Nevin looked around the front-of-house position and realized that there was no place to comfortably have our interview, only the many rows of audience seats facing the stage. He suggested that we sit upstairs in the lobby of the balcony

section. Once we were seated, I gave an overview of the project and its frameworks. He immediately responded to the concept of "fidelity." Nevin told me that he uses the term "fidelity" when he guest-lectures at local colleges, and thinks of it as a term with "deep meaning" in what he feels to be important in conveying "truthfulness" in sound engineering work.

We talked about how sound designers consider fidelity, and how each of them defines sound designing. Jason shared his belief that sound design has many different definitions, all dependent on the way that the design labor is divided within a given production's engineering crew. For example, he told me—and Nevin agreed—that sound designers may compose and select and make sound systems, but that there are conditions in which the sound designer does no composing, and a systems designer selects equipment. Nevin also added that design produces both the content and the means by which people experience "the audible world of the production." The following are some key moments from these conversations.

On Sound Design, Fidelity, Intelligibility, Reinforcement and Acoustics

In our discussion, Nevin found the topic of fidelity to be very important to the work of sound design. Fidelity is a topic of discussion in his guest lectures and master classes. He uses the term as a twentieth-century technological term that defines the utility of truthfulness in live sound engineering work. Jason defined sound design as creating optimum communication through the content and means by which people experience the audible world of a production. He told me that sound design work is multifaceted, encompassing both technical and creative work through designing a sound system, composing sound effects, and constructing acoustic sound. The way that sound design is credited varies from production to production. The sound designer,

the composer, and the system designer are occasionally three different people, yet a combination of these roles can be executed by one person. For example, some sound designers are strong at content creation but not system design. In that case, a system designer would work with them. Nevin indicated that on Broadway sound design for plays and musicals is similar, including the design of reinforcement systems for the two genres. As a baseline, audiences need to be able to hear the words, whether the production is a play or a musical. Sound designers must accommodate people who will be disadvantaged acoustically by where they are located in a Broadway theater, both from audience members' listening points and from cast members' listening points. In musicals, of course, the complexity of managing the communication of words as it relates to music diverges from the sound design for plays, especially in the content creation for prerecorded soundscapes, or the sound effects that are made on the voice. Nevin explained that the role of reinforcement is different in plays and musicals. Plays often include prerecorded sounds played through computers of various kinds. While musicals also include prerecorded sounds, they require designers to attend more to the communication of a live event. Both Nevin and Jason primarily work in Broadway theaters that have between 800-2,000 seats. The architecture of these theaters, specifically the sound specifications that their size commands, is the starting point for their design work. While the range of these theater sizes is fairly narrow, the differences in how they design for a 800 seat theater and a 2,000 seat theater is wide (Steinberg and Crystal 2012).

On Specifying Equipment per Production/Four Wall Contract

WHITNEY: With these different theaters, it appears to me that the theaters themselves, the venues on Broadway, or in the Broadway area, have systems inherent to the building. Is that the case?

JASON: No. Incorrect.

WHITNEY: So when we walked up the back there, there was a whole undulating collection of cables.

JASON: Yes.

WHITNEY: You had people lay them down for this show?

JASON: Yes.

WHITNEY: They look really tenured.

JASON: There's not even electricity run, and we're running everything from speaker wire to microphone cable to power.

WHITNEY: Okay.

JASON: The theater comes with *nothing* in it except a big switch for power. That's kind of what you get.

NEVIN: We do everything. We bring everything into a production on Broadway, it's called a "Four Wall Contract.: When you walk in, you get four walls. That's all you get. All the lighting, sound, scenery, everything is brought in per production.

WHITNEY: Okay. And you specify that, as sound designers.

NEVIN: Right.

WHITNEY: Who are you collaborating with to decide things like which board to get, or which array of speakers? Do you discuss those choices with anyone?

Nevin told me that specification divisions are made by the sound designer alone. When he selects equipment, he first considers what sound sources are in the production, then what the audience

might need, and finally what would support the scenic design. Reading the play and speaking with the director to visualize the production is also important in informing how he chooses equipment. He explores the capability of new equipment by using them in productions where the success or failure of the equipment won't make or break the success on the production. Since Nevin has worked with Jason on a number of shows, he will occasionally talk with him about specifying equipment, but the final decision is his (Steinberg and Crystal 2012).

Equipment

Nevin is conscientious learning about the capabilities of new equipment. He attends productions to access new equipment in use, attends trade shows, reads trade magazines and does demonstrations offered by manufacturers to learn about new equipment as soon as it is available. Jason stressed that learning about the availability and capability of new equipment also comes from their colleagues. Additionally, when visiting the three major rental shops that service Broadway shows: Mask Sound in New Jersey, Production Resource Group (PRG) Audio, also in New Jersey, and Sound Associates in Yonkers, he will ask them about new equipment.

Additionally, Nevin is sensitive to the fact that when he specifies equipment for a production, he is, in essence, asking vendors to purchase the equipment. Given this, he tries to select equipment that he is confident he would select again for a different production. He knows that vendors profit from renting equipment over many years, and he feels a responsibility to be efficient with vendors for the longevity and health of the entire live sound industry. Most of the equipment for Broadway productions is rented on a per production, per week basis. Jason recognizes this responsibility as well, and expressed that it is also important to be efficient with

the funds that producers provide for a production. Building and maintaining credibility with production managers, producers, and vendors, in large part, rests on the ability to deliver what was promised for the least amount of money (Steinberg and Crystal 2012).

Sound Signatures vs. Transparency

I asked Nevin if he had a sound, and whether he embraces it or counts it as a distortion that needs to be made transparent. He told me that he does not think that he has a sound, though he can guess who a sound designer is when he sees a show. He describes this as a sound designer's "sound signature," which designers develop with experience, though it may not be deliberate. More than a designer's sound, Nevin said that a Broadway sound designers' relationship with audience members, sound sources, the architecture of the venue, and the style and kind of production create the sound of a show. Jason agreed, telling me that he does not feel that it is advantageous for a designer to have a trademark sound. This is distinct from sound designers for rock shows in large venues, who do not have a relationship with the audience or the sound sources. Nevin's work is also different from the job of a sound designer in a studio, where time and the expectations of performers can be more controlled.

When I asked Nevin about transparency, he said that it was his least favorite word in the lexicon of modern sound design for theater. He explained that given the premise that most contemporary listeners believe that sound is always amplified, being transparent is not a worthwhile goal. The goal of designers and engineers is to amplify. *Porgy and Bess* was a good example of this. The engineers amplified the show more than one would want to admit. Being transparent, being invisible, Nevin argued, erases the affect of engineering on the process of the

production. A sound designer and a sound engineer is supposed to add value, not pretend like something is not amplified. Nevin said that his goal is to make people forget that the show is amplified, or to do it so well that listeners do not care. He describes this as fidelity, not transparency. He said: "I believe that transparency actually diminishes the experience, because it's about saying, 'I'm not there.' That isn't really ever my goal. You know? I'm very much there and I'm expected to be there."

Jason was also troubled by the concept of transparency in sound design and engineering. He said that his goal is to "free passage of information" so that the audience feels connected to the story of the production. Jason and Nevin do not work to make productions louder, but to bring audiences acutely closer to the production. Nevin said that he wants to have the "… feeling like *that's* what we're asking the audience to listen to at the moment." Choosing when to make something louder is an incredible, subtle power that sound designers wield. Nevin has always been oriented toward production in his listening. Even when listening for pleasure in his private time, he listens for sound and production quality. In moments of a production, he hopes that he will forget about he sound design, even for a second. When that happens, he described it as hearing like a layperson. It's at that moment when he knows that he has done something right in his sound design work (Steinberg and Crystal 2012).

On Audiences and Genre

WHITNEY: How do you think about audiences?

NEVIN: They're terrible.

WHITNEY: Terrible?!

NEVIN: They need to be better behaved.

WHITNEY: How do you think of the people who are walking into these shows?

NEVIN: You're serious?

WHITNEY: I'm serious.

NEVIN: I'm amazed they come at all. So happy to see them. (Laughter.)

I asked Nevin if he imagined who the people are coming to his shows, and if what they may be listening to en route to the theater influences the equipment that he specifies. He does not consider these factors, but he does think about the expectations of the audience with regard to how the equipment he chooses will shape their experience.

I asked Kevin about how the music genre of a Broadway show impacts his work. He recalled the recent example of *In the Heights*, which he sound designed. He was not as familiar with the Latin Hip Hop of the musical as he is with shows that feature western orchestral music. In preparation, he did a lot of listening to Latin music in effort to design authentically for the style of the show. He told me that sound designing with musical genre in mind comes down to the question: "How do I communicate, in a way that is satisfying, what is happening on stage to the 1,400 people in this theater?" (Steinberg and Crystal 2012).

Engineers

To my curiosity about whether sound designers get bored during the long run of Broadway shows, Nevin explained that sound designers do not engineer, and are thus not there on a nightly basis. Once the sound design for a show is completely set up, the engineers may have to fight boredom to a certain extent. There are, however, sections of a musical that are least

interesting to him, but they pass into another section that is stimulating. Jason expanded, saying that when he sits with the engineer during a musical (as opposed to sitting in the house with the audience), he listens less to the music, and more for how equipment is functioning. He thinks: "This part is easy. He's got the right mic up, and the orchestra is feeding the right speakers. The technology is working correctly….and if it's working, then all right." Jason referred to technology "not working" as instances where the designers had not finessed the sound to the extent with which they are satisfied. There are also extreme situations where a piece of equipment has failed, which happens once in most shows.

Figuring out whether a sound design will work for a show or not, initially, involves improvisation. For engineers, through improvisatory trial and error, they determine microphones, inputs and fader arrangements that will make it easiest for them to mix, and have the flexibility they need to follow the script and make the show sound like the designers desired. There is creativity in that process.

Nevin does not hire engineers, but he does place them. The production pays the engineers. Nevin decides who mixes at the musicals that he sound designs. He looks for people who demonstrate talent, have some musical background (he said these people "tend to have ability with their hands and ears"), ability to deal with people, and to stay calm under high-stakes pressure. He described engineers as "thoroughbreds." Broadway engineers have to be able to successfully mix from scratch, starting from a score and a console. According to Nevin, most engineers know that they are low in the chain of command and need to be problem solvers through difficult situations in which they are typically discouraged to voice complaint. Ideally, he would have seen the work of a potential engineer as they contributed to another part of a

previous production, so that he can asses how one fits his criteria. Selecting an engineer for a production puts a lot of responsibility out of his control.

The personality of a sound engineer is crucial to the success of a show. Their attitude in dealing with the pressures of stage management, directors and producers is very important, as is how an engineer responds to mishaps. There is never a perfect show, so being able to respond to problems calmly and swiftly is a big part of the sound engineer's job. Nevin explained that he transitioned from being an engineer to a sound designer when he started sharing his opinion. He realized that the conversations that he wanted to be a part of were at the level of the design team and the director. He liked to engineer, and he continues to engineer special events. After doing the job of an associate while he was still an assistant, he formed a company, Acme Partnerships, with Tom Clark. Acme has done many successful productions including *Porgy and Bess, In the Heights*, *Hair*, *Fences, Bengal Tiger of the Baghdad Zoo, Spamalot*, *Avenue Q*, *La Bohème*, *Adam* and *Legally Blond* (Steinberg and Crystal 2012).

* * * * *

In my own sound engineering practice, I work primarily with regard to intelligibility and artistic expression, and do not know a lot about sound design work. I was glad to learn Nevin's and Jason's definitions of sound design. They also illuminated their relationship to intelligibility, reinforcement, and acoustics. Nevin explained that intelligibility is the most common concern of sound production for theater sound designers. The architecture of a theater and the ability for an audience to hear the words of characters are absolute imperatives for sound designers, ones that all theater productions share. Sound designers on Broadway act as a managerial staff that proposes specific assemblages of sound reinforcement equipment to producers of plays and

musicals. In addition to this, they are responsible for hiring live sound engineers, who in turn work directly with sound designers during the early stages of renting specific sound systems for productions, installing and configuring the system within the theater, and eventually operating the sound system throughout the run of the production long after the sound designers are present at the productions. This division of labor between sound designers and live sound engineers is standard on Broadway, but not as commonplace on the shop floors of live popular music productions. In those contexts, it is common for live sound engineers to have a greater degree of control of a selection of sound equipment, its placement and configuration at a venue, as well as being responsible for explaining and advocating for his or her decisions with the sound system among musicians, managers, promoters and audiences. In addition to observing the extent to which a live sound engineer at *Porgy and Bess* produces sonic intelligibility and transparency, the following section investigates how much artistic and technological autonomy this engineer maintains within this comparatively bureaucratic music production context.

Opening Interview with Justin Rathbun at Richard Rodgers Theater

Justin Rathbun, the live sound engineer of *Porgy and Bess* on Broadway, agreed to meet me in the audience section of the Richard Rodgers Theater for an introductory interview on July 22, 2012. We discussed how he became involved in live sound engineering, his training in the craft, his relationship to musicians, his engineering techniques, and his labor experiences.

Justin and His Path to Live Sound Engineering on Broadway

Justin became interested in live sound engineering early in his life. When he was five years old, he started playing guitar in effort to be part of his church's music group. In that experience he became involved in the technical side of the music at his church by age eleven, doing set up and breakdown every week. He did not yet know that he was involved in sound engineering, but he said he knew what sounded good, and how to set things up. He played guitar through his teen years, as well as the bass. He was active in his junior an high school band, orchestra and jazz ensembles, as well as active in a cover band. He went to college and majored in music performance, where he continued to play in multiple ensembles and to play multiple instruments. He got burnt out, sometimes playing from 8am to 2am, and his interest turned to sound engineering. He liked setting up and doing sound checks more than performing himself. Justin told me that he knew how concerned musicians were about their individual sound. He, however, was more concerned with the sound of the big picture.

Justin went to college at Full Sail University, where he said he received a real world education. He went there after the music performance program. He started the recording arts degree and soon realized that he did not want to be in a recording studio all the time. He preferred live sound engineering, which he found to be more challenging. He enjoyed the pressure of having to execute sound at the first try, rather than being able to go back and do it over as one can in recorded engineering (ibid). Live sound engineering on Broadway had a particular challenge, even though he did the same show every day. The changes in cast, when an understudy performed for instance, made the show different for him each night. He told me that if he came into a show and thought that it would be the same, it was then time for him to stop

engineering. He thrived on the drive to continually make things better. Justin said that he learned how important it was to leave his work in the theater when he left. When he would go home, he would not think about his live sound engineering labor. Otherwise, he said rethinking how to fix a wrong note, or a timing issue after a show "would drive you insane. There's stuff that I can control, there's stuff that I can't—and knowing the difference is very important"(Rathbun 2012).

Broadway musical theater production: reinforcement v. amplification

Justin was able to hear the imbalances that occurred when swing performers were the lead in the show. There were four swings in *Porgy and Bess*.[17] These swings were the people who were in ensemble roles and covered [a] principal character's repertoire in the case if a need for a substitute performer. These swing roles tended to have a good grasp of what was happening on stage since they were performing in the ensemble each night. There were occasional balance issues when a new person was performing a lead role. They may have been louder or softer than the other actors. Justin explained that the mic placement on the actor greatly effected this.

In *Porgy and Bess*, Justin explained that the live sound engineering approach was more about reinforcement than amplification. He did not like the word "amplification." He said that he was reinforcing what the actors were giving and making it sound back into the theater so that a person in the back row and a person in the front row heard the same thing. It was extremely difficult and required finessing, tweaking, and knowledge of the acoustics of the theater, he explained, but that was his ultimate goal.

---

[17] Swings are performers who prepare to perform multiple roles in a production, and are called upon to substitute for another character, usually with short notice, if need be (in the case of illness, for example).

Porgy and Bess was the third show that Justin engineered in the Richard Rodgers Theater. He also engineered *Bengal Tiger at the Baghdad Zoo* and he engineered a play with Robin Williams. He was the head sound engineer for *In The Heights*, which was also at Richard Rodgers Theater. His previous experience engineering in the theater helped him engineer *Porgy and Bess* with fluidity. He knew that temperature and humidity effect the room resonances drastically.

Justin thought that it was important for the engineer to have a good relationship with the conductor and the musical director. Constantine [Kitsopoulos], the musical director for *Porgy and Bess*, would come out and watch the show. Justin's listening attuned to know what the conductor wanted to hear, and with every show that he has ever worked on, whether it be on tour or Broadway, he has been able to give the conductor notes. Justin told me that the conductor, music director, and live sound engineer collaborated to make a great product. Justin described his best days as when the entire cast was performing, the orchestra was good and the temperature and humidity were stable. He said that he never felt that he has a perfect show, but that these factors made for a great show.

When I asked Justin if he thought he had a sound, he said that he probably did. Similar to Nevin's perspective, Justin said that through working with designers over years, he had developed an understanding of what they wanted to hear. The designers crafted the initial equalization settings, whether for voices or orchestra. After that, Justin made tweaks as needed. He shared that *Porgy and Bess* was like nothing that he had ever mixed. There were twenty-three pieces in the orchestra, and twenty-five members of the cast, all "fantastic singers." Engineering

Porgy and Bess reminded him of the thrill of mixing the forty-eight piece orchestra of *Beauty and the Beast* at Wolftrap.

Justin worked with Nevin Steinberg and Acme Sound Partners for several shows. He said that his collaboration with Nevin was very good and that they had a good understanding of each other. For a successful show, the sound designer and the sound engineer needed to trust each other. Justin had worked with Acme since 2006, and he recognized that Nevin selected engineers based on both personality and technical ability. The demands that Justin juggled exemplified the difficulty of doing live sound on Broadway. Nevin, or a sound designer, was not the only person that he had to please. The audience, the producer, and the actors all had to like the work of the live sound engineer. "Everybody is a sound person. Everybody has an opinion on what they think should be," he told me. Justin tried to balance demands and pick battles.

Justin was able to read the audience after observing their reactions in the first few minutes of the show. If audience members clapped at the end of "Summertime," then he knew that, barring technical failure, that it would be a good show, where the sound would be satisfying to multiple stakeholders. Audience members occasionally expressed their thoughts on his live sound engineering. They would say "I could hear everything," or "I can hear all the words. It's good," or "The orchestra is too loud." Most audience members were not critical listeners, like sound engineers are (Rathbun 2012).

On Equipment: the gear for this production

Nevin and Jason originally specified very new and expensive equipment for *Porgy and Bess*, but it exceeded the budget from the producers and management. Despite this, Justin stated

that the equipment turned out to work very well for the show. Most of the gear for the show was older, though there were some new pieces. There were a lot of Meyer [a brand of professional loudspeakers] and a lot of MSL 2s. The MSL 2s were non-powered, so there were several amp racks in the lower level of the theater. With the older Meyer processors, a lot of DNB were in the theater as well. The main system was comprised of Meyer speakers, amplification comprised of Lab Griffin, DNB for the speakers, and Meyer Galileo processing.

Justin explained that there were several zones in the theater to make it sound as acoustic as possible. This required metric outlets from the desk that had different levels per zone. The front end of the system was a Digico D5, with 48k Maddy racks. It was an older desk of the 2000s. Sound effects were all Q lab machines. Everything was MIDI'd together, and everything talked to each other. Justin described this as a medium small system. *In the Heights* also had a medium system.

The orchestra pit had mostly DPA microphones, 4006 and 4001s, though there were also AKG, 414s and Sennheiser (4021s) microphones in the pit. There were two microphones per instrument. The reed players had a high mic and low mic because their range in this production was rather wide. The drum kit had all overhead microphones. Most of the microphones for the actors in *Porgy and Bess* were lavalier, either in the hair or the wig. The microphones were placed in the enter of the actor's head, or close to center. Justin liked the microphones to be over the eyeball pointing down at the mouth. This way, he told me, the nose did not get in the way. The actors always had omnidirectional mics. Justin had tried cardioid mics on the actors, but found that the way that they laid on hair made the sound balloon. For the actors with no hair, or who changed hats often, he used an ear rig, so that the microphone (DPA 4061) went below the

sideburn, pointing down. The production used thirty Sennheiser 4,000 series wireless microphones. There were five MSL 2s in the central speaker cluster. Two of them were pointed down to the orchestra. One was pointed up at the mezzanine, and two were pointed straight up at the ceiling. Those were the regular MSL 2s, and the only thing feeding those were the orchestra and a little bit of surround reverb. The sound was to go out of the pit and up, and and Justin was to help it. It was an experiment at first, and it ended up working well.

In the theater, there was a whole grid of ceiling. Justin could go up and walk around. He told me that when *Tarzan* was in the Rodgers Theater, there was a catwalk system with flying rigging points. There were people swinging all over the audience in *Tarzan*. That was many years ago, but all the equipment was still there. Disney [which produced *Tarzan*] installed all of that equipment, and decided that it would be more cost-effective to leave it than to try to take it out.

As a contract employee, Justin worked for the show, not the theater. There were members of the production team that worked for the theater, and they generally install equipment, speakers in the ceiling, for example. However, aiming those speakers was something that Justin did. That work was part of the show, not the install. There were eight to ten men on the sound crew for the show, all of whom were part of tearing down the show when it ended. When the next show started, another crew of eight to ten sound men would install equipment again, which is typical of Broadway theaters. Having done three shows in the Richard Rodgers theater, Justin had been through every space in the building (Rathbun 2012).

Labor and Fidelity

Justin enjoyed that the Broadway schedule typically allowed for daytime off. On a typical Friday, for instance, he had the daytime to himself to answer email and do leisurely activity like go to the beach. His call time for the show was 6:30pm, ninety minutes before the house opened. When he arrived at the theater, he would power up the system, check through all of the speakers and microphones, to make sure that the equipment was working. After doing the live sound engineering for the show, he left the theater at 10:45pm to go home and get ready for the two shows that ran on Saturday. Working late nights, especially on weekends, can be hard on one's social life, he shared. He works five nights a week. Between shows, Justin would typically eat or take a nape if he was exhausted. Between shows, he will recheck the system to make sure that the equipment still worked. To give his ears a break on days where there were two shows, he would have Jim, a backstage guy and the A2 on the show, mix the first show of the day. Doing eight shows a week is taxing.

Justin told me that he felt fortunate to be in a career that he enjoyed doing, and that his love for live sound engineering drove his work. He said that when one loves what they do, they have faith in the areas of their work, whether it be "…faith in the people that you work with, or whether it be faith in the gear that you're working with, whether it be faith in your ability to actually achieve what you want to do." When I asked Justin about Nevin's faith in his live sound engineering, Justin responded saying that Nevin had been very upfront with his intentions and asked for Justin's opinion. Justin knew that Nevin would not do anything to throw him off track, and if something surprising arose, Nevin would alert Justin. Nevin would say, "Hey, we're going to do this on this show, learn how to use it." Justin had used all the gear in the

theater a hundred times. Nevin put a lot of trust in the engineer's knowledge of the using the equipment well (Rathbun 2012).

* * * * *

In our interview, Justin described the typical aspects of his live sound engineering work in theaters on Broadway. He detailed the types of interactions he had with different production workers and typical configurations of sound reproduction and amplification equipment, as well as offering brief descriptions of what constitutes good and bad days at work. His commentary about several forms of trust and faith—in the functionality of equipment, in his own abilities to listen and mix, and the faith that Nevin and Jason have in him—demonstrate a type of fidelity that circulates across several aspects of his work. In addition to the more classic type of fidelity that is commonly associated with the success of sound reproduction technology, social forms of fidelity also circulate within this context. We discussed these points in anticipation of my observation of a typical production effort at the theater.

Justin's Tour of Richard Rodgers Theater

This section is an extended thick description of my walk-through of the theater with Justin, and Justin';s preproduction live sound engineering work on *Porgy and Bess*. In addition to introducing me to actors, directors, producers, security guards, wardrobe and makeup artists, musicians, and technicians, he showed me a plethora of different kinds of state-of-the-art sound reproduction technologies, as well as his extensive procedures for each of them before each performance.

Stage Door

When I arrived at the stage door on 46th Street, Justin introduced me to Jim, a crew member who is responsible for Deck Audio. Along with Justin and Jim, cast members were hanging out outside of stage door. They joked about how hectic the production had been, especially with the swings who sub for multiple characters. There was also an instance where an actor had to run offstage to the bathroom, and another actor had to speak the missing actor's line. They acknowledged how Justin quickly responded to the sudden change in the mix.

Below the Stage

We all went inside. Justin introduced me to Angelo, a security guard sitting in a chair on the inside of the stage door. Below the stage, Justin and I walked down a narrow spiraling staircase, with a low clearance. Over our heads, a bundle of audio cables spanned the length of our downward journey. Justin instructed me to watch my head. He showed me the Sound Lab, which was an area that contained a 12' long row of 6' tall audio equipment racks, as well as a workbench with a soldering iron and wireless microphone parts outlined. We sat in the two swivel chairs inside of that area, and he listed all of the devices in the racks: RF, video, Intercomm, MIDI racks for the ins and outs, and amp racks. He told me that he installed all of the equipment, nodding as if to indicate how laborious that was, while also anticipating the breakdown of the system at the end of the production. Amidst the many cables, parts, and pieces of gear, I pointed to an odd item on the work surface near the microphone parts, asking what it was. He said, "Oh, that's the espresso machine," adding, "It's critical!" We laughed.

We walked up one of the equipment racks in the lab and Jim joined us. Justin told me that they usually don't have meetings in the sound lab, but that they "usually just turn everything on, talk about chaos that might be happening, what happened today, how much nothing we got done . . . in our personal lives." Both Justin and Jim laughed. Jim and Justin exchanged pleasantries about Jim feeling better than he did last night. Justin said that it was probably because of the espresso shot and encouraged him to have another. He said, "You probably should. It can't hurt!"

I looked at one of the broken $500 DPA lavalier microphone transmitter body packs that each performer wears. Justin said that these microphones had a tendency to break at the connection between the thin cable from the small microphone and the cigarette-box-sized black plastic transmitter. They also often broke within the small microphone capsule. I could tell that the three of us shared a less professional and more personal moment when we paused at the mention of throwing away a DPA microphone, one that each of us would never have wanted to lose.

In prepping for the show, Jim pulled out dozens of wireless lavalier microphone sets from a case. The number of wireless microphones was dizzying to me. Looking at them, I remembered using early Nady VHF versions for music theater shows in the 80's and 90's, and being traumatized by bouts with feedback and transmission crosstalk. Jim also extracted a number of small white elastic latex items. I was confused. Justin saw this in my facial expression and said, "They're like condoms but they're not, they're called 'sheevees.'" Jim placed cotton balls on the small switches on the top of each microphone transmitter pack and covered each pack with a sheevee. He does this to prevent the perspiration from the actors from short-circuiting

microphone transmissions. Steve, the house electrician, walked up to Justin, confirming that he had answered someone's question about a circuit that had been mistakenly first posed to Justin. Justin introduced me to Steve, and they joked about that fact that I was following Justin to learn about sound engineering. A few moments passed until Justin proclaimed, "It's 6:30 on the dot!" He and Jim powered on an array of devices in the racks. I asked Justin about his use of uninterruptible power supplies. He told me that he used them for the Digico MADI I/O interface and the Galileo loudspeaker control system. If the Galileo lost power for even a moment, the loudspeaker system would amplify DC (direct current) offsets as clicks and pops.

We continued to walk around. Julie, the stage manager, passed us. Justin introduced us before they casually checked in with each other about that night's show. She was concerned about Phillip Boykin's recent illness. (Boykin was the actor who played the antagonist role of Crown). We passed by wardrobe dressers. Justin remarked about their new technique in quickly preparing the costumes before the curtain call. From there, we walked up to a very small doorway, down in that underworld of production beneath the stage. That 2.5'x5' opening was the musicians' entrance to the pit. I stuck my head through the opening to see a few orchestra members, dressed all in black, adjusting reeds, oiling valves, and tuning strings. Tightly-packed chairs, music stands, instruments and an assortment of dynamic and condenser microphones on stands and hanging from the underside of the stage completely surrounded them. We walked up another staircase that passed by the dressing rooms. On the way, we saw crew members testing the hydraulics of what looked like a large boat before I briefly met Nancy, the manager of the production.

Justin and I finally made it up to the downward-sloping stage, amidst the impressive scenery of Catfish Row. We stood at the center of the stage, where he pointed at a few devices in the audience that he checked before each performance. He took a glance at the video monitors that show the conductor to the performers on stage, as well as the faint glow of the color red from infrared transmitters that supply an audio mix of the show to headphones for audience members who require hearing assistance.

Front of House (FOH)

Justin and I walked from center stage toward stage left, and backstage where there were a few steps that led to the front row of the audience orchestra section. We continued up a long upward-angled aisle along the stage left side of the auditorium, from the stage to the back row of the orchestra seating area, on that same side, beneath the balcony. We arrived at the front-of-house (FOH) mix position. It was a mix position that was covered in equipment. A large Digico digital audio mixer faced the stage, and an even larger one was to the right at a ninety-degree angle. Computer and video monitors filled the gaps of the leftover surface area around the mixers. Below each of these desks, as many engineers call them, an array of processors and Mac Mini computers filled equipment racks that supported each mixer. On the left side of his seat was another pair of racks. On their top surfaces, Justin had placed framed photographs of Norm Lewis as Porgy and Audra McDonald as Bess, as well as pictures of himself with friends and family. A red mixer lamp illuminated just enough for him to see the pictures, but was not bright enough to interrupt the view of audience members in the back row, on the other side of the FOH mix position wall.

What did it mean for Justin to mix these pictures of the cast with pictures of his loved ones? I was conflicted between asking him about it or just letting him continue to prepare and tell me what he was doing at his own discretion. He was busy removing plastic covers from the two Digico mixers, complaining about how much dust accumulates on the surfaces overnight in the old theater and the importance of not letting dust get into any of the encoders that would compromise certain presets. Pointing at the racks below, he showed me more uninterruptible power supplies and which devices had redundant power supplies. He also showed me how the mixer on the right could instantly replace the stage-facing mixer if that mixer malfunctioned. If this switch had to happen, the audience would not hear any distortions from this switch in the amplification system.

I pointed to one of the Mac Minis, labeled "Surround PC," and asked what it did. Justin told me that it powered the processing and reverb for some of the loudspeaker zones in the theater. I recalled that, when we had first met several weeks earlier, he had described a problem with those speakers. He said it was a synchronization problem with that computer that made slight clicks and pops in that channel. He said, "And we reset everything and . . ." (here he knocked on the wood of a small table).

Justin then described the purpose of the two mixing consoles. The one facing the stage, the simpler of the two, contained the standard row of faders, but only a few buttons and knobs in other sections of the chassis. I could not see the entirety of the surface of this console, since the script of *Porgy and Bess,* to which Justin referred during performances, covered the top two-thirds of the board. He told me that he mixed on that console, only adjusting fader positions for each cast member and for balances between the pit orchestra and the performers on stage. While

powering on the digital mixer on his right side, the one that was perpendicular to the stage, he told me how that console functioned and how it worked in conjunction with the front facing mixing console. That larger console on the right collected each microphone and playback signal in the entire production. This included all of the wireless microphones, pit microphones, and sound effect playback signals. The same board's outputs fed the elaborate loudspeaker distribution processors and amplifiers. In short, this board interfaced with the MADI snake that spanned from the FOH to the area beneath the stage. This board also allowed Justin to group multiple input signals as a sub-mix into fewer faders on the stage-facing mixing console. This was how Justin could consolidate the myriad microphone signals from the pit into only two faders on the front-facing console.

After pointing out more details about the two consoles, Justin told me that in a perfect world, he would only use the larger console to his right. Since it was live theater, the need to consolidate multiple inputs to a simpler console with just faders accommodated his ability to focus on the level of each sound source coming from the stage. He indicated that it was an older model of the Digico D5T10—the oldest Digico on Broadway, he said. He, Nevin, and Jason had requested a D512 for an upcoming production. That console reconfigured the placement of faders, meters, and potentiometers, but Justin preferred the configuration of the D5T10.

A light flashed on the surface of the console, and Justin immediately explained that the sound cue light was good, thanking Jim backstage. Then, Justin began to insure that all of the devices, the computers, the two consoles, as well as other signal processing devices, were synchronized to each other and the master clock for the system. Once the system was fully synchronized, Justin had the ability to seamlessly engage the faders of the more detailed mixing

console to his right, without the audience hearing any sonic artifacts of that shift from the front-facing console.

I asked Justin how often the need arose to engage the right console as a backup upon which to mix mid-performance, as well as how often there are clicks or sonic artifacts that sounded amidst such transitions. He knocked on wood again while indicating that he seldom encounters the need for such shifts with that particular system and within that particular building, and that he frequently clears all of the computer drives associated with the synchronization process to ensure that there are no glitches in the complex digital system. Every time he powered down the system, he explained, the system stored all of the latest synchronization data, as well as EQ settings, other signal processing settings, MIDI information, and fader positions. If he didn't regularly clear this data before each production, the system would begin to accumulate too much unnecessary data to process, and the amount of latency in the transmission of digital audio throughout the system would problematically increase.

He then began to show me the cue editor software. This allowed him to label sixteen channels of the consoles with the names of particular performers for each scene of the production. These labels, per scene, would appear on the computer screens, as well as the LED displays above each fader on both mixing consoles. By pressing a large button on the surface of the front-facing console, at the conclusion of a scene, all of the labels for the microphones and inputs for the next scene would appear. He also checked the fluidity to screen share. Justin used screen sharing to monitor various forms of software for the single processors and consoles within the front-of-house mix position, as well as the Galileo amplifier and loudspeaker system that was computer-controlled in the sound lab beneath the stage.

After waiting for all of the components of the large system to synchronize, Jim called Justin on a walkie-talkie to notify him that the amplification system was ready for a test. Digital audio consoles of this caliber use a configurable matrix of inputs and outputs. Justin configured groups of outputs from the boards within the mix position to feed the networks of amplifiers and loudspeakers that comprised specific amplification zones throughout the Richard Rodgers Theater.

Playing hard-driving rock music with a prominent drum set, synths, and distorted electric guitars from one of the computer's iTunes programs, he began testing each of the amplification zones within the theater. First, he checked the under-balcony loudspeaker systems, then he scrolled the output of the board to the zone he calls "stalls," which are cluster speakers around the orchestra section. In particular, he listened to ensure that the full bandwidth of audible frequencies was emitting from the loudspeakers in these locations. Then he checked all of the proscenium speakers, the front fill speakers, and the box seat speakers. During this test, Justin normally walks around to each of these locations; however, that day, he didn't feel the need to, as he had done it the day before. Then he tested the zones that he referred to as "surround zones." These were loudspeaker clusters that were aimed at the far edges of the venue. I then asked him about the unique configuration of loudspeakers in the hanging central cluster, those that were aimed at the ceiling of the theater. I wanted to know if they had their own zone. He told me that they did, and that they sent signals from a special mix from the console that only contained the lower frequency instruments that were placed beneath the lip of the stage in the orchestra pit.

Finally, he listened for the lower frequencies from the subwoofers in the central cluster. Then, with a microphone in his hand, he began what he called an "insert check." This tested all

of the sound effects that are inserted into particular channels for certain sound sources in the console. First, he checked a multi-band compressor that was inserted in the orchestra channel. Then he checked the reverb for the orchestra. The next insert to test was the doubler effect for the string section. This produced a sound that made the string section of the orchestra seem larger than it was. This might have been the most controversial effects insert in the list, as there had been a lot of press about how this production of *Porgy and Bess* employed a large orchestra. One could consider the use of a string doubler as similar to the controversial use of electronic and MIDI-based alternatives to human performers on Broadway. However, my earlier brief moment sticking my head into the orchestra pit beneath the stage confirmed for me that there were so many musicians and instruments in the pit that it would probably be unlawful for more people to be working down there. So the string doubler in this context did not seem that problematic to me.

Justin yelled, "Sound effects onstage!" Then Jim began playing back all of the prerecorded sound effects that sound at different moments in the performance. First, we heard a whistle, then we heard an extended train whistle. The next aspect of the system that Justin checked was the complex array of presets. In particular, he double-checked all of the EQ settings assigned to each wireless microphone channel in the console. He referred to these several EQ presets per channel as "aliases." If in one scene Audra McDonald entered the stage and vocalized, Justin would ensure that alias #1 was engaged. If, in another scene, McDonald entered on stage with a broad-brimmed hat, Justin would engage alias #2 on the same mixer channel instead, as alias #2 would enact an equalization profile that would reduce the unwanted standing wave resonances between the brim of the hat, her body, and the diaphragm of the microphone. Justin explained that he would select different aliases once he found out that an understudy

would perform that night. Ideally, aliases were preset during rehearsals or when the shows are in preview. In certain instances, during the run of the show, he's had to make new alias presets or adjust the old ones.

From that point, with a list of swing performers in hand, Justin loaded all of the preset aliases for the different actors. He yelled, "Let it rip!" to the stage. Jim began testing each wireless lavalier microphone pack on stage. Each rectangular pack hidden within the costumes of the performers onstage contains two transmitters, in case of electromagnetic interference, or EMI, from nearby and passing radio frequencies through which ambulances and police communicate. If one of these interferences intercepts the signals from the first transmitter within the microphone pack, Justin can immediately flip a switch near the console to amplify signals from the secondary transmitter within the microphone's pack. During the soundcheck of each of these wireless microphones, he was toggling those switches back and forth to ensure that both of the transmitters within each of the microphone packs were working.

After the usual "check 1-2, check 1-2," for the earlier microphones in the list, Jim began to speak specific actor's names into the microphones, particularly those actors who were swing characters for that evening's performance. I could tell that Jim and Justin tested the microphones this way to ensure that they were both on the same page about substitutes and the preset aliases for their microphones in the console. However, during this mic check, Justin disabled all of the listed EQ aliases to ensure that he could hear the full frequency bandwidth as similar among all of the microphones on stage. In so doing, he could make sure that all of the microphones were functioning in the same way without processing from the mixing console. Justin told me that since David Allen Grier was bald, they had to put two microphones near his ears, as their

standard practice would be to tuck the capsule of the lavalier microphones at the front of the actors' hair above their foreheads. I noticed that one of the computer screens changed to show a number of different multicolored graphs, measuring different amplitudes between 20Hz and 20,000Hz. I asked him if he was measuring something specific. He explained that each colored graph measured the resonances that measurement microphones captured at various locations within the theater. He kept an eye on the overall contours of each of these colored graphs, making sure that those contours were more or less consistent throughout the performance. He said that if there was a peak in one of the graphs at one particular bandwidth of frequencies for one colored graph but not the others, it meant that there was an exaggerated resonance at one location—for instance, the balcony—but not at others, like the box seats or the orchestra section. Then, in an effort of maintaining sonic transparency, he could further investigate such a discrepancy and mitigate it.

I looked to the corner of another screen, and identified a temperature and humidity reading. Justin said that there was a sensor in the mixing console and one at another location in the theater. Before every performance, Justin records the temperature and humidity of the venue, especially when testing the Galileo amplifier and loudspeaker system. Once the performance begins, the Galileo system remeasures the temperature and humidity and automatically makes fine-tuned adjustments to the overall equalization for each of the many loudspeaker zones in the theater. With this capability, the absence of warm bodies in the seats during the system tests does not affect the overall sound of the system during performances, when the audience members are present.

He then showed me the “holy shit” button. It was a large red button that muted every channel in the system. Justin typically pressed it after the system test and before heading backstage before the performance started. As we were wrapping up this overview of his pre-show procedures in the FOH mix position, I asked him what I would primarily see him adjusting during the performance. He told me that it would mostly be the faders. I asked him if he would keep the faders at or near the zero dB, unity gain position or if he would be “riding gain,” a process of continually moving the faders; he explained that he would mainly ride gain throughout the show. He said that I would see how much of a nightmare the opening scene was going to be, given how many faders he would have to rapidly turn on and off for each performer from the stage, but that this process would become less hectic as the scenes progressed.

“The Butt Kicker”

Justin asked an usher for a stool that I could sit on during the performance. When he and I began to move it around in relation to his seat behind the front-facing console, I noticed a large speaker driver beneath the cushion of his seat. He called it “the butt kicker.” If it really started to kick his ass, that’s when he knew that the subwoofers in the theater were too loud. Before leaving the FOH position, Justin flipped through the three-ring binder that sat above the front-facing mixing console, turning it to page one. It was his heavily marked-up script. He explained that he seldom used it at that point except during the more hectic scenes. He had mostly memorized all of the settings for each microphone channel throughout the show.

We walked back down the aisle towards the stage, eventually twisting through the narrow doorways near the side of the theater to briefly return to the center of the stage. There, we stood

again surrounded by many of the props that the stage hands had placed, where he and I were looking at the dozens of loudspeakers aimed at the many zones of the audience sections. We mainly only heard them when he was testing them at the FOH position, but it was compelling for me to see where he, Nevin, and Jason had aimed them before the show ran. Then we returned to the underside of the stage, where we both popped our heads into the orchestra pit again. Justin pointed out all of the different kinds of microphones used for the many instruments. It was primarily an array of DPA, Sennheiser, AKG, and Neumann small- and large-diaphragm condenser microphones. After looking around the pit, we returned to a couple of chairs in the sound lab area, near the amplifier racks beneath the stage, to wait for the start of the show.

Justin showed me what he calls the "bible" of the sound system. It was a very thick three-ring binder filled with laminated lists, circuit diagrams, and specifications for every audio device used for *Porgy and Bess*. The "bible" functions as an archive of Nevin's, Jason's, and Justin's decisions, and they use it when considering equipment and configurations for upcoming productions. As Justin was flipping through the pages, Bruce, the company manager, greeted both of us and presented Justin with a white envelope, which I assumed was Justin's paycheck.

Returning to the large binder, pointing out different configurations of processes and amplifiers, and then pointing to those items in the racks beside us, Justin also explained how this meticulous inventory of the system was the mark of very organized and efficient sound designers. He told me that some designers did not log these details, and that if something broke, the engineer would have to frantically troubleshoot, sometime mid-performance, whereas the presence of such a detailed account of the system made troubleshooting much easier for Justin. I asked if either Nevin or Jason had attended any of the recent performances. They hadn't been to

a performance in months by that point, and Justin remarked that this was understood to be a good thing: Justin's name thus would never need to be included in the notorious production report that highlighted particular problems in the show. This "no news is good news" attitude was another example of a kind of transparency, one within the context of the production team, its division of labor, and its hierarchies.

At this point, I accompanied Justin as he left the theater to smoke a cigarette before the show. As we turned to go back in, he said that he would stop by the dressing rooms of Norm Lewis and Audra McDonald. On the way in from the stage door off the busy street, we walked up and down the many staircases, passing by the sound lab beneath the stage and up another set of staircases that led to the dressing rooms. Justin explained, "I always like to go check in with him [Norm Lewis] before we start just to make sure he's feeling okay, so I know what I have to do. I usually check in with him; I check in with Audra to make sure things are kosher, stroke the ego a little bit." We laugh. To my surprise, he does this before every show. He further explained: "If everybody feels like they are being taken care of, they don't complain as much. Whether they are or not—just being around and having your face seen is important. It's not standard practice. It's standard practice for me, but a lot of engineers don't do it."

After Justin checked in with the leads, he and I returned to the front of house mix position in time for him to mix the show.

Justin Mixing *Porgy and Bess* on Broadway

During the performance of *Porgy and Bess*, Justin mixed the microphone signals from the stage by only moving the corresponding faders on the surface of the front-facing digital Digico mixing console. He regularly made drastic fader movements to amplify and attenuate the wireless microphones that the vocalists used on stage. In particular, Justin's listening-based choices about how much the audience should hear direct acoustic vocal sounds from the stage, versus how much the audience needed to hear comparatively more-amplified and sonically colored sounds from the system, determined how often and to what degree Justin moved each fader, which was as frequently as every passing musical phrase or lyric.

He warned me that the opening scene would be hectic for him to mix and for me to follow. Although, several shows into production, Justin seldom looked at his heavily-notated script propped above the faders, he would rapidly turn each page of the opening scene to follow along with each performer's entrance cue, while simultaneously watching every vocalist onstage intently. It seemed that the pages of the script were in the far edges of his peripheral vision, with the faders beneath his fingers almost nowhere in his sight. Above each fader were small LED mini-displays that showed the name of each character for the microphone that each fader controlled. The faders on the left side and center of the mixer controlled the levels of the vocalists' microphones, and only a pair of faders controlled mixed-down sub-mixes of the microphones within the orchestra pit. Most of these sixteen displays were lit with the character's names during the opening scene, but Justin had memorized which faders were which. What made the opening scene so complex were all of the many entrances of over a dozen vocalists, who for a period quickly interjected short lines in dialogue with each other. Some were in close proximity

to each other, making it much less possible to keep the fader up for one vocalist while waiting for him or her to vocalize again. Keeping too many microphone faders up in amplifying position, especially for microphones that are close to each other, could have developed feedback ringing. Certain vocalists were so close to each other in the scene that Justin simply amplified one of their microphones for multiple singers. All of this meant that Justin continually raised individual faders, before immediately and rapidly pulling each of them down for every sung or spoken line in the opening scene, which conveys the hustle and bustle of Catfish Row.

Following this opening scene, Justin moved the faders as an act of amplifying and attenuating the individual vocal sounds of actors on stage in relation to sound effects, chorus members, and the orchestra pit. One compelling example of this occurred during Porgy's famous solo "I Got Plenty of Nuttin.'" I observed the following scheme of Norm Lewis's vocal statements, Justin's fader movements, and their collaborative production of sounds in the theater, as Justin continually moved the faders toward greater color or transparency in conjunction with each melodic phrase.

Norman Lewis sings: *I got plenty o' nuttin'*
Justin Rathbun's fader movement: -dB↓—Justin continually slides the fader downward from its original position just below the zero dB, unity gain, position near the too of the fader's path. He pulls the fader downward throughout the entire vocal phrase.
The amplified sound: The first four words of the phrase sounded amplified through the system, until the second half of the lyric "nuttin'" when Lewis sustains pitch on the final "n"—the amplified version of that sound begins to diminish into a greater proportion of that sound propagating directly from Lewis's voice on the stage.

Norman Lewis sings: *and nuttin's plenty for me*
Justin Rathbun's fader movement: +dB↑—In anticipation of the next phrase, Justin quickly returns the fader back to its original, higher, position in the fader's path and kept it there throughout the duration of this phrase.

The amplified sound: Lewis's emphasis on the word "and" was further emphasized by Justin's additional amplification through this fader movement. Then the "a" vowel of the word "and" resonated in the most prominent way, as compared to the other vowels and consonants thus far.

Norman Lewis sings: *I got my gal, I got my song, I got Hebben*
Justin Rathbun's fader movement: +dB↑—Just before these lyrics, Justin further pushes the fader upward and holds it.
The amplified sound: Each clause of the lyrics stood out and sounded prominently throughout the space.

Norman Lewis sings: *the whole day*
Justin Rathbun's fader movement: +dB↑—In a similar gesture, Justin raised the fader even further, momentarily holding it in place for these three words.
The amplified sound: Through this fader position, and the amplification system, primed to amplify Lewis's voice to a thus-far unprecedented level, the crescendo of his singing further intensified the efforts of the many amplifiers and loudspeakers that were very actively oscillating throughout every crevice of the theater.

Norman Lewis sings: *long*
Justin Rathbun's fader movement: -dB↓—For this one word near the climax of the musical phrase, almost in anticipation of Lewis's heightened vocal effort, Justin quickly pulled the fader downward.
The amplified sound: Lewis's display of his full voice did not distort the efforts of the sound system, or call the audience's attention to the presence of a sound system.

Norman Lewis sings: *got my gal*
Justin Rathbun's fader movement: -dB↓—For these lyrics, Justin maintained the fader position for the first two words ("got my"). During the sustained "a" vowel of "gal," he pulled the fader downward.
The amplified sound: In conjunction with Lewis's sonically-dissipating vibrato, Justin's attenuation through this downward fader movement seamlessly blended the direct vocal and amplified system sounds into the noisy silence of the space.

Norman Lewis sings: *Oh, I got plenty o'*
Justin Rathbun's fader movement: +dB↑—As the word "o" resided on the pick-up note before the downbeat of the measure that begins with "I," the fader remained in the previously lowered position only briefly before Justin raised it to a higher position for the remainder of the musical phrase.
The amplified sound: This repeat of the A section of the form was accentuated by these sections of the composition, and also by Lewis's emphasis on the word "I" and Justin's support of it though the audio system.

Norman Lewis sings: *nuttin'*
Justin Rathbun's fader movement: -dB↓—Justin lowered the fader position with a downward and accelerated movement, pulling the fader to a depth that it had not yet traveled thus far.
The amplified sound: Lewis sustained the final "n." Yet again, this sound seemed to dissipate into the space, and into the dominant harmony of the accompaniment.

Norman Lewis sings: *and*
Justin Rathbun's fader movement: +dB↑—Before the word "and," Justin quickly lifted the fader to an explicitly amplifying position.
The amplified sound: The word "and" sounded present, but not emphasized from the stage or the speakers.

Norman Lewis sings: *nuttin's plenty for*
Justin Rathbun's fader movement: +dB↑—Justin continually raised the position of the fader through this phrase through the most sensitive section of the fader's path.
The amplified sound: This reiteration of the word "nuttin" contrasted with its earlier utterance. The additional amplification, specifically for the "e" vowel in "plenty" and the "o" vowel of "for," excited a number of acoustic standing waves between the loudspeakers and surfaces of the hall in ways that added additional color to the amplified version of Lewis's lower vocal formant.

Norman Lewis sings: *me*
Justin Rathbun's fader movement: +dB↑—Justin pushed the fader upward even further for this lyric.
The amplified sound: Similarly, this explicit amplification further intensified a differently deeper sonic color in the sound of Lewis's voice.

Norman Lewis sings: *I got the sun*
Justin Rathbun's fader movement: -dB↓—Justin moved the fader below the sensitive range in its path before these words, and held it there.
The amplified sound: The "o" vowel in the word "got" sonically appeared to resonate more from the voice on stage, especially in the way that the brighter colors of Lewis's upper harmonics shimmered towards us in the back row in ways that sounded so much different from the comparatively darker and warmer vocal sounds that had proceeded this one.

Norman Lewis sings: *I got the moon*
Justin Rathbun's fader movement: +dB↑—Justin moved the fader upward for these words.
The amplified sound: The sound for this "o" vowel in "got" was more intense while maintaining its relative brightness, while still not calling our attention to the sound system as an obvious sound source.

Norman Lewis sings: *I got the deep blue*
Justin Rathbun's fader movement: +dB↑—Justin only nudged the fader less than a millimeter upward for this nearly repeated phrase.
The amplified sound: Again, the "o" in "got" was a sound that Lewis and Justin emphasized, especially in comparison to the relatively softer, and cooler, "u" vowel of the word "blue."

Norman Lewis sings: *sea*
Justin Rathbun's fader movement: -dB↓—Justin lowered the fader position with a downward and accelerated movement.
The amplified sound: Lewis attacks this lyric with straight-tone singing until he transitions towards a decrescendo with vibrato. Justin's downward fader movement very closely followed the contour of this vocal effort, such that the vibrato on the "e" vowel seemed to lap throughout the hall like the waves described in the text.

Norman Lewis sings: *The folks with plenty of*
Justin Rathbun's fader movement: +dB↑—Justin lifted the fader to a higher position in anticipation of these words.
The amplified sound: The "o" in "folks" seemed to benefit from Justin's fader movement, as that vowel would have been markedly quieter than others in the musical line.

Norman Lewis sings: *plenty*
Justin Rathbun's fader movement: -dB↓—Justin's downward fader movement moved with the passing pair of syllables in this word.
The amplified sound: Lewis's voice increased in intensity between the first and second syllables of the word. In addition, the "plen-" syllable was sung on the major third interval of the piece, while the "-ty" was sung on the perfect fifth. Justin's fader movement contrasted this melodic contour and the dynamics that Lewis asserted while singing. The resulting sound produced a homogeneous dynamic across the two syllables of the word.

Norman Lewis sings: *got to pray*
Justin Rathbun's fader movement: +dB↑—Justin returned the fader to an upward position.
The amplified sound: Once again, the "o" in "got" sounded very hard edged and aggressive.

Norman Lewis sings: *all the day*
Justin Rathbun's fader movement: -dB↓—Justin moved the fader downward.
The amplified sound: This was another instance in which the intervallic motion was similar to the dynamic reduction in the musical composition, Lewis's singing, and Justin's fader movement.

Norman Lewis sings: *it seems with plenty you sure gotta worry how to*
Justin Rathbun's fader movement: +dB↑—Justin raised and held the fader to an upward position throughout the duration of these many lyrics.
The amplified sound: This moment exemplified how, even in instances when the fader was still, there were similar examples of heterogeneous sound that dependent upon Lewis's singing of various consonants and vowels, with different emphases on the stage, through the microphone, and the rest of the sound system, yielding a plethora of sonic colors in his performance.

Norman Lewis sings: *keep the devil away*
Justin Rathbun's fader movement: -dB↓—After the passing of the previous long line, Justin abruptly pulled the fader downward in anticipation of the word "keep." He lowered the fader further for the remaining words.
The amplified sound: Justin's downward fader movement contrasted Lewis's crescendo towards the end of the phrase in effort to transition the sound product from the heterogeneity of the previous phrase to a comparatively homogeneous sound product that attenuated the sound system's version of Lewis's intensifying vocal work.

Norman Lewis sings: *away*
Justin Rathbun's fader movement: -dB↓—Justin pulled the fader downward even further. He did this while also pulling the faders for the microphones of other vocalists in the male chorus downward as well.
The amplified sound: Once again, Justin's attenuating fader movements worked to contrast the building vocal powers onstage.

After this moment in the performance, I looked up at the stage, watching Norm Lewis sing a verse in the song. I noticed the upper torso of the conductor peeking out from the orchestra pit and within Lewis's sightline. Unlike conductors that I have seen in the context of western classical music, who conduct in ways that emphasize both rhythm and dynamics. The conductor of this Broadway production only conducted tempo and rhythm. It almost seemed as if Broadway musical conductors, such as this one, had relinquished their control of musical dynamics to sound designers and live sound engineers long ago.

Then Lewis repeated the famous chorus of the song, accompanied by the full chorus. With multiple fingers, Justin raised multiple faders that corresponded to the male and female vocalists' microphones on stage, blending their sounds with Lewis's in ways that preserved the

homophonic texture of the musical sound product. All of these voices, as well as the swelling orchestra, the sound system, and the acoustics of the Richard Rodgers theater, resounded until the punctuated conclusion of the piece. As the audience applauded, Justin hit the large red button on the mixing console's surface, which changed the scene of the digital mixing console, allowing it to load different microphone inputs into the sixteen faders beneath his fingers. As the applause began to fade, and the new inputs were loaded, Justin finally returned to chewing his gum and stretching his neck and shoulders, relieving himself from the tension associated with such careful and exact fader movements across the long scene, and was at that point prepared for the next one.

Justin's frequent and seemingly drastic movements of the fader that controlled the level for Norm Lewis's microphone was much different from those of many popular music live sound engineers who typically keep faders at, or near, the unity gain position, with only slight movements to compensate for changes in the musical dynamics. Justin's use of a digital mixing console alleviated his need to simply keep the faders at unity gain as he would need to on an analog mixing console. The voltage-controlled amplifier faders on the Digico console allowed him to amplify and attenuate the signals from the microphone without too drastically altering the electronic gain structure for that signal throughout the sound system. The many fader movements that this type of circuitry afforded enabled Justin to intensify the amplified sound of Lewis's voice in the hall at times, and reveal the acoustic sounds of his voice directly from the stage to listeners in the audience at other times. As such amplifications at and attenuations within the theater also excite specific frequencies and waveforms, the addition and subtraction of decibels in the amplified version of Lewis's voice also constructed resonances of different sonic colors of

these amplified versions at different times throughout the performance. An extension of Nevin's and Jason's effort that ensures sonic intelligibility throughout the theater, Justin's efforts with the fader support Lewis's efforts to project lyrics from the stage; at other times, Justin's sonic coloring of fader movements was an assertion of his creative and artistic control of the amplified sound in the theater.

Conclusion

Justin's engineering is emblematic of a Broadway live sound engineer's labor. His fader movements during "I Got Plenty of Nuttin'" were negotiations of his difficulties in listening to pre-amplified and amplified sounds in the theater, as well as the associated transparent and sonic colored representations of musical timbre. He also moved the fader to make lyrics intelligible and to make sounds live and exciting, and his assertions of his own sonic artistry which included colorations of Lewis's performance that invoked genre ideologies and racialized vocal archetypes. For the purposes of dialogic editing, I met with Justin on February 20, 2013 to show him the video of his mixing *Porgy and Bess,* particularly Norm Lewis's solo "I Got Plenty of Nuttin.'" The interview was held at the Broadway theater, where Justin was mixing a for the *Cinderella* production. We discussed his mixing techniques, more about his live engineering background, and how he thinks about the craft of live sound engineering.

> WHITNEY: First of all, let me show you the shot from *Porgy and Bess.* Here you are. [I show Justin video footage]. I wonder about your finger movements at the board. I'd say it's one of the most compelling things I've ever seen.
>
> JUSTIN: Why is that?

WHITNEY: Well, I know some singers who would cringe that someone is doing this. As an engineer, I think it's compelling. You're controlling each decay of the vocal melody.

JUSTIN: Oh, sure.

WHITNEY: A lot of pop music engineers keep the faders ruler flat at zero on analog consoles. The console that you use, a digital board, has voltage-controlled amplifiers.

JUSTIN: Yeah, absolutely.

WHITNEY: My project considers how engineers are more than just technicians who amplify. I argue that engineers are highly artistic. What you do in this video is obviously artful. I noticed that at moments you're punctuating certain lyrics. You did this throughout the show in spite of the fact that many people believe that the singer, the instrumentalist is controlling all of this.

JUSTIN: Absolutely, right.

WHITNEY: And it seemed that the conductor was like a metronome with a hand. You were balancing the ensembles and, in western music, orchestral music, conductors are usually doing that. But at *Porgy*, it was you, the engineer.

JUSTIN: Yes.

WHITNEY: With the micro movements we saw in the video in mind, how do you make speech different from singing, the lyrics and all of that?

JUSTIN: Gosh, it's—it's difficult. This is all fresh in my mind since I'm still doing this on almost a daily basis here with this show, *Cinderella*. It's like storing in your head what each actor is going to do, and when they're going to do it. After two or three runs, you kind of have an idea what they're going to do unless they're being inconsistent, which that's a whole other thing. With live theater especially, and I think live musical theater in particular, I think it's kind of drilled into cast members' minds and actors' minds that consistency means that there aren't going to be any surprises. I understand trying new things here and there. But completely changing how you're going to do something is very rare.

As far as the balance between vocals, singing and speaking, it kind of all depends on your sound designer. With *Porgy and Bess*, and now here with *Cinderella*, the houses

> —the Richard Rodgers and the Broadway Theaters—are completely different animals. Richard Rodgers is extremely reverberant. There's stuff bouncing everywhere. Here at Broadway, it's a cavern. There's felt all over the walls. It's very acoustically—I don't want to say dead, but it's not live. Therefore, there's a lot more control, I think, of the sound in this particular room than in the Rodgers. It's not a good or a bad thing. It's just different. Making it appear as if words are being spoken to you, rather than being amplified over a PA, is very important because if you have a PA that's just shouting at you constantly— it's extremely fatiguing on your ears. If you're just getting hit over the head constantly with SPL, and overdriving just spoken word, you're just killing the audience. And there's also some psychotherapy things that happen in there as well. Whereas you can run things at different levels to make people either sit back in their seats and enjoy it, or you can make them be up on the edge of their seats wanting to listen and know what's going on. It's a fine line. If you find it, it's golden because you can have people sitting there, sitting on the edge of their seats waiting to hear what's going to happen next—if you do it right. Not being too loud, but being loud enough where it gets them—you know (Ratubun 2013).

At the conclusion of our post-performance interviews, I asked Justin to address a broad question: what had he learned over his years of work as an audio engineer? He responded:

> That's a totally loaded question. Sound is hard. Sound is really hard because everybody, that sits in every seat has an idea of how things should sound. Everybody has their opinion. Not everybody's opinion is the same, as we all know. Producers have their opinion, directors have their opinion, musical directors have their opinion, sound director has an opinion, and you, as the engineer, have your own opinion. You have to figure out who you have to please. Ultimately, it's the person that signs your paycheck at the end of the week. But what I've learned most about sound is to trust my instincts, especially working with Nevin. I've learned not to necessarily always rely on marks. It's good to hit your marks in general. But listening to what's happening is most important. Be aware. On the *Porgy* video that you have, I was already several months into the show, and not necessarily using the script anymore. I was able to look up and pay attention to what was happening…I also try to make myself a part of the audience so that I'm having an experience, and making it as magical for them as it was for me the first time I saw the show (ibid).

Justin's commentary about trusting his own ears to discern between direct acoustic vocal sounds from stage, verses amplified versions of those sounds through the sound system, outlined one of the most significant challenges of his live sound engineering work on Broadway. He

described how difficult it is to discern between such sounds after critically listening to them during eight performances each week. In addition, he indicated that listening to amplified sounds so frequently was also fatiguing. In spite of this, he tried to listen and mix every night as if it were his first time encountering the show. The juxtaposition of the challenges associated with fatigue, and his efforts to hear like a first-time listener, give meaning to his many fader movements during “I Got Plenty of Nuttin’” which alternately moved with the musical dynamics and against them.

Conclusion

I am reminded, as I come to the end of this dissertation, of walking through the Princeton University campus with sound engineer John Baker. After he showed me resident live spaces for acoustic classical recording, I asked him how he mixed. He explained that he lets the artist mix. I also asked him how he develops a client's trust as a sound engineer. Looking directly in my eyes, as if responding to my anxieties about my own live sound engineering work, he said: "Whitney, don't worry. You are an expert and you know what you are doing. They should trust you."

John Baker's assertions about mixing and trust in sound engineering evoked for me the "Composition" chapter in Jacques Attali's groundbreaking book *Noise: The Political Economy of Music* (1985). Letting the artist mix as a heightened form of trust and trust building exemplifies the extent to which older industrial divisions of labor that had once preserved and insulated the position of sound engineer are further becoming the mark of older modes of production in favor of creative musical artists finally gaining more fine grained control over their own sound and developing their own modes of musical production. In this light, this ethnographic dissertation serves as a history of a musical practice that is continually threatened by forms of technological automation and do-it-yourself music production capabilities.

The students that I have worked with while researching and writing this dissertation are of the millennial generation. I have learned that many of them do not think of live performance as an origin of music making, the way earlier generations typically have. Their perspective is worthy of serious consideration in terms of adjudicating the current moment of auditory modernity. As I discussed in the introduction, this ethnography studies both traditional industrial and post-industrial approaches to live sound engineering, and the very ontology of "music." It

also points to the fraught place of the engineer within the changing musical ontologies of the early twenty-first century. My millennial students build upon older divides in music production scholarship and practice, specifically the divide between recording studio verses live performance, and assert that 'bedroom' production – individuals producing electronically mediated sound on their own -- is an emergent 'third space' of music technology. This study of live sound engineers is, in part then, a study of a dying practice, along with what might become a further developed 'do it yourself'[18] phenomenon (Perlman 2004).

The ontology of music in the modern world has, in one century, shifted from an experience of authenticity rooted in live performance to one dependent on recorded mediation, to the point that recorded music is the naturalized condition of music for many listeners, musicians, and engineers across many musical genres and cultural settings. Music recording, as inscription, shares ontological similarities to literate musical mediation through notation, which preceded recording notation, but differs significantly from notation in its generative relationship to sound and listening practices across a much wider range of social contexts.

My goal has been to contribute to scholarship about the techné of live music and live sound engineering within this larger epistemic shift, and especially to show how engineering enacts the most basic mediation, and calls liveness into question, beyond the processes of the recording studio. The technology that live sound engineers use, which is shared among ethnomusicologists and contemporary musicians and listeners, is also, of course, enabled by recording. The vast majority of music ever heard by anyone who ever lived, prehistoric times until just over a century ago, signified the living co-presence of another sentient being in a

---

[18] Perlman, Marc. 2004. "Golden Ears and Meter Readers: The Contest for Epistemic Authority in Audiophilia." *Social Studies of Science.* 34(5): 783-807.

listener's immediate audible world. This is a biological phenomenon, engaging the brain, nerves, and the ears. Humans are evolved to be able to echo sound, and to locate friend or foe through sound. Only 120 years ago, with the emergence of sound recording, did it became possible for a sound that was made 150 years ago, or one thousand miles away, to be audible. Now most people in the modern world, with technologically elaborate lives, experience most of the music they hear in the form of recorded sound.

Ethnomusicology emerged as a discipline only when one could objectify music as happening somewhere else, or some other time, what Steven Feld calls, following R. Murray Schafer, schizophonia, through sound recording (Feld 1995). At that moment, it became ontologically possible to understand music as being more or less context bound—to hear music's relationship to culture, facilitated by processing the sound recording "out" of its original cultural context (Attali 1985; Sterne 2003; Katz 2004). This fundamental sense of the nature of music by industrial technology, recording, and mediation produces the idea of live music as an entity. Yet, in the current moment, what may be a transitional era, live music is exoticized and esoteric, and I argue, the product of recording and amplification mediating between ontologies of live and recorded sound. The ontology of a live sound engineer's labor—its transparency, as an ideological construct, as well as the opacity of it—shifts throughout and across each production, as has been shown in the case of the three engineers studied in this dissertation. We may begin to see a broader historical shift from the transparency of these laborers toward a comparatively opaque and explicit recognition of their art.

Bibliography

Anderson, Elijah. 2011. *The Cosmopolitan Canopy: Race and Civility in Everyday Life*. W.W. Norton & Company.

Attali, Jacques. 1985. *Noise: The Political Economy of Music.* Minneapolis: University of Minnesota Press.

Audio Engineering Society. accessed 2017. http://www.aes.org/about/

Auslander, Philip. 1999. *Liveness: Performance in a Mediatized Culture*. London: Routledge.

Becker, Howard. 1982 *Art Worlds.* Berkeley: University of California Press.

Blacking, John. 1973. *How Musical is Man?* Seattle: University of Washington Press.

Bohlman, Philip. 1999. "Ontologies of Music." *Rethinking Music.* Eds. Nicholas Cook and Mark Everist. Oxford: Oxford UP.

Born, Georgina. 2005. "On Musical Mediation: Ontology, Technology and Creativity." *Twentieth-Century Music.* 2: 7-36.

DeNora, Tia. 2000. *Music in Everyday Life.* Cambridge: Cambridge UP.

Feld, Steven. 1994 [1984]. "Communication, music, and speech about music." In *Music Grooves*, C. Keil and S. Feld, Chicago: University of Chicago Press.

_____. 1995. "From Schizophonia to Schismogenesis." George Marcus and Fred Myers, eds. *The Traffic in Culture.* University of California Press: 96-126.

Feld, Steven and Donald Brenneis. 2004. "Doing anthropology in sound." *American Ethnologist* 31: 461-474.

Feld, Steven. 2012 [1982]. *Sound and Sentiment: Birds, Weeping, Poetics, and Song in Kaluli Expression*. Durham: Duke University Press.

_____. 2015. "Acoustemology." *Keywords of Sound*, edited by David Novak and Matt Sakakeeny. Duke University Press.

Fletcher, Harvey and Walden Munson. 1933. "Loudness, Its Definition, Measurement and Circulation." *Bell Labs Technical Journal*. 12(4): 377-430.

Fox, Aaron. 2004. *Real Country: Music and Language in Working-Class Culture*. Durham and London: Duke University Press.

_____. 2013. "Repatriation as Re-Animation through Reciprocity." Philip Bohlman, Ed. *The Cambridge History of World Music*. Volume 1. Cambridge: Cambridge UP: 522-554.

Garcia, Louis-Manuel. 2011. *"Can you feel it, too?": Intimacy and affect at electronic dance music events in Paris, Chicago and Berlin.* Ph.D. Dissertation. University of Chicago.

Geertz, Clifford. 1973. *The Interpretation of Cultures.* New York: Basic Books.

Grey, Lila Ellen. 2013. *Fado Resounding: Affective Politics and Urban Life*. Durham: Duke UP.

Griffin, Farah Jasmine. 1996. *Who Set You Flowin'?: The African-American Migration Narrative.* Oxford: Oxford UP.

Hartley, Robert. 1994. *The Complete Guide to High-End Audio.* Albuquerque: Acapella Publishing.

Hesmondhalgh, David. 1996. "Flexibility, post-Fordism and the music industries." *Media, Culture and Society.* 18(3): 469-488.

Hornbostel, Erich M. and Curt Sachs. 1914. "Systematik der Musikinstrumente." *Zeitschri für Ethnologie.* 46(4–5): 553–90.

Jackson, John L. 2005. *Real Black: Adventures in Racial Sincerity*. University of Chicago Press.

Jones, Ralph and Gary Davis. 1987. *Sound Reinforcement Handbook.* Yamaha. Milwaukee: Hal Leonard.

Katz, Mark. 2004. *Capturing Sound: How Technology Has Changed Music.* Berkeley: University of California Press.

Kealy, Edward. 1979. *From Craft to Art: The Case of Sound Mixers and Popular Music.* Work and Occupations. 6(1): 3-29.

Lewis, George. 1996. "Improvised Music after 1950." *Black Music Research Journal.* 16(1): 91-122.

_____. 2000. "Too Many Notes: Complexity and Culture in Voyager." *Leonardo Music Journal*, Vol.10. pp. 33-39.

_____. 2008. *A Power Stronger than Itself: The AACM and the American Experimental Music. Chicago: Chicago UP.*

Meintjes, Louise. 2003. *Sound of Africa!: Making Music Zulu in a South African Recording Studio*. Durham: Duke UP.

Merriam, Alan. 1964. *The Anthropology of Music.* Chicago: Northwestern University Press.

Miles, William. 1981. *I Remember Harlem.* Documentary.

Monson, Ingrid. 1997. *Saying Something: Jazz Improvisation and Interaction.* Chicago: University of Chicago Press.

Montague, Antoniette. 2017. Interview with Whitney Slaten.

O'Meally, Robert, Ed. 1998. The Jazz Cadence in American Culture. New York: Columbia University Press.

Perlman, Marc. 2004. "Golden Ears and Meter Readers: The Contest for Epistemic Authority in Audiophilia." *Social Studies of Science.* 34(5): 783-807.

Piore, Michael and Charles F. Sabel. 1984. The Sound Industrial Divide. New York: Basic Books.

Porcello, Thomas. 1998. "Tails Out": Social Phenomenology and the Ethnographic Representation of Technology in Music-Making." *Ethnomusicology.* 42(3): 485-510.

Porcello, Thomas. 2003. "Tails Out: Social Phenomenology and the Ethnographic Representation of Technology in Music Making." *Music and Technoculture.* Eds. Rene Lysloff and Leslie Gay. Middletown: Wesleyan UP.

_____. 2004. "Speaking of Sound: Language and the Professionalization of Sound-Recording Engineers." *Social Studies of Science* 34/5, pp. 733-758.

_____ 2005. "Music mediated as live in Austin : sound, technology, and recording practice." Greene, P. and Porcello, T. Eds. *Wired for sound: engineering and technologies in sonic cultures*. Middletown: Wesleyan University Press.

Rathbun, Justin. 2012. Interview with Whitney Slaten.

_____. 2013. Interview with Whitney Slaten.

Roediger, David R. 1991. *The Wages of Whiteness: Race and the Making of the American Working Class*. London: Verso.

Samuels, David. 2004. *Putting a Song on Top of It: Expression and Identity not eh San Carlos Apache Reservation.* Tucson: University of Arizona Press.

Samuels, D; L. Meintjes, A Ochoa, T Porcello. 2010. "Soundscapes: Toward a Sounded Anthropology." *Annual Review of Anthropology* 39.329-345.

Sandstrom, Boden. 2000. "Women Mix Engineers and the Power of Sound." in Music and Gender, ed. Pirkko Moisala and Beverley Diamond. Urbana: University of Illinois Press, 289-305.

Schramm, Adelaida Reyes. 1982. "Explorations in Urban Ethnomusicology: Hard Lessons from the Spectacularly Ordinary." Yearbook for Traditional Music, 14.

Schutz, Alfred. 1951. "Making Music Together: A Study in Social Relationship." *Social Research: An Interdisciplinary Quarterly.* 18(1): 76-97.

Shelley, Braxton. 2017. "'This Must be the Single': Valuing the Live Recording in Contemporary Gospel Performance." *Living the Life I Sing: Gospel Music from the Dorsey Era to the Millennium.* Eds. Alphonso Simpson Jr. and Thomas A. Dorsey III. San Diego: Cognella.

Stahl, Matt. 2010. Cultural Labor's "Democratic Deficits": Employment, Autonomy and Alienation in US Film Animation." *Journal for Cultural Reseaerch*. 14 (2): 271-293.

_____. 2012. *Unfree Masters: Popular Music and the Politics of Work.* Durham: Duke University Press.

Steinberg, Nevin and Justin Crystal 2012. Interview with Whitney Slaten.

Sterne, Jonathan. 2003. *The Audible Past: Cultural Origins of Sound Reproduction*. Durham, NC: Duke UP.

Stolzoff, Norman C. 2000. *Wake the Town and Tell The People: Dancehall Culture in Jamaica.* Durahm: Duke UP.

Taber, Randy. 2011. Interview with Whitney Slaten.

_____. 2013. Interview with Whitney Slaten.

Théberge, Paul. 1997. *Any Sound You Can Imagine: Making Music, Consuming Technology.* Hanover: Wesleyan UP.

Thompson, Emily. 2002. *The Soundscape of Modernity: Architectural Acoustics and the Culture of Listening in America, 1900-1933.* Cambridge, MA: MIT Press.

Thornton, Sarah. 1995. *Club Cultures: Music, Media and Subcultural Capital.* Polity Press: Cambridge.

Urban, Greg. 1991. *A Discourse-Centered Approach to Culture: Native South American Myths and Rituals.* Austin: University of Texas Press.

Veal, Michael. 2007. *Dub: Soundscapes and Shattered Songs in Jamaican Reggae*. Wesleyan: Wesleyan University Press.

Washburne, Christopher and Maiken Derno. 2004. *Bad Music: The Music We Love to Hate.* New York: Routledge.

Walker, Akili. 2011. *Turn the Horns On.* New York: Wynter-Lynn.

Wilson, Olly. 1999. "The Heterogenous Sound Ideal in African American Music." Signifyin(g), Sanctifyin' & Slam Dunking: A Reader in African American Expressive Culture. Ed. Gena Dagel Caponi. Amherst: University of Massachusetts Press.