Masculinity and knowledge in audio engineering

Ky Brooks

School of Information Studies
Faculty of Arts
McGill University, Montreal

August 2024

A thesis submitted to McGill University in partial
fulfillment of the requirements of the degree of
Doctor of Philosophy

List of Figures and Tables

Literature Review Part II

Chapter 1: Knowing, doing, and being: revisiting performativity with Michael Polanyi & Marjorie Grene

Chapter 2: Do we really want to keep the gate threshold that high?

List of Abbreviations

AES: The Audio Engineering Society, a prominent professional organization catering to audio engineers

DEI: Diversity, Equity, and Inclusion

FOH: Front of House

JAES: The Journal of the Audio Engineering Society

MG: Marjorie Glicksman Grene

MP: Michael Polanyi

PK: Personal Knowledge

Abstract

In recent years it has been noted- almost to the point of cliché- that there are very few women working in audio engineering and music production. Nonetheless there is a gap between the recent increase in interest in this issue and a meaningful understanding of how it has come about. This thesis approaches the question of 'Why no women?' by exploring how the social practices of audio engineering reproduce the masculinization of the industry. First, I present the results of a scoping review of the literature on the working practices of audio engineers, describing a shared cultural conception of who an audio engineer is and what they do which corresponds to a mode of hegemonic masculinity that is highly naturalized and key kinds of knowledge considered necessary for success as an audio engineer. In the first manuscript, I develop a theoretical framework for understanding how knowing how to do gender relates to other kinds of knowing via a diffractive reading of Judith Butler's gender performativity theory with Michael Polanyi and Marjorie Grene's theory of personal knowledge (PK). In the second manuscript, I use a large-scale international survey to explore what the outcomes of hegemonic masculinity in audio engineering are for people unable to fully cleave to the hegemonic norm (for example, women and non-binary people, younger men, and racialized people). I describe a profession where exclusionary closure along identarian lines is aggressively enforced via microaggressions, hostile work environments and glass ceilings. In the third manuscript, using a series of semi-structured interviews, I interrogate how audio engineers relate to the naturalized masculinity of the industry. By exploring what kinds of masculinities audio engineers of all genders learn to do in the context of their professional life, I show that the hegemonic norm is a source of tension for audio engineers who both knowingly act in complicity with it and discursively position

themselves in opposition to it, framing this in terms of competition, precarity, and a changing industry.

Résumé

Ces dernières années, on a remarqué – presque au point de devenir un cliché – que très peu de femmes travaillent dans l'ingénierie audio et la production musicale. Néanmoins, il existe un fossé entre l'augmentation récente de l'intérêt pour cette question et une compréhension significative de la façon dont elle s'est produite. Cette thèse aborde la question du « pourquoi pas de femmes ? » en explorant comment les pratiques sociales de l'ingénierie audio reproduisent la masculinisation de l'industrie. Tout d'abord, je présente les résultats d'une revue de la littérature sur les pratiques de travail des ingénieurs du son, décrivant une conception culturelle partagée de ce qu'est un ingénieur du son et de ce qu'il fait qui correspond à un mode de masculinité hégémonique hautement naturalisé et à des types de connaissances clés considérés comme nécessaires pour réussir en tant qu'ingénieur du son. Dans le premier manuscrit, je développe un cadre théorique pour comprendre comment le savoir-faire en matière de genre se rapporte à d'autres types de connaissances via une lecture diffractive de la théorie de la performativité du genre de Judith Butler avec la théorie de la connaissance personnelle (PK) de Michael Polanyi et Marjorie Grene. Dans le deuxième manuscrit, j'utilise une enquête internationale à grande échelle pour explorer les conséquences de la masculinité hégémonique dans l'ingénierie audio pour les personnes incapables d'adhérer pleinement à la norme hégémonique (par exemple, les femmes et les personnes non binaires, les jeunes hommes et les personnes racialisées). Je décris une profession où la fermeture exclusive selon des lignes identitaires est agressivement imposée par des microagressions, des environnements de travail hostiles et des plafonds de verre. Dans le troisième manuscrit, à l'aide d'une série d'entretiens semi-structurés, j'interroge la façon dont les ingénieurs du son se rapportent à la masculinité naturalisée de l'industrie. En explorant les types de masculinités que les ingénieurs du son de tous les genres apprennent à adopter dans le

contexte de leur vie professionnelle, je montre que la norme hégémonique est une source de tension pour les ingénieurs du son qui agissent sciemment en complicité avec elle et se positionnent discursivement en opposition à elle, en formulant cela en termes de concurrence, de précarité et d'une industrie en mutation.

Acknowledgements

I would first like to thank my supervisory committee for their guidance and support throughout this project- Ilja Frissen, Martha De Francisco, Jonathan Sterne and Catherine Guastavino. Throughout this PhD I have benefited from and deeply appreciated their insightful feedback and consistent encouragement. It has been a genuine privilege and pleasure to work with each of them in different capacities over the past seven years. This thesis would not exist without them.

Outside of McGill, I'd like to thank Amandine Pras (University of York) for her mentorship over the years we worked together on the microaggressions survey and afterwards. Amandine's research set the stage for this work and our collaborations have significantly contributed to my understanding of my own research. I'd also like to thank both her and Athena Elafros (University of Lethbridge) for their excellent guidance and for the financial support during the microaggressions project. On the AUDIO+ team, I'd like to thank Kirk McNally (University of Victoria) for involving me in his research programme, and Eliot Bates (CUNY) for the many excellent and inspiring conversations on subjects related and unrelated to this thesis, as well as the musical collaboration. Thanks to Dominique Vuvan (Skidmore College) and Eddy Abraham for the years of friendship, food, board games, and encouragement. Thanks also to M. Azevedo (UMass Lowell) for working with me on a million projects and for always lending a careful ear, whether as a friend, a scholar, or a mastering engineer.

I'd like to thank my colleagues Allyson Rogers, Jordie Shier, Burç Kostem, Annie Goh, Andy Stuhl, Mariana Mejia, Ezra Teboul, John Sullivan, and Maxime Brunet for their friendship and support. Allyson, thank you for our weekly conversations during the early COVID-19 pandemic and Mariana, thank you for being a co-conspirator and keeping me focused. Maxime, I met you

late in this project but I'm so glad I did. I'd also like to thank all the members of CATDAWG not mentioned in this list for their community and feedback. An extra special thanks to Aaron Vansintjan for the support, encouragement and fine editorial intervention during various phases of this project. I'd also like to thank CIRMMT - especially the CIRMMT staff and various CIRMMT Student Reps over the years- for the space, funding, and fun.

Outside of academia, I would like to thank my mentors in the worlds of live sound and sound recording, Steve Newton and Radwan Ghazi Moumneh, for opening the doors that got me here in the first place. Thank you to my friends at Constellation Records and Hotel 2 Tango for the space and support over the years, and to my partners in crime at the Plant and Error 403 for letting me talk your ears off about all this nerdy stuff. Thanks to my bandmates for being the best friends I could imagine and keepin' it real real weird, and to Nick for always listening and goof humor. Thanks to the punks for making this world feel like it's worth improving, you know who you are. Thank you to my partner Robyn Grieve for her patience in my crankiest hour. Thanks to my brother Eliot, for the insightful conversations about emotional labor and for reminding me to work hard, play hard, and be kind to myself. Thank you to my parents Elaine, Martin, and Susan. Dad, special appreciation for your generous and careful editing, and for always encouraging me to remain involved in both music and science. I can easily think of fifteen more people I'd like to thank off the top of my head, but I guess that's just how these things work.

Thank you to SSHRC and the School of Information Studies for providing key funding for this project.

This thesis is dedicated to Joni Sadler (1986-2021). We miss you very much.

Contributions of Authors

With the exception of Chapter 2, I was the sole author and researcher who contributed to this thesis. Chapter 2 was a collaboration between myself and my collaborators Dr. Amandine Pras, Dr. Athena Elafros, and Monica Lockett. Dr. Pras and Dr. Elafros developed the concept and interdisciplinary framework of the study and obtained ethics approval and a SSHRC Partnership Engage Grant in partnership with the Audio Engineering Society to conduct the research. All four of us contributed to the study execution and instrument design. I built the survey instrument in Qualtrics, and recruited participants via a series of talks promoting the survey. The survey was available in 20 languages; I coordinated the translation process with volunteers from the AES DEI committee and from CIRMMT. Dr. Pras and I recruited participants from our audio engineering social networks, and (along with several students, credited in the acknowledgements section of the article) recruited additional study participants at the AES NY 2019 conference. I conducted a statistical analysis of the data using Matlab, in conversation with my collaborators. Monica conducted a qualitative analysis. We wrote the Introduction, Literature Review, Theoretical Frameworks, Discussion, and Conclusions together in close collaboration when I spent some time visiting Lethbridge in 2020. We also wrote the Survey Instrument Design and Respondent Recruitment sections together, in keeping with the collaborative nature of those parts of the project. I wrote the rest of the Methods and Results sections and produced the figures. This project was meaningfully collaborative; it would have been impossible without the expertise of a cross-disciplinary team.

Robyn Grieve assisted me by translating some German text in the letters between Marjorie Grene and Michael Polanyi into English.

Introduction

From the ringtone of your smartphone to the rock concert downtown, the invisible influence of audio engineering practice marks and mediates the production and reproduction of nearly every sonic media source encountered within the modern media landscape. Despite this ubiquity, there are very few women working in audio engineering and music production (Bell, 2015; Mathew et al., 2016; Smith et al., 2023; Young et al., 2019), and there remains a notable gap between recent interest in this fact and a meaningful understanding of how it has come about. The purpose of this thesis project was to develop a structural understanding of the ongoing masculinization of the audio industry. In doing so, I found that it was necessary to address not only the extent to which this masculinization is a function of precarity within the industry, but also how deeply masculine hegemony is implicated within the knowledge economies of audio engineering.

Audio engineering encompasses a nebulously defined collection of practices including but not limited to musical production, audio recording, mixing, and archiving for music, sound design, arrangement for radio and film, and sound reinforcement for amplified live performance. Canonical narratives have the audio engineer giving voice to the works of others from 'behind the curtain' (Williams, 2010) without necessarily taking a place in the spotlight, if not directly (via mediation tasks such as recording and mixing) then indirectly by their implication in the design of and norms associated with the audio equipment required for these activities. They engage in a wide mix of tasks, some technical and some artistic (Beer, 2014; Kealy, 1979; Neuenfeldt, 2007; Porcello, 2004). Musical entrepreneurship also involves an element of aspirationalism, and the economics of audio engineering depends on mobilizing affects of hope and optimism via skilled performances of emotional labor (Watson & Ward, 2013).

Despite their precarity (Brunet, 2024), careers in audio engineering remain highly sought after (Porcello, 2004; Watson, 2013), and the boundaries of who counts as a 'real' audio engineer are tightly delineated via social practices of exclusionary closure. Some of the many criteria used by audio engineers to police the borders of their profession include the linguistic – such as knowing how to speak about sound in the 'correct' way (Porcello, 2004), the skill based – such as knowing how to coil a cable over-under (Marshall, 2020), and the socioeconomic – for example working in commercial studio rather than a home studio (Cole, 2011; McCartney, 2009). Not only that, but as my research shows, masculinity is hegemonic within the industry, and *the* main criteria that can immediately disqualify someone from being taken seriously as an audio engineer is being a woman. I show how in a field structured by neoliberalism and masculine hegemony, deliberate gendered exclusions can be understood as reflecting power struggles under conditions of economic uncertainty. Under these conditions, engineers of all genders perform masculinity to wield the power and authority necessary to do the job, and masculine performativities have become key skills for success within the industry (Annetts, 2015).

Positionality

This interdisciplinary PhD thesis consists of a cross-disciplinary literature review and three articles, as well as interstitial material relating the articles to one another and to my underlying goals and interests. It has been tacitly informed by my own career in audio engineering for music. I began doing live sound at noted Montreal DIY space La Plante over ten years ago, and worked at two local venues as a front-of-house mixer until the pandemic started. Now I mainly work in studio recording, supplemented by two to four month-long tours each year. This positions me as an insider among the population I am studying, offering some unique

affordances and, conversely, limiting my results in specific ways. I've had firsthand experience of watching my mentors mix and then very literally imitating their movements, of feeling out the connection between moving my hand on a potentiometer and hearing a filter sweep in my ear, of enjoying the kinetics and athleticism of patching a stage from scratch with five minutes to go before doors or coiling twenty cables over-under lickity-split between sets. I've had positive and supportive learning experiences with peers and mentors, and directly encountered some of the negative sides of audio culture such as overt glass ceilings in the workplace and contending with the precarity that is so characteristic of work in cultural production and audio engineering specifically. My goals with respect to this project are liberatory, towards a more equitable audio milieu where the pleasurable experiences of facilitation and creativity that I have enjoyed in my decade of working as an audio engineer are available to anyone who wants to access them. In keeping with these liberatory intentions this project is best understood as a mixed-methods action research project, although with the caveat that my thesis research only meets some of the criteria for action research, and some parts of it more than others. This is typical within the history of action research (Elden, 1993; Tripp, 2005). It is about working within existing practices to change the existing culture of audio engineering; in one nomenclature it is a *socially critical action research project* (Tripp, 2005).

My epistemological perspective throughout is feminist, emphasizing the relation between power and knowledge, the impossibility of being absent from the research process, the contextuality of my findings, and the state of entangled relationality with the research participants I found myself in during this PhD (Fox, 2008; Haraway, 1988; Mumby, 2004; Tadman, 2020). A researcher is always changed by the research they do, and the deep conversations and surprising interactions I had with the participants- many of whom I count as friends and colleagues- have become

implicated in my own coexisting practices and identities as an audio engineer, scholar, and performing artist. The audiences I sought to speak to include academics as well as working professionals both within and outside of formalized professional audio organizations. Mixed-methods research can represent a powerful tool kit for speaking across disciplines and in heterogeneous social spaces, and so I have taken a deliberately reflexive approach that integrates statistics with interview material, archival research, and research through reading.

Structure of the thesis

The literature review of this thesis is divided into two parts. In the first part, I present some key concepts and theories from within feminist philosophy and philosophy of science, gender studies, and science and technology studies (STS). In the second part, I present a scoping review of the literature on the working practices of audio engineers. This review describes the state of the art in social studies of audio engineering as it stood when I conducted the review in 2019, as well as a shared conception as presented in the academic literature of who an audio engineer is and what they do which has informed my understanding of the role of masculinity in audio engineering. The archetypal audio engineer has excellent analytic listening skills (*the ears of the engineer*), can use his social skills (especially certain forms of masculinized emotional labor) to create feelings of trust and positive affect as well as navigate the unsparing power relations of the recording studio (the *social side of engineering*), and is aware of and able to correctly reproduce *processes and best practices in audio* involving complex configurations of sociotechnical knowledge- much of which is tacit. The theme *recording is about power* describes how audio engineers *must* be able to exercise authority to guide the music making process under conditions characterized by informal relations, uncertainty, and limited time. They are also precarious.

Within a constantly shifting industry (Brunet, 2024) and specifically in the context of the demise of the vinyl record industry and the proliferation of streaming technologies, the audio engineer has become an economically marginal figure (*engineers are marginalized*), eking out a living as a freelancer in competition with home studio technologists. This suggests that class interests and economic anxiety may be important factors influencing the working practices of audio engineers, a subject which I explore in more detail in Chapters 2 and 3 of this thesis.

In the first manuscript (Chapter 1), I depart from describing the role of gender in audio engineering to develop a philosophical framework for understanding the relationship between the construction of masculine subjectivity via social techniques and technical knowledge and the gendered construction of technical knowledge. In this theoretical paper, I present a diffractive reading of Judith Butler's gender performativity through Michael Polanyi and Marjorie Grene's work on personal knowledge (PK) (Butler, 1990; Grene, 1995; Polanyi, 1958). I wrote this article over an extended period between 2020-2024, and the perspective I developed while writing it both informs and is informed by the research presented in Chapters 2 and 3. It exists in conversation with these texts and should be read as such. The data is 'threaded through' and 'plugged in' (Deleuze & Guattari, 1980; quoted in Mazzei, 2014), becoming diffractively present as another text in the 'assemblage in formation' (Mazzei, 2014).

I suggest that Polanyi and Grene's work represents something of an unrecognized sibling to feminist epistemologies of science and reveal resonances between their conceptualization of personal knowledge and performativity theory. Thinking these theories together relates being (subjectivity), doing (skilled performance through embodiment), and knowing (knowledge/power) as part of a single intra-active phenomenon (Barad, 2017). I describe performativities generally and gender specifically as an instance of personal knowledge in

Polanyi's sense, and conversely point to the performative aspects of knowledge we might not usually think of as such. Relating knowledge to performativity is not a novel move- after all, asking questions about subjectivity is impossible to do without asking epistemological questions (and vice versa)- but foregrounding the central qualities of personal knowledge as Polanyi and Grene conceived it (its *partiality*, *from-to structure*, *extensivity* and *unspecifiability*) invites a reading of performativity that grounds it in all the human activities of meaning-making, from the sensorimotor to the complexly social[1]. Using Polanyi's personal knowledge as a theoretical basis for understanding how performativity and knowledge figure together furthers the argument that performativity is compatible with enactive approaches to cognitive science (Albarracin & Poirer, 2022; Butnor & MacKenzie, 2022). It also has implications for Knowledge Management and organizational studies broadly, fields which have invoked both tacit knowledge and performativity while largely failing to reckon with the epistemological consequences of such referents (Gond et al. 2015; Straw 2016). I suggest that renewed theoretical rigor with respect to source material might inform a more effective stance towards articulating the interplay of knowledge and identity within the workplace.

The scoping study suggested that the normative idea of a sound engineer is a man who can use certain socio-technical tools to structure the space of the recording studio or soundcheck such that the musicking process proceeds straightforwardly. To do so, he must be able to exhibit a facility and liberty with respect to technologies (both social and analog/digital) to gain and maintain the confidence of musicians and in some cases other audio engineers (Marshall, 2020).

[1] Not that the sensorimotor and the social exist on a spectrum, rather they are always themselves in co-constitutive mutuality.

So, how important is being a (white, abled, straight, cis, young/old) *man* to achieving these goals? I addressed this question using a two-pronged approach.

In the second manuscript (Chapter 2), along with my collaborators Dr. Amandine Pras, Dr. Athena Elafros, and University of Lethbridge Masters' graduate Monica Lockett; I used a large-scale survey to capture the experiences of social discrimination and microaggressions reported by 387 recording engineers, producers, and studio assistants living in 46 different countries. This clarified the severity of the gendered closure of the field as well as the mechanisms used to maintain (white, abled, older) masculine hegemony within the industry. My collaborators and I describe a situation where the boundaries of the profession are enclosed along identitarian lines via microaggressions, hostile work environments and glass ceilings (Brooks et al., 2021; Leonard, 2016; Sue, 2010; Yonemura & Wilson, 2016). Hegemonic masculinity structures the social field, resulting in negative outcomes for younger men, women and non-binary people; as well as immigrants, disabled, or BIPOC people of all genders. Our intended audience for the article was audio engineers themselves, and the research process involved community intervention. We hoped that it would generate conversation and awareness as well statistical evidence to help audio engineers experiencing discrimination, microaggressions and gaslighting[2] legitimate their experiences. We administered the survey with the expectation that a repeat measurement would be made using the same instrument at some point in the future, although this has not yet taken place.

[2] 'A set of attempts to create a "surreal" (Ferraro 2006) social environment by making the other in [a] … relationship seem or feel "crazy."' (Sweet, 2019)

In the third manuscript (Chapter 3), I interrogate how audio engineers relate to the naturalized masculine hegemony of the industry on a personal level, asking the question: what kinds of masculinities are audio engineers learning to do in the context of their professional life, and how do they feel about it? Using a series of semi-structured interviews, I explore how adeptness with both the gendering technologies and techniques of gender central to audio engineering is a source of satisfaction and anxiety for audio engineers, as well as how the masculinities privileged and produced in audio engineering relate to audio engineers' sense of themselves as professional and gendered subjects. Hegemonic masculinity is a source of tension for audio engineers of all genders, who both knowingly act in complicity with it and discursively position themselves in opposition to it, especially in the context of changing social norms around masculinity and patriarchy (Cornwall et al., 2016; Leyshon, 2009). Women working in audio discursively position themselves as masculine; and the practiced, self-conscious masculinity performed by audio engineers is associated with being perceived as technically competent and with professionalism articulated in terms of having good 'bedside manner'. Bedside manner corresponds to certain forms of emotional labor which are valorized within the profession (Watson & Ward, 2013) and which are themselves coded as masculine, disrupting the usual narrative of emotional labor as a woman's activity and contributing to the burgeoning body of work on masculinity and emotional labor (Táíwò, 2020). The invocation of gender to protect the class interests of audio engineers also shines through as a central theme, albeit one that the engineers I interviewed discursively distanced themselves from: stereotypically excessive masculine performances and 'toxic' behavior were associated with insecurity as well as the precarity and competition that are the norm within the industry, once again illustrating the presence of gendered closure. In this context, the hegemony of masculinity allows men (and, via

‘queen bee’ behaviors, certain women (Derks et. al., 2013)) to maintain a sense of their own power under conditions of economic disenfranchisement and cutthroat competition, incentivizing the reproduction of masculine hegemony within the industry.

Rather than asking how the technologies and techniques of audio engineering are realized as masculine due to the naturalized masculinity of those who create and use them, in this thesis I show how in audio engineering certain masculinized forms of emotional labor (Watson & Ward, 2013) and accentuated performances of technical expertise (Annetts, 2015) constitute both masculine performativities and essential professional knowledge. In doing so, I emphasize the role of knowledge-in-practice in gendered subject formation and develop a materially invested understanding of gender performativity as tacit knowledge with epistemological consequences for organizational and information studies. I also contribute to the literature on masculinity and emotional labor, and by situating emotional labor as gender performance at work show how ‘feeling rules’ can contribute to the reproduction of hegemonic masculinity in the workplace. Conversely, I show how professional knowledge of technology and social technique shapes not only the social formations and configurations within which gender is practiced and through which gendered subjectivities can emerge, but the forms that those genders themselves take (Landström, 2007). I document audio industry masculinities in flux, where changing cultural norms around gendered workplace behavior and the desire not to be seen as ‘toxic’ or ‘controlling’ paired with the functional necessity of remaining in control to effectively guide the creative process renders the hegemonic form both a source of power and a site of tension. This can be further placed into context by understanding how neoliberal policies of individualism and modularity both pave the way for consequence-free gendered exclusions (Zendel, 2024) and, to a certain extent, disincentivize ‘awkward’ sexist behavior in the service of remaining a frictionless,

blank slate facilitator. This case study illustrates how the splitting, atomizing power of global neoliberal capitalism creates and reproduces gendered fields of power in highly unregulated social fields such as the arts, while constitutively concealing the structural nature of their exclusions and instead placing the ultimately impossible onus on individuals to change things 'from the ground up'.

Literature Review Part I: Feminist epistemologies, masculinity, closure, and knowledge

The first part of the literature review begins with a discussion of my epistemological orientation, which I draw primarily from work within feminist science studies. Then I present the methods which I employ, namely action research, mixed-methods research, and a diffractive method of research through reading. Then, I'll introduce some key theories which will come into play later in the thesis, namely Butler's Gender Performativity Theory, Connell's Hegemonic Masculinity, Hochschild's concept of Emotional Labor, Parkin's Closure Theory, and Polanyi's Personal Knowledge, which I will contextualize in relation to theories of enactive cognition and the discipline of Knowledge Management.

Epistemological orientation

As noted in the Introduction, my epistemological orientation is feminist, liberatory, and largely pragmatic with respect to methodology. Throughout this thesis I will refer to the concept of *power*- or the differential ability to act- returning repeatedly to its relationship with subjectivity and the social construction of knowledge. Feminist epistemology emphasizes this link (Haraway, 1988; Mumby, 1996), and feminist research paradigms are characterized by a reflexive analysis of power which both emphasizes and questions dialogue as a strategy for knowledge creation, bringing the relationship between the researcher and the researched into the spotlight (Butler, 1990; Mumby, 1996). Epistemic injustices related to framing who can know and what can be known are rooted out and examined, and standpoints that have been discursively or ideologically neglected are often brought to the fore (Spivak, 1988). In keeping with this, feminist research often involves the practice of genealogy, or exploring and deconstructing an idea by examining

how it has and is transformed across time and context, where it intersects politically, what it has done and what it can do. This practice typically involves historical research and research through reading and can provide us perspective on our perspective and an escape from an ingrained viewpoint (Owen, 2002) by providing a counter-ontology that undermines the stability of the dominant one (Mumby, 1996).

Haraway's Partial Perspectives

This research draws on feminist science studies and feminist philosophy of science. While critical inquiry into scientific practices and the knowledge created through them is characteristic of feminist research, feminist epistemologies are not typically anti-scientific; rather, they reflect a long and storied tradition of ontological inquisition and arguments against claims to 'views from nowhere' from within science and science studies. According to Donna Haraway, feminist philosophers of science have historically vacillated between two poles: on the one hand, strict social constructionism, 'wherein insider scientific views have no value and all demarcation along insider lines are power moves rather than moves towards truth' (Haraway, 1988; p. 577), where scientific knowledge is fully socially constructed or simply rhetorical, functioning mainly as a field upon which power can be exerted. On the other hand, a more optimistic and materially oriented stream of 'feminist critical empiricism' retains objectivity as a legitimate concept and claims that feminist methodologies can produce a better, more truthful account of the world- that a 'successor science' is not only possible but necessary (Harding, quoted by Haraway, 1985). These two attitudes are identified by Judy Wajcman in her work on feminist approaches to technology as 'critical feminist' and 'technofeminist' accounts respectively; the first associated with a somewhat overdetermined deconstruction of technology's masculine origins, and the

second with the creation of new and radically feminist meanings for science and technology (Wajcman, 2004).

Haraway insists on holding both these conceptualizations of science in ‘contradictory and necessary’ tension, doing so by developing a concept of partial perspective, or a 'feminist objectivity [that] is about limited location and situated knowledge, not about transcendence and splitting of subject and object’ (Haraway, 1985; p. 599, 583). As Marjorie Grene (whose views on this subject I will discuss in more detail later) expressed, ‘There is no [transcendental] ‘human mind’, as such, as Kant believed, whose eternal structures we could investigate; but there are human beings responsibly trying to approach nature objectively, along the lines prescribed in each case by the maxims, techniques, [and] beliefs of a given scientific culture’ (Grene, 1995; p 46). According to this perspective, any trustworthy claim to objectivity is based upon the premise that it’s impossible to remove the observer from the experimental apparatus, and that objectivity is about observation that is true to the body- that aligns with the accounts of our senses and sensations. I locate my own research within this third paradigm: observation is necessarily situated, and thus all trustworthy knowledge is explicitly partial (Haraway, 1988).

Foucault’s Power-Knowledge

The concept of power as mobilized in this thesis refers principally to the work of the French philosopher Michel Foucault, who describes how systems of power both produce and regulate subjectivities (Foucault, 1975). He defines power as ‘not a thing, an institution, an aptitude or an object. Power describes relations of force… power is not an institution, and not a structure; neither is it a certain strength we are endowed with; it is the name that one attributes to a complex strategical situation in a particular society’ (Foucault 1976, p. 93). Rejecting simplistic

conceptualizations of power as negative or repressive, Foucault theorizes power as fundamentally implicated in all generative processes, to the point that it defines the conditions into which it may come to operate, resulting in 'perpetual spirals of power and pleasure' (Foucault, 1976, p.45), of circulating pursuit and resistance: 'Power creates its own area of operation such that it draws out and induces the conditions under which it increasingly comes into play' (Basumatary, 2020; p. 325). Exercising power involves transforming bodies, and thereby brings about the emergence of subjectivities and objects of knowledge (Basumatary, 2020). While they are conceptually separable, power and knowledge cannot exist without one another- they facilitate each other's production, a configuration which Foucault assigns the portmanteau 'power-knowledge'. In producing knowledge, one always makes a claim to power (Basumatary, 2020); there can be no power without knowledge: 'it is not possible for power to be exercised without knowledge, it is impossible for knowledge not to engender power' (Foucault, 1980). Power is exercised in the 'local, mundane and quotidian practices of institutional life and has multiple points of origin' (Mumby, 1996; p.255)- for example in knowledge-sharing practices (Basumatary, 2020).

A common typology of power describes juridical power (prohibitive- as in, I stop you from shoveling the snow by taking away the shovel), regulatory power (as in, an organization defines rules and standards that determine the action of its members), and productive power (generative- as in, I can play the guitar right now because I have a guitar) (Butler, 1990; 1997). Most real-world examples involve multiple kinds of power, and so this typology is most effectively used as a descriptive tool for thinking about a dynamic landscape of relations. For example, regulatory power differentials within an organization define roles and tasks. These roles and tasks in turn define potentials and capacities which are forms of productive power.

Power and Knowledge in Research

Within a research context, power-knowledge plays out in terms of what becomes the object of research- for example, ‘'Foucault would argue that information is produced about women in Western countries, because of the structural and institutionalized imbalance in power relations between men and women. Thus, we find many people writing about the rights of women leading to the emergence of various theoretical concepts about women, while very little is written about men.’ (Basumatary, 2020; p. 328). Furthermore, the organizing categories themselves come into play: a great deal of knowledge has been produced about how gender structures women’s lives, and gender itself is often conceptualized as a ‘woman’s problem’, at least in part because of the way in which womanhood as a class has come to be associated with artificiality, constructedness, and inauthenticity; while manhood is associated with authenticity (Hansen, 2022). However, not only is understanding men’s experiences of masculinity just as revealing of gender as is understanding the interactions of women with femininity, but masculinity is just as much a constructed and performed modality as is femininity. Indeed, since masculinity and femininity are not simply different things that have the same value but reflect a gender system in which masculine men have higher status, more power, and greater privileges than women or less masculine men (Berdahl, 2018; Ridgeway, 1999); an understanding of how masculinity works is just as crucial to understanding how people experience gender as is understanding femininity.

‘Difference’ approaches to research which analyze subordinate groups only in terms of their difference from a dominant group can also contribute to perpetuating stereotypes and further marginalize those it is nominally meant to empower. For example, framing research into women creating their own subcultures within organizations in terms of ‘community and egalitarianism vs. dominant patriarchal power structures’ runs the risk of essentializing women and obscuring

the influence of dominant power structures on the formation of woman-centric subcultures (Ashcraft & Mumby, 2003; p. 52). It not only fails to account for the complex dynamics emerging from intersectional power differentials, but also to account for the variegated and heterogenous experiences of men. Furthermore, people who a researcher might nominally identify as part of a subordinated group may not wish to be identified as such at all, finding it disturbing to their sense of their own identity. This type of contestation has arisen repeatedly in research about women in engineering (Jorgensen, 2002), and is reflected in the interviews I conducted with women audio engineers in Chapter 3 of this thesis.

Methods

Action Research

By way of this research project, I sought to identify the processes at work contributing to the ongoing masculinization of audio engineering. I also sought to intervene within the industry by communicating those findings directly with my professional community, facilitating conversations about structural inequalities in the profession via in-person discussion and articles in publications catering primarily to professional audio engineers. As such, it falls within the boundaries of what is usually referred to as action research. The concept of action research, or the activity of gathering knowledge about a social situation while also trying to change it, is typically attributed to Lewin (1946). However, analogous methodologies emerged in the 1930s from several different research disciplines striving to address social problems, and methods bearing some resemblance to action research date as far back as Greek empiricism (Tripp, 2005).

Action research capitalizes on the connection between knowledge and action and the capacity for scientific research to transform sociality. It constitutes a multiparadigmatic family of research

practices spanning fields including but not limited to organizational change, education, feminisms and community development (Elden & Chisholm, 1993; Tripp, 2005). A functional definition is provided by Tripp (2005): 'Action research is a form of action inquiry that employs recognised research techniques to inform the action taken to improve practice.' Rather than contributing to (social-)scientific knowledge by solving scientific problems, action research contributes to both general and (social-)scientific knowledge by solving practical, contextual problems: engaging with '‘tacit knowledge’ and ‘local theory’ rather than ‘general knowledge’ and ‘scientific theory’' (Elden & Chisholm, 1993; p. 127).

Ultimately, all research has an active quality; action research simply addresses this aspect head on. Rather than accounting for a ‘value-free’ science, it formally acknowledges the performative nature of knowledge creation and strategizes around it to most meaningfully effect change. ‘It is not research-to-be-followed-by-action, or research-on-action, but research-as-action.’ (Lippitt quoted in Tripp (2005)). Action research does not always succeed (Tripp, 2005), and the extent to which my research has been *effective* as an action research project and contributed to ‘local theory’ versus the extent to which it has more generically contributed to ‘general knowledge’ is still an open question to which I will return in the Discussion section of this thesis. There’s been a lot of public attention towards ‘women in audio’ since I started this degree, and at the very least I hope to have contributed something to that discourse.

Elden identifies six core elements which I will discuss with respect to my research project, at least some of which must be present for a project to constitute action research. Firstly, *purposes and value choice*. Action research typically takes place via cyclical, future-oriented processes in which research is used to help people recognize their own values and desires for the future and organize together to actively construct that future (Elden & Chisholm, 1993). My values have

remained basically liberatory throughout the project. However, my understanding of what 'knowing things about gender in audio' has to do with liberation has evolved significantly through the seven years I spent working on this project, as has my attitude towards the often-naive (and sometimes cynical) inclusivity discourses which are often invoked as a way to sidestep talking about hegemony and justice within professional contexts. As neatly stated by Tripp (2005; p. 7), 'we only discover the nature of some things when we try to change them'. This changing understanding of what factors are at play in the ongoing masculinization of the industry and what audio engineering could look like as a more equitable profession in the future has occurred in an iterative manner with respect to the processes of knowledge creation I have undertaken through this research.

Secondly, *contextual focus*. The context in which this project took place is specific and bounded. My research focuses mainly on people working professionally in audio engineering for music, as opposed to audio engineering for video games, films, or computing (although there is some inevitable cross-over). I am also not really concerned with prosumers or musician-producers, although these are important demographics within the music industry they fall outside the scope of this research. The included scope includes individuals working in music *production*, *recording*, *sound reinforcement/live sound*, and *mastering*. My interview research took place in Canada, the USA, and Germany; and while the survey presented in Chapter 2 was a globally international survey, the majority of participants came from either these three countries or elsewhere in Europe and the UK. Therefore, it applies to a specific, limited, Eurocentric audio engineering culture.

Third, *participation in the research process*. In participatory action research, research involves collaborative meaning-making between researcher-participants and participant-researchers

(Elden & Chisholm, 1993). My work falls short of being participatory, since it did not involve co-management of the research process with my research participants, rather it was partially co-operative. In a co-operative paradigm, participants are regularly consulted and may function as partners in the research, but on a project that always 'belongs' to the researcher (Tripp, 2005). The project presented in Chapter 2 most clearly falls within the co-operative paradigm. Both myself and Dr. Amandine Pras, one of my co-authors, are professional audio engineers and thus participants in the culture of audio engineering. However, for the project to be a *participatory* action research project we would have had to involve our research participants more fully in the ontological/epistemological aspects of the research process. Finally, while I did meaningfully consult the interviewees who contributed to the project presented in Chapter 3 on the use of their quotations in that chapter, I did not take part in a formalized consultation exercise with respect to the findings presented in the article and so it should not be understood as either collaborative or co-operative.

Fourth, *change-based data and sense-making*, and fifth, *knowledge diffusion*. Action research tends to be pragmatic (Tripp, 2005) and can be oriented towards creating self-sustaining systems of meaning-making and knowledge creation, such that the researcher can leave the system which will continue to generate meaningful knowledge for participants. Diffusion of knowledge generated within the context of action research to the participants and stakeholders involved in that research is also a key attribute. Again, these aspects apply primarily to the research presented in Chapter 2 and to a lesser extent Chapter 3. We developed the research tool we used in Chapter 2 with the specific intention of it being used again in the future in the same context in order to measure change. While this has not at the current time taken place, it *has* since been used in the closely related but geographically and culturally distinct context of the East Asian

recording studio (Pi & Yang, 2022). My colleagues and I shared the knowledge we developed directly with the research participants and with the audio engineering public via an Open Access publication in the Journal of the Audio Engineering Society (JAES), one of the few academic journals with meaningful readership among professional audio engineers.

Sixth, *problematization*, or the critical examination of the research questions themselves to challenge ontological/epistemological bias and understand *who* within the research programme has something to gain from the research. In this research, I, as a gender minority audio engineer, have something to gain from a reconfiguration of the audio industry towards gender inclusivity. While I would also argue that all audio engineers have something immaterial to gain from a less toxic, more inclusive industry; as Zendel (2024) points out, gender exclusion within the music industry has a material purpose: it makes money for people. In keeping with this perspective on my own perspective, I have tried throughout this thesis to take Alcoff's posture with respect to determining when it is appropriate to speak for others: when possible to move over and allow people to speak for themselves via direct quotations, to not shy away from seeking outside input, to remain accountable for what I say, and to look towards the possible effects of any speaking-for (Alcoff, 2009). Coalitional unity need not be a goal or prerequisite for solidarity (Butler, 1990; p. 20), so while I write in solidarity with sound engineers of all genders who experience poor working conditions or financial marginality and with BIPOC, disabled, and gender minority engineers who weather the added alienation and stress associated with the intersecting structural discrimination that they experience, I do not claim to speak *as* or *for* them, nor can I expect my experience to be like those of all audio engineers with whom I share identifications or identities. I have also held to Tripp's maxim for ethical action research: 'No researcher or other participant

ever engages in an activity that disadvantages another participant without their knowledge and consent.' (Tripp, 2005; p. 12)

Mixed-methods research

I strategically employed standard qualitative and quantitative research methods as well as a literature review and a diffractive methodology of research by reading (Hepler et al., 2019) to develop an understanding of the ongoing masculinization of audio engineering. The work presented here thus constitutes a mixed-methods research study. Mixed-methods research can allow researchers to develop a deepened perspective by synthetically combining qualitative and quantitative representations of a phenomenon (Caruth, 2013); however deepened perspective also risks theoretical fracture and ultimately inevitable epistemological contradictions (Botha, 2011; Salehi & Golafshani, 2010).

I used mixed methods primarily for opportunistic reasons related to communicating with stakeholders in an action research context. In designing the study presented in Chapter 2, my colleagues and I were acutely aware that to speak to a target audience of audio engineers (who fetishize graphs and numbers as communication tools over qualitative data, a tendency that is notorious even within audio communities) our research would be most effective as an advocacy tool if we could present 'hard' numbers. My academic training is in applied mathematics in biology, and on a functional level I'm at ease using the tools of statistics and mathematical modeling when warranted. I suggest that there are some kinds of limited things that can be learned by applying normal statistics to experimental findings, cases where building a mathematical model can be an expedient strategy towards finding good-enough solutions to a problem, and certain types of argument that can be most effectively made to specific audiences

using statistical instruments (Olsen & Morgan, 2004). There are also limitations to these kinds of tools. For example, as my colleagues in Chapter 2 and I were well aware, using statistical analyses to analyze the data collected from a large-scale survey exploring a highly power-laden and intersectional topic such as experiences of discrimination will necessarily overlook much meaningful detail and flatten complex, personal experiences in essentializing ways. As such, there are times where archival work, in-depth interviews, participant observation, and artistic interventions are more effective research tools. I have attempted throughout this thesis to keep the limitations, histories, and indwelling political investments of the tools I use in mind because on a practical level keeping these investments in mind was key to critically assessing my findings.

Mixed methods research may be used in order to deepen an argument via *complementarity* (obtaining multiple viewpoints about similar experiences or associations), *completeness* (representing totally such experiences or associations), *developmental understanding* (building questions in a step-by-step manner, where research questions for a method are developed from results presented via the use of another method), *expansion* (using a second method to clarify the results obtained using a first method), *corroboration* (confirming findings using two separate methods), *compensation* (countering the weakness of a method by the use of a second method), and *diversity* (to obtain opposing viewpoints on the same phenomenon) (Venkatesh, 2013 as quoted in Caruth, 2013). All these purposes of using mixed methods play out through this thesis. For example, the scoping study presented next uses a literature review method to develop a picture of the dominant cultural image of an audio engineer as presented within the academic literature. A major theme within the literature identified by this scoping study was that *recording is about power*. This was corroborated in the firsthand accounts of the participants in the

interview series presented in Chapter 3, who associated power with control and performances of masculinity. This then complements the finding presented in Chapter 2 that audio engineering is a field structured by heteropatriarchy.

Diffractive Methodologies

Feminist philosophy of science has both historical roots and methodological consequences. One explicitly feminist method that I use in this thesis is a diffractive method of research through reading based on the work of physicist and philosopher Karen Barad. Barad departs from quantum physicist Niels Bohr's work on complementarity as a starting point for developing a holistic feminist onto-epistemology of phenomena, which they term agential realism (Barad, 2007). According to Barad's interpretation of Bohr, objectivity is always in relation to 'permanent marks' and defined in reference to bodies in relation to each other rather than to outside-in observations from an unidentified perspective. The distinction between 'objects and agencies of observation' (Barad, 2007) is dissolved, prompting Barad to use the neologism 'intra-action', or 'the mutual constitution of objects and agencies of observation within phenomena', emphasizing the co-constitution of intra-acting parts in contrast to 'interaction' which presumes a relationship between distinct, separated parts (Barad, 2007; emphasis in original). Phenomena and objects emerge through their mutual intra-action within apparatuses, which are 'material-discursive'.

Barad's onto-epistemology has a methodological correlate in diffractive methodologies, which abandon the normative theory : research question : praxis : verification format of normal science in favor of an approach which appreciates and exploits the impossibility of removing praxis from theory or theory from praxis in processes of knowledge creation. Barad claims that this follows

as a direct consequence of Bohr's interpretation of quantum mechanics, particularly his interpretation of double-slit experiments, where depending on the experimental apparatus employed to measure its behavior a photon can be found to behave either/both as a particle and/or as a wave (Barad, 2007). While a detailed discussion of still-controversial interpretations of key experiments in quantum physics is beyond the scope of this thesis, an admittedly crude summary of their argument is that it is not possible to ask meaningful questions without already over-determining the forms the answers might take. To attempt escape from this inevitability, theory and praxis should be used to guide one another in a circular, back-and-forth-in-time-and-text process which attends to the differential possibilities opened by socio-material configurations and arrangements of knowledge. This reflects Barad's underlying challenge to the idea that a researcher can develop theories, tools, or techniques for learning about the world which exist at an ontological distance from either themselves or the world itself and emphasizes what I will later denote the performative nature of research processes (Murris & Bozalek, 2019).

On a practical level, diffractive methodologies involve processes of 'reading' texts or data[3] through and alongside each other, holding them together as an assemblage-in-formation allowing meaning-making with respect to a given phenomenon or situation (Fox & Alldred, 2023). Much like action research, rather than seeking representational accounts of phenomena, diffractive methodologies generate situated novel insights.

[3] Broadly defined; these might also include impressions, memories, emotions, and fictions (Fox & Alldred, 2023; Murris & Bozalek, 2019).

Theories

Gender Performativity Theory

In this thesis, I understand gender as *performative*, it is something that is interactively produced in relation to others and to oneself, rather than simply a quality that one *has*. This perspective on gender is most strongly associated with the work of queer theorist Judith Butler, whose theory of gender performativity synthesizes a Foucauldian concept of power with J. L. Austin's work on *performative utterances* - speech that does something - to understand how gender is produced and naturalized within society.

In the mid-20th century, J. L. Austin and contemporaries associated with the field of *performance studies* (for example the philosopher Helmuth Plessner, whose work I will discuss in some detail in Chapter 1) sought to understand how performative acts (including speech) figure in the production of interiority and subjectivity and are not only communicative but constitute social actions in and of themselves (Austin, 1955). Austin differentiated between elements in a performative speech act corresponding to the *actual words spoken*, the *intended effect* of the words spoken, and the *actual effect* of the words spoken. He distinguished between *illocutions*- those utterances that directly bring into being that which is spoken (for example, a judge sentencing a prisoner or a minister proclaiming a couple to be married) - and *perlocutions*- which require a hoped-for response from the world to take place in order to be successful (Austin, 1955). As Butler points out in their later work on political and economic performativity, most speech acts are perlocutionary, and 'The perlocution implies risk, wager, and the possibility of having an effect … certain kinds of effects can possibly follow if and only if certain kinds of felicitous conditions are met' (Butler, 2010).

In Butler's application of performativity to the phenomenon of gender, they describe how the performative acts of gender, the 'expressions' that are supposedly its results, actually define gender itself and are naturalized as the qualities of gendered individuals. They say: 'what we take to be an internal essence of gender is manufactured through a sustained set of acts, posited through the gendered stylization of the body' (Butler, 1990; p. xiv). Butler indicates that they do not intend to suggest that there is never psychic meaning in gendered identity, but in developing a theory of gender *performativity* they focus mainly on the linguistic and theatrical elements of gender and their role in producing gendered subjectivities. This emphasizes identity as a discursive practice, something done in relation to others. Any description of gender is therefore inseparable from its normative expressions- even the question of what elements of a person count as gendered elements will refer to normative ideas of what these elements might be. The replication of heterosexual constructs in non-heterosexual contexts (for example, butch/femme lesbian identities) illuminates the constructed nature of these relations, whose stability is accomplished by the creation of temporarily stable gendered power differentials and exclusions (Connell & Messerschmidt, 2005) as well as by the permeability of the various categories involved.

According to Butler, heterosexuality is the defining norm responsible for binary gender as we know it, with the coherence of 'man' and 'woman' as gendered categories relying on the oppositional relation implied by heterosexuality. In turn, 'biological sex', which according to normative accounts appears to be a physically and biologically evident set of characteristics, is constructed in terms of (and in support of) normative gender and the reproductive aims of compulsory heterosexuality. The gendered essence possessed by other people is something that we expect exists based on their performances of a gendered style and our immersion within

social formations that link 'biological sex', gender, and sexuality; within which discontinuous identities are defined and prohibited via their (failed) relation to mandatory heterosexuality. Performances of gender are always with reference to the *idea* of an originary or genuine gender, in Austin's terms they are *perlocutionary*. In this context, our own self-regulating practices of gender and sexuality are understood as attempts to stabilize our own sense of a consistent identity and an intelligible selfhood. Thus taking up a gendered identity acts as a *literalizing fantasy* upon the body- that is, it requires one to classify and differentiate bodily pleasures based on gendered meanings, with the fantasized body (whose limits and characteristics are defined by mandatory heterosexuality) taking the place of the real body. Strangely, the idea that the body is unified under sex and gender actually serves to fragment it (Butler, 1990).

Of the various critiques of gender performativity theory which have arisen over the years, there are a few which I will briefly mention here to inform and complement my own reading of the theory as presented in Gender Trouble. A first critique is that of gender as a useful analytic category in the first place. Gender as a concept was developed in the 1950s by American sexologist John Money and his colleagues Joan and John Hampson at Johns Hopkins, who sought a definitive method for determining a person's sex when biological variables were inconclusive (as is often the case; global prevalence of intersex rests at about 1.7% - IHRA, 2013; Karhu, 2022). They argued that 'gender role' was not an innate feature of a body's chromosomes, genitals, gonads, and hormones but was learned via perceptual stimuli to the genitals during a period of 18 months after birth; and as such developed protocols for the coercive surgical 'correction' of the bodies of intersex children (Karhu, 2022). Based on this work the psychiatrist Robert Stoller introduced the concept of 'gender identity' in his work on transsexuality, culminating in the current paradigm wherein the concept of 'gender identity' is

understood as located outside of the physical body (Karhu, 2022). Given that gender has its origins in medical coercion, white supremacy, and mind-body dualism as a 'normalizing, humanizing device of binary sex and heterosexuality for white bodies' (Gill-Peterson, 2023), some authors have argued that it is conceptually poisoned at the source and lacks liberatory capacity. However, while keeping this living history in mind, I align myself with Karhu (2022) who argues that Butler's use of the gender concept stems from their feminist desire for a more 'livable world' for those whose self-presentation and identity is deemed 'abnormal, non-existent, or impossible' and furthermore that 'gender has already become a lived reality through which to affirm one's sense of self and, simultaneously, contest normative regulation of bodies' (Karhu, 2022). Because the idea of gender has become ubiquitous, within a modern context people think of themselves as having a gender and use that concept in their own projects of self-expression and self-creation.

A second critique comes from within the trans community and consists of a criticism of Butler's (and queer scholars generally) instrumentalization of trans identity only when it affirms the flexibility and contingency of sex and gender (Prosser, 1998 quoted in Draz, 2022). It should (but often doesn't) go without saying that not all trans people are non-binary or gender fluid, and the idea that gender has a 'choose your own adventure' quality clashes with the lived reality of many trans people- especially trans women, whose hard-fought battles for basic recognition of their gender 'realness' are often uphill with respect to both everyday interaction and institutional power and policy (Draz, 2022). The deeply felt importance that many trans people assign to being recognized as *really* a man or a woman comes into apparent friction with queer projects of denaturalizing gender and with Butler's assertion that gender is first and foremost performative. In the last decade this critique has largely been understood to represent a misreading of Butler's

theory (Draz, 2022; Stryker, 2008), which in its early articulation neglects the material and situated nature of performativity and the corralling power of social coercion but which has been meaningfully addended in Butler's subsequent work. According to Susan Stryker, Butler's point is not that gender isn't 'real', it is that 'the reality of gender for *everybody* is the 'doing of it'… gender is like a language we use to communicate ourselves to others and to understand ourselves' (Stryker, 2008; p. 132). In Karen Barad's words, 'Performativity, properly construed, is not an invitation to turn everything (including material bodies) into words; on the contrary, performativity is precisely a contestation of the excessive power granted to language to determine what is real' (Barad, 2003). Nonetheless, hydra-like, this critique persists into the current moment in ways that remain generative. For example, Draz (2022) connects Prosser's allegation that early Butler favours 'trans phenomena that affirm the fluidity of gender' at the expense of 'realness' with another critique of Butler's early work on the fluidity of identity as playing into a neoliberal biopolitical regime of interchangeability, modularity, and expendability. By productively collocating these critiques she shows how trans claims to realness can be understood as a form of resistance to neoliberal instrumentalization of difference. Rather than being normative, trans inflexibility has a resistant quality with respect to 'institutional structures that enable particular forms of subjectivity at the expense of others' (Namaste, 1996; paraphrased in Draz, 2022).

Hegemonic Masculinity

Because there is no 'perfect' performance of either masculinity or femininity, and because what signifies as masculine or feminine is subject to change – 'is never comprehensive' (Cornwall & Lindisfarne, 2003) - genders are necessarily multiple, contextual, and relational. Clearly, this applies to masculinity just as it does to femininity: the 'social processes, practices,

characteristics, expectations, interactions, and institutional dynamics culturally associated with [men] become the means through which individuals constitute themselves (and come to be seen by others) as 'men'' (Berdahl et al., 2018). Thus, masculinity represents a viable mode of expression not only for men, but for women and people of other genders (Halberstam, 1998). Indeed, freely chosen performance of masculine gender roles can provide an important recourse for women in stereotypically male professions such as composition or sound engineering (McCartney, 2003). For example, the performance of female masculinity within a male-dominated music production landscape was identified to be a factor in the success of noted Hip-Hop producer Missy Eliot (Djupvik, 2022). For a second example which I will revisit in more detail in Chapter 3, women engineers often adopt performances of masculinity and male interaction rituals to be afforded legitimacy and experience feelings of belonging (Jorgensen, 2002). This gender-crossed female masculinity is predicated upon being 'different from other women', because just as womanhood is constituted as the visible other, 'central to the definition of what it is to 'be a man' is 'to not be a woman' (Berdahl et al., 2018). Understanding sexual harassment as an act that 'makes' the harassed person into a certain gender (and therefore as an act that is used to enforce gender) (Butler, 1999; p. xiii), taking on a masculine-gendered role may not only be used to fit in, but also represents a protective strategy against sexual harassment.

Within a context of gender multiplicity, the concept of *hegemonic masculinity* is useful for understanding the complexity of gendered power differentials and interactions. This concept originated in Connell's 1987 book *Gender and Power*, and means 'the current most honored way of being a man … require[ing] all other men to position themselves in relation to it, and … ideologically legitimate[ing] the global subordination of women to men' - alternatively - 'the configuration of gender practice, which embodies the currently accepted answer to the

legitimacy of patriarchy, which guarantees (or is taken to guarantee) the dominant position of men and the subordination of women' (both Connell, 2005). What is hegemonic about hegemonic masculinities isn't that most men successfully perform them, it is that they have such a strong hold in the cultural imagination of how men 'should' act that other, non-hegemonic, hybrid or subordinate performances of masculinity are typically defined in reference to them. Hegemonic masculinity structures the field, just as gender as a social system of stratification operates to structure people's lives at the 'individual, interactional, and organizational level' (Acker, 1990). Subordinate masculinities are those that fail to embody the hegemonic ideal. While men in general benefit from patriarchy, 'men embodying subordinated masculinities may suffer disproportionately the costs of existing gender regimes' (Cornwall, 2016; paraphrasing Connell, 2005). As I will show, in the context of audio engineering this extends to the subordinate masculinities practiced by women and non-binary people.

Several key articles relate hegemonic masculinity and audio engineering cultures. Articles about masculinity in audio engineering typically identify audio gear fetishism as a primary site for the production of masculine identities, and uses analysis of written texts, whether online forums such as the recently renamed 'GearSlutz' (Bates & Bennett, 2022) or in print media such as Tape Op Magazine (Annetts, 2015). Audio gear fetishism, or the fetishised emphasis on acquiring and talking about audio technologies (rather than using them for functional or creative purposes), is linked to hegemonic performances of masculinity within audiophile communities (Annetts, 2015; Bates & Bennett, 2022). It is necessary here to carefully differentiate between audio engineers and audiophiles: while some audio engineers may also be audiophiles, there are vast communities of consumer or prosumer audio equipment enthusiasts who engage in audio equipment acquisition on a large scale but do not meaningfully work in audio engineering;

indeed, these communities make up a significant fraction of the audio technology market. However, certain findings related to masculinity in audiophile communities can be carried over into pro audio, specifically those related to the establishment of the audio domain as masculine. In the context of popular discourses stressing a simplistic dichotomy of masculine technical competence, scientific mindset and rationality in opposition to feminine irrationality and consumption of mass media, audio engineering has been marked as masculine via its association with action, the means of production, and technology (Annetts, 2015).

Emotional labor, gender, and the workplace

Gender is materialized through, by and within the workplace (Buzzanell et al., 2023; Tyler & Cohen, 2010). Gender performance is simultaneously embodied and situated - 'instituted in an exterior space'. Just as the body is an ‘intentionally organized’ medium through which gender is brought into being, so is organizational space (Butler, 1990: 521; cited by Tyler & Cohen, 2010). In a professional context, gender is typically implicated in how organizational roles and tasks are defined. This is one of the many ways gender is implicated in behaviors related to knowledge. It is not something that is added to organizational processes after the fact, but rather one of its elemental organizing principles, defining our idea of what work roles and organizational citizens look like on a fundamental level (Acker, 1990). Within global neoliberalism, power and authority remain highly masculinized, and the ‘ideological work done by [the] gender binary [helps] to secure consent to hierarchical social relations’ (Greig, 2011). For this reason, under neoliberalism, where demeaning, ‘un-manly’ experiences of labor injustice and precarity are rife, disjunctures in gendered expectations can be a significant source of anxiety for men (Cornwall et al., 2016). Aesthetically, gender performances reveal themselves as the material realization of the desire to project a coherent and intelligible gender identity within the workplace via aesthetic

decisions (for example putting up posters, plants or pictures of children), self-presentation (physical comportment, clothing choices), and spatial practices (leaving a door open vs. keeping it closed, letting one's possessions spill out into the workspace vs. keeping them tidy) (Tyler & Cohen, 2010).

It also defines affective experiences within organizational space: for example, women's affectual experiences at work can often be characterized by feelings of invisibility, over-exposure, spatial constraint, containment, and invasion (Tyler & Cohen, 2010; Buzzanell et al., 2023). Not only that, but people experience and express emotions in the workplace, and how they manage or mismanage their emotions can have serious material and social consequences (Sacha, 2017). The shared social norms or *feeling rules* that determine how people are expected to feel in a given situation can vary for individuals in a given situation depending on race, class, or gender (Hochschild, 1983; Sacha, 2017). Skilled performances of *emotional labor*- the production, restraining, or expression of emotions in accordance of the expectations with a given social context, the 'management of feeling to create a publicly observable facial and bodily display'- are central to many jobs, especially public-facing or customer-service jobs, and are often gendered (Hochschild, 1983; Sacha, 2017). Emotional labor is gendered, with certain forms of emotional labor being typically associated with certain configurations of masculinity or femininity. It is often assumed that emotional labor is intrinsically feminine, something that women are 'better at'. This is because the historical division of labor wherein men have been expected to take up public roles privileging rationality while women have been cast into private roles emphasizing nurturing and care-work has resulted in a fully naturalized discourse that associates women with emotional intelligence, empathy, and people skills – even if that's not what any given woman is particularly inclined towards, and despite the association of this

situation with elevated rates of stress and burn-out amongst women (Evers, 2019). This can also create difficulties for men in jobs traditionally associated with women: studies on nursing show that in that highly feminized profession, male nurses may actively avoid performing emotional labor and instead emphasize their technical skill and rationality to alleviate anxiety about their perceived masculinity (Evers, 2019).

Emotional labor consists of three components: *emotional requirements*, or the display rules required by the job ('service with a smile'); *emotion performance*, or displayed expressions which are consonant with job requirements; and *emotion regulation*, the effort expended by the employee to meet the socioemotional demands of the job (Grandey & Gabriel, 2015). A differentiation is also often made between two forms of emotion regulation. In *surface acting*, the internal feelings of the person performing the emotional labor do not correspond to the performed emotion- the emotions are faked (Evers, 2019). Conversely, in *deep acting*, the internal emotions of the person doing the emotional labor are brought into at least partial coherence with the emotions being displayed. This is not to say that the emotional labor is spontaneous- rather, just that the performance is congruent with the felt feelings of the performer. Deep acting can involve significant work and sophisticated techniques such as listening to music or imagining past events to 'summon up' the appropriate emotions (Evers, 2019).

There is a small body of literature pertaining to men's experiences with emotional labor, much of it about their experiences in sport. This work suggests that there are forms of emotional labor that are naturalized as masculine, and that gendered differences in emotional labor may be more a matter of difference in kind than strictly of degree (Evers, 2019). Indeed, performing emotional labor in certain ways can become essential to successfully performing certain masculinities- they

become part of the gendered performance itself. Emotional control and stoicism ('compression', in an audio engineering sense, of intense emotions) is a form of emotional labor often associated with masculinity (Táíwò, 2020). For example, Sacha describes how boxing coaches mentoring young men of color in LA use 'emotional regimens'- consciously implemented emotional training exercises meant to evoke and attempt to control difficult emotions like fear, shame, anger, or pride- to develop a form of authentic, competent, mature masculinity in their fighters (Sacha, 2017). Evers (2019) shows how male 'freesurfers' use emotional labor in the form of affects of 'stoke' to sell surf lifestyles and make a living, embodying an 'enthusiastic masculinity' that involves 'circulating and validating a routinized happiness, aspiration, and optimism through careful management of emotional states and performances of strength, resilience, and vulnerability'. Like the boxers of Sacha's research, authenticity is a characteristic feature of preferred masculinity in this context – however, Evers shows how freesurfers must deliberately *perform* authenticity by the careful manipulation of cultural signs and signals to succeed in their work (Evers, 2019).

Parkin's Closure theory

Understanding how a given discipline reproduces itself as highly gendered may superficially seem to depend on what kind of discipline is under consideration. For example, the mechanisms underlying the feminization of secretarial work might seem like they should be different from those underlying the masculinization of auto mechanics, which in turn seem like they should be different from those underlying the masculinization of applied mathematics. However, in all three of the cases above, some of the same mechanisms are present: discursive positioning of certain workplace roles as intrinsically masculine or feminine; the association of masculinity with technology, transcendence, and stoicism; the converse association of femininity with the

body, materiality, and sociality; the presence of professional networks that systematically enable some people and disempower others; and acts of 'doing closure' such as exclusion and harassment.

Closure theory was developed by Frank Parkin to explain the enforcement of class boundaries, and has been applied to understanding how professions define and boundary themselves along gendered lines (Kidder, 2004; Parkin, 1974; St-Pierre & Holmes, 2010). The purpose of closure is to maintain status hierarchy and any attendant privileges afforded by it. *Exclusionary closure*, characterized by 'the attempt by one group to secure for itself a privileged position at the expense of some other group through processes of subordination' (Parkin, 1974), describes how professions may bound themselves by excluding possible participants based on a variety of (often fluid 'moving target') criteria. Gendered occupational closure is dynamic, persistent, and performative; consisting of typically informal interactional processes of 'doing closure' performed through language and symbolic acts in relations between people (Shortall, 2020). Like gender, closure is a relation, not an attribute. 'Doing closure' vis-à-vis gender may involve women being made to feel uncomfortable via nonverbal or verbal communication, or more direct acts of discrimination, exclusion, or harassment. Verbal communication might include 'pointed comments dressed up as humor', while nonverbal communication can be harder to pinpoint: for example, being 'looked at' in ways that communicate incredulity (Shortall et al., 2020). As Shortall points out, 'This type of 'look' is nebulous and difficult to challenge, but those giving the 'look' and those receiving it are both very clear about what is being communicated.' These various techniques of closure are mobilized interactionally to create a hostile or uninviting work environment, and to reify a normative gendered occupational identity which benefits the dominant group.

Closure is complemented by gender segmentation, a term which describes women's limited career progression in their jobs (the proverbial 'glass ceiling') (Shortall et al., 2020). Importantly, employers are often implicated: because cultural ideas of what kind of person is good at what kind of task extend beyond the profession, biased hiring and promotional practices are often implicated in maintaining a gendered status quo (Shortall et al., 2020). These relational processes can be difficult to observe, and in the context of equity legislature making gender discrimination illegal, are often covert. Exclusivity is sometimes justified in terms of '[x group] just don't want to participate', when what is really taking place is a slew of concurrent acts of intentional exclusion which causes members of the subordinate group to not feel comfortable participating[4].

Microaggressions research

Doing closure involves *microaggressions*. As has been repeated in the catchy titles of numerous articles, there's nothing micro about microaggressions (Heung et al., 2022; Ohanmamooreni, 2013): rather, this term refers to brief, everyday indignities that convey hostilities towards a group of people. Sue et al. (2007) expanded the concept, breaking microaggressions into three categories: *microinsults* (demeaning or insulting comments), *microinvalidations* (negating or denying someone's experiences or feelings, i.e. 'gaslighting'), and *microassaults* (explicit discrimination and acts of violence spanning from name-calling all the way to sexual assault). The concept of microassault has been a source of debate, since using the prefix *micro* to describe intentional acts of violence seems incongruous. Accordingly, some authors deliberately

[4] In audio engineering, the oft-repeated narrative of 'there are lots of good women producers, they just work from home studios' has something of this flavor to it: rather than look clearly at what is taking place, it is easier for men (and less depressing for women) in commercial audio engineering to sidestep the issue by invoking a mysterious legion of women home producers.

distinguish between subtler microassaults and more overt acts of harassment and assault (Gartner et al., 2020). Microaggressions occur interpersonally, and are characterized by their ubiquity, subtlety, ambiguous intent, and likelihood of being enacted by 'well-meaning' people as well as people with hostile intent (Sue, 2010). Their ambiguity is to the advantage of people perpetrating them, since they can be explained away as so minor as to be beneath consideration or offer alternate explanations for their actions (Gartner et al., 2020). This can cause people receiving microaggressions to second-guess their experience. Over time, the cumulative stress of experiencing microaggressions can contribute to depression, anxiety, trauma, and lowered self-esteem (Gartner et al., 2020; Nadal et al., 2012).

Microaggression theory was originally developed to describe racial discrimination, but more recently the term has been applied to discrimination based on gender and other factors (Gartner et al., 2020; Pierce et al., 1977; Sue, 2010). A variety of measurement tools for quantifying experiences of microaggressions have been developed over the last decade. Validated or partially validated taxonomies for different kinds of microaggression have been developed including gendered microaggressions (Gartner et al., 2020); gendered racial microaggressions (Lewis & Neville, 2015); microaggressions associated with being transgender (Nadal et al., 2012) or LGBTQ (Swann et al., 2016); and microaggressions associated with being LGBTQ and disabled (Miller & Smith, 2021). For a scoping review surveying this work in the context of gender microaggressions, as well as an in-depth discussion of some of the issues related to measurement and validity implicit in microaggressions research using survey tools, see Gartner et al. (2020). In Chapter 2 of this thesis, I present the results of a survey based on Lewis and Neville's (2015) survey instrument examining the experiences of audio engineers with a variety of identity-linked

microaggressions, exposing the intensely toxic environment of audio engineering and illuminating the mechanisms of closure within that field.

Personal Knowledge

In Chapters 1 and 3 of this thesis, I will develop an argument for understanding how doing emotional labor can represent an instance of gender performativity, and for understanding performativities themselves as a kind of embodied, *personal* knowledge. In doing so, I link gender performativity theory with a formal theory of knowledge and in turn to Information Studies via the work of mid-century Hungarian-British polymath Michael Polanyi.

Polanyi's theory of personal knowledge (PK), which he developed in close collaboration with his friend and colleague Marjorie Grene, rests upon a refutation of logical positivism that (as I will show in Chapter 1) has epistemology in common with feminist science studies. This refutation goes like:

> 'Knowledge is justified belief, which we have good reason to believe but can never 'know' for sure, is true. Belief, in turn, however carefully defended, is the elaboration by a sentient, embodied being of its perceptions of the structures of its environment. That's why there is always a tacit foundation of knowledge: it cannot be detached from the efforts of living, sentient beings to orient themselves among the salient patterns of things and events offered by a real perceptual world' (Grene, 1995; p.17).

Just as Donna Haraway encourages scholars to embrace the multiplicity of local and specific knowledges, Polanyi conceives of science as socially constructed, personal, affectual, local, sometimes contradictory, and specific; and yet still the only route to understanding the world (Haraway, 1988; Polanyi, 1958). Not only that, but knowledge rests on tacit, fiduciary

foundations: ‘Only the fiduciary mode, used in the first person 'I believe this or that’ can be self-consistently upheld’ (Polanyi, 195; p.7). Knowledge is therefore always personal, however, the personal is distinct from the subjective, in that the personal contains an element of *commitment*, while the subjective does not. In the context of science this means simply that the scientist has devoted themselves to the pursuit of science and been inoculated with ‘scientific’ culture and modes of thought: they think of themselves as a part of science.

Tacit knowledge is knowledge which cannot be articulated using words. Because all knowledge involves personal judgement used to infer things about the world based on changes and regularities in sensory data, there is a tacit foundation to all knowledge (Grene, 1995; Polanyi, 1958). Skilled performances are actions based on tacit knowledge- ‘the aim of a skillful performance is achieved by the observance of a set of rules which are not known as such to the person following them’ (Polanyi, 1958; p. 49). Much working knowledge in audio engineering is tacit, from skills such as microphone choice and placement to the anachronistic practices of record cutting (Horning, 2004) to performative professional norms such as those surrounding ‘speech about sound’. In the case of speech about sound, although it is possible to express some of these norms semantically (as does Porcello, 2004), one would be hard pressed to learn to speak like an audio engineer using these semantic instructions. Even critical listening- the most central, basic skill for audio engineering- is built on tacit, embodied knowledge developed via experimentation and observation. One of the audio engineers interviewed by Neuenfeldt (2007) says: ‘the thing about blending the sound comes down to experience and having listened and knowing what those sounds should be’. To hear sonic elements functionally and easily and to understand them within a given musical context requires tacit knowledge of embodied techniques of listening (Henriques, 2007; Neuenfeldt, 2007). He is expressing that he has tacit

knowledge of the listening techniques required to identify which sonic affordances exist within a given mix of sounds.

Tradition is seen as key to the maintenance of tacit knowledge within a lineage, and learning by example is its primary mode of transfer. Mentorship plays an important role in this process. Because tacit knowledge cannot be articulated using words, the loss of even a single generation of practitioners of a skilled trade can result in the loss of that trade altogether (Polanyi, 1958; p. 53). On the other hand, explicit knowledge or 'rules of art' can be used to complement tacit knowledge, and guide the learner in their acquisition of skill, but they cannot replace it.

Polanyi's work and the concept of tacit knowledge specifically has been taken up primarily by two very different fields: *Knowledge Management* and *enactive* approaches in cognitive science. What these fields have in common is a shared concern with processes of meaning-making, KM in the context of firm-based organizations and enactive cognition on the level of the organism.

Enactive Cognition

Theories of *enactive cognition* (or sometimes, *embodied cognition*) are somewhat varied, but their central tenets are typically that cognitive processes depend constitutively on the body – that cognition is *embodied* action - and that the world is *enacted* via active sensorimotor processes of sense-making (De Jaegher & Di Paolo, 2007; Di Paolo & Thompson, 2014). In enactive approaches, the most essential aspect of knowledge is how the knower relates to the known, epistemological inquiry forms the basis for a theory of cognition (Hufferman, 2023). This is grossly characterized in terms of five central concepts: *autonomy* (organisms are self-individuating systems); *sense-making* (the orientation of an organism towards valence within the environment); *emergence* (organisms are dynamic systems which self-regulate in relation to the

environment); *embodiment* (sense-making depends on the integrated studies of the living body); and the centrality of *experience* (defined in terms of the qualitative, affectual, sensorial aspects of lived sense-making) (Butnor & MacKenzie, 2022). Polanyi has been located within this lineage by both enactive theorists (De Jaegher, 2021) and Polanyi scholars alike, with Takaki (2011) describing Polanyi's epistemology as *enactive realism*.

Enactive approaches, with their emphasis on embodiment and relational meaning-making (De Jaegher & Di Paolo, 2007), are compatible with performativity theory. The theoretical basis for this relation has been developed by Butnor and MacKenzie (2022) and Albarracin and Poirer (2022), with Albarracin and Poirer coming closest to the understanding of performativity and knowledge which I propose in this thesis. They articulate how gender is done via enactive processes within gendered affordance landscapes and with reference to culturally gendered social scripts, which they describe as both a culturally embedded 'knowledge structure about the sequence of events to be produced in a certain setting' and as 'sensorimotor cultural affordance loops' (Albarracin & Poirer, 2022). These 'scripts' are similar to Gabbay and Le May's (2004) *mindlines,* which are sequences of linked, practiced, practical knowledge developed iteratively via negotiation between practitioners. Mindlines, like scripts, are reinforced via observation of trusted experts (hegemonic models of gender) within the community of practice (gendered group one seeks acceptance within) and tested in daily life. Mindlines (and scripts) may involve physical objects as well as processes, and procedural knowledge as well as tacit knowledge (Gabbay & Le May, 2004). I have not integrated either mindlines or scripts into my account of gender knowledge, but describing gender knowledge in audio engineering in terms of these concepts would produce an articulation largely analogous to Albarracin and Poirer's.

Knowledge Management

Knowledge management (KM) is a discipline that attends to all aspects of creating, sharing, using, and managing knowledge, as well as the role of knowledge as a source of organizational, social, and economic change. The origins of KM as a business discipline lie with management professional Peter Drucker in the late 1960's, who conceived of an economy where knowledge- rather than capital or labor- was the primary asset and economic driver (Straw, 2016). The simplest view of knowledge management is that it's 'the business activity and research discipline focused on leveraging knowledge for organizational competitive advantage' (Straw, 2016). A more broadminded definition of KM extends its reach to all aspects of and strategies towards managing knowledge, inside and outside of corporate contexts, placing special emphasis on the role of knowledge as a source of innovation and change. Knowledge and power are closely related within this paradigm: correct management and use of knowledge allows for originality, innovation, and resilience to flourish on individual and organizational levels; 'it has become trite to assert that knowledge is a fundamental source of advantage for contemporary organizations' (Barley et al., 2018). KM makes use of models that do not usually present a 'theory' per se but rather suggest relationships and interactions that can be tested (Wilson & Asay, 1999), by necessity reducing complex fields of power to simple, directional relationships. Correspondingly, approaches to epistemology in knowledge management are mixed: some authors engage heavily with questions of how we know and what it is to know (Nonaka & Von Krogh, 2009; Paucar-Caceres & Pagano, 2009) while others embrace a more positivist, behaviorist view that can be somewhat uncritical (Allix, 2003; for some examples see Sanchez & Mahoney, 1996; Jennex, 2005). This second tendency is puzzling - given that knowledge management as a field is all about knowledge; understanding how knowledge itself is constructed would seem to be a primary concern.

Polanyi's work has been influential within KM mainly via Ukirjo Nonaka's Socialization Externalization Consolidation Internalization (SECI) model (Nonaka, 1994); developed in a series of papers published in the early 90's in response to what Nonaka perceived as a failure of KM research to successfully explain innovation and knowledge creation within corporate firms. This work brought abundant citations- if not a devoted readership- to Polanyi's philosophy (Straw, 2016). KM has also superficially taken a 'performative turn', referencing Butler but – according to some critics- fundamentally misunderstanding their theory (Gond, 2015). As I will later argue, both understanding performativity as a kind of personal (largely tacit) knowledge and articulating how knowledge itself can be performative has meaningful consequences for the activity of managing knowledge within organizations.

Interstitium I

In the second half of the literature review, I present the results of a scoping study surveying the breadth, content and methodology of the English-language research and biographical literature on the working practices of sound engineers in studio and live sound. I conducted this research in the second year of my PhD, when I was trying to determine who was writing about audio engineering in a non-technical way and what they had to say about it. I knew that there was substantial technical literature from within audio engineering dealing with technology and, although less typically, techniques; mostly published in journals such as the Journal of the Audio Engineering Society (JAES). However, I wanted to know what other literature existed, especially research pertaining to social techniques and sociology of music production. I was aware of some research scattered across the literature landscape- for example the many papers published by Amandine Pras and Catharine Guastavino in my own department, and certain articles in the Journal of the Art of Record Production (JARP). There didn't seem to be any central resource available compiling this material to which I could refer, and so I made my own.

Scoping studies are a form of literature review typically used to reveal key concepts and types of evidence within a research area. This rigorous research methodology involves a broad literature search, a winnowing process to retain only the most relevant results, followed by full-text review and data extraction. Since scoping review methodology invokes well-defined criteria for including and excluding papers, systematically combines findings from multiple studies, and should be reproducible. This careful, regularized search strategy is invoked to reduce researcher bias (Lame, 2019). However, unlike other forms of systematic literature review which usually involve evaluating the quality of findings and ultimately answering a specific research question,

the scoping study is a form of narrative review (Rother, 2007) surfacing dominant discourses within the literature without formally evaluating the quality of the research. There is always going to be some uncertainty implied in this process, since understanding what something is 'about' (which themes are important or interesting in a text) is ultimately a personal matter. It's for this reason that scoping study methodology best practices suggests having a second researcher independently reproduce or verify the coding employed; however I skipped this step. I did conduct an expert consultation exercise with my supervisor Martha de Francisco, who provided valuable insight from her many years working in music production. I also shared my findings with Jonathan Sterne's CATDAWG research group at McGill University who provided valuable feedback.

In the course of this review, I read 2,239 abstracts obtained from Scopus and Google Scholar, resulting in 210 articles which I analyzed in full using a rigorous qualitative coding method. The qualitative coding was conducted in Microsoft Excel, resulting in a spreadsheet summarizing what findings were presented, research methodologies employed, and to the extent possible what clearly defined research disciplines were represented within the articles. I extracted bibliometric information about the literature sample. Finally, I coded for topics, which I organized into themes. In hindsight, I find that some the primary themes which I identified within the literature (eg. *recording is about power*) falls along the axes of my own research interests, while certain other themes (eg. *technical developments influence engineering aesthetics*) aren't so clearly related.

Literature Review Part II: Working practices in audio engineering for music: a scoping review

From the ringtone of your smartphone to the rock concert downtown, the invisible influence of audio engineering practice marks nearly every sonic media source encountered within the modern media landscape. Audio engineers work mainly 'behind the curtain' (Williams, 2010), mediating the production and reproduction of sonic media without necessarily taking a role in the spotlight as might a musician, composer, or conductor. It is perhaps for this reason, along with the diversity of tasks involved in audio engineering and wide variety of roles that an audio engineer may work in that despite their crucial role in moulding the modern soundscape there is no unified academic consensus on what audio engineers do and how they do it. There's a flourishing - if scattered - body of literature that deals with working practices within audio engineering consisting of writing from within sound studies, human geography, sociology, musicology, and audio engineering itself, but each of these disciplines paints a slightly different picture of the sound engineering habitus.

To address this issue, I conducted a scoping study surveying the breadth, content and methodology of the English-language research and biographical literature on the working practices of sound engineers in studio and live sound. Scoping studies are typically used to reveal key concepts and types of evidence within a research area, allowing the researcher to sketch a clear image of the overall literature landscape. The research methodology I used for this literature review was adapted from Arksey & O'Malley (2005) and Levac et al. (2010) and included a pilot study, a wide-ranging literature review, and an expert consultation exercise. In the pilot study, I developed a research query as well as inclusion and exclusion criteria which I

used to determine whether a given article was relevant to the query. I reviewed 2,239 abstracts obtained from Scopus and Google Scholar, resulting in 210 articles which I analyzed in full. Using a rigorous qualitative coding method, I identified three primary research objects present within the literature as well as nine primary themes consisting of thirty-two unique topics. I also extracted bibliometric information about the literature sample and information about what methodologies and disciplines are represented within it. Finally, I identified some areas where research is sparse, locating holes in the literature that suggest fruitful avenues for future work.

Methodology

In the context of this literature search, I undertook to define precisely what was meant by the terms 'working practices' and 'audio engineer'. Because the literature search involved screening thousands of abstracts, only by clearly defining what I was looking for could I define which articles were relevant within the results while also ensuring the scoping review remained of a feasible size. It was essential that the definitions I used were easy to implement in practice within my search strategy. As such, I defined an *audio engineer* as 'a technician or director dealing with acoustics for performance, recording, or playback', and *working practices* as 'within the workplace or towards a work-related goal, the application or use of an idea, belief, or method.' This definition of working practices was intended to exclude purely theoretical subjects. For example, the application by a specific audio engineer of acoustic principles to control room design would be considered a working practice, while a text defining these acoustic principles in isolation would not.

I limited the definition of audio engineer to include exclusively those audio engineers working mainly in recorded or performed music. This meant that sound designers working in games,

sound archivists, foley artists, and so on were excluded). Individuals who fit my definition might consider themselves audio engineers, or they might call their job ‘recordist’, ‘music producer’, ‘sound engineer’, ‘sound mixer’, ‘mastering engineer’, ‘sound tech’ or one of several other names. By including producers within this list, I account for the fact that under a modern recording paradigm there may be little to no distinction between the tasks of the producer and the engineer, and individuals working in small studios will frequently take on both roles.

The goal of the pilot study was to develop a Boolean test query and exclusion and inclusion criteria. I conducted a backward search using Ulrichsweb (an online resource containing definitive bibliographic and publisher information on more than 300,000 periodicals of all types) for fifteen pilot texts representative of the kinds of materials I hoped to find. I identified Scopus (a large abstract and citation database of peer-reviewed literature) as an appropriate pilot database. I began by searching for 'audio engineer' OR 'music production' in Scopus. My search strategy was refined to attempt to reconstitute the original eleven pilot texts. I developed a Boolean query that returned nine of the eleven pilot texts (see Appendix A for the full query), which I then applied both to Scopus and Google Scholar (a free, accessible web search engine that indexes both full-text and metadata of scholarly literature across an array of formats and disciplines).

The pilot study informed the development of a set of **exclusion and inclusion criteria** (see Appendix B), which were retroactively applied to the pilot articles. The exclusion and inclusion criteria were applied in a purposefully inclusive manner at this stage, as I was aware that the papers might contain relevant information that was not presented in the abstract.

The Scopus search returned nine of the pilot texts as well as 1,730 additional abstracts, all of which I comprehensively reviewed. The exclusion and inclusion criteria were applied in a purposefully inclusive manner at this stage, as I was aware that the papers might contain relevant information that was not presented in the abstract. At the end of this step, I was left with 119 relevant documents (9% retention rate). I chose Google Scholar as a second data source because it includes vast coverage of publications in a variety of formats, including peer-reviewed articles, conference proceedings, books, magazine feature articles, and other forms of 'grey' literature. Google Scholar returned ~ 31,900 results, sorted in order of relevance from highest to lowest. I screened the abstracts in this order, cutting off the screening process after no more useful articles were found for over thirty pieces of reviewed media. This occurred after five hundred abstracts had been screened. A total of 150 articles were retained from this search, 24 of which fit the search criteria but were duplicates of articles identified during the Scopus search. The remaining 126 articles were added to the Scopus documents, for a total of 245 documents included for full-text screening. See Figure 1 for a PRISMA flow chart summarizing this process. The content of these documents was entered into a data charting form by the author using Microsoft Excel. Data extracted from each document included bibliographic information, keywords, field of origin, theoretical framework, background information to the research question, research question, research method, data analysis method, sample population (if working with human subjects), and main findings. During this step 35 further texts were determined to be irrelevant. The quantitative findings presented in the current version of this article are derived only from the remaining 210 documents.

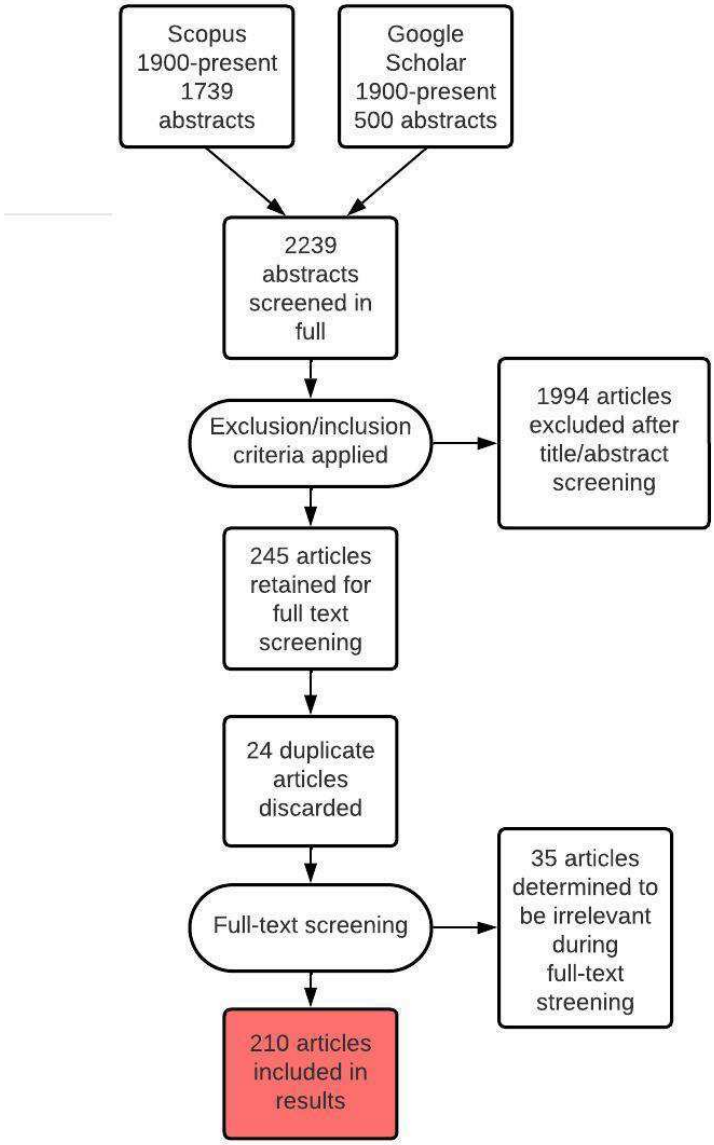


Figure 1: PRISMA flowchart for this scoping review.

Following data charting, I coded the Dataset in Dedoose, a cloud-based coding and qualitative data analysis software. Each data was tagged with codes for AGENT (*type of individual under study*), FIELD (*academic discipline*), METHOD (*research methodology or methodologies used in the article)*, RESEARCH OBJECT *(what is the scale of the research object: studio, project, or engineer)*, QUAL QUANT (*qualitative or quantitative)*, SOUND GENRE (*studio sound, live*

sound, or home recording), MUSIC GENRE (*what genre of music, if any, is mentioned in the text),* and TOPICS (*what subjects are central to the text*). A total of ninety codes were used, see Table 1 for the qualitative coding schema and Tables 2 and 3 for the list of TOPICS and their corresponding themes. Coding for topics was undertaken using the constant comparison method, so as new topics appeared I returned to previously coded articles and re-coded them considering these new tags.

AGENT	**MUSIC GENRE**
Recording Engineer	Indigenous music
Producer	Classical
Mixing Engineer	Computer music
Live Sound Engineer	Hip Hop
Musician	Jazz
Mastering Engineer	Pop
Tonmeister	Punk
Composer/Conductor	Reggae/Dancehall
Home recording	Rock
METHOD	**MUSIC GENRE**
Questionnaire	Indigenous music
Case Study	Classical
Technical Review	Computer music
Tech-processual analysis	Hiphop
Focus Groups	Jazz
Outline of Research Methodology	Pop
Participant Observation	Punk
Biography	**SOUND GENRE**
Ethnography	Home recording
Experiment	Live Sound
Historical	Studio Sound
Phenomenological analysis	**FIELD**
Interview	Public Health
Audiovisual Media Analysis	Education
Linguistic corpus analysis	Audio Engineering
QUAL QUANT	Communications
Qualitative	Ecology
Quantitative	Geographical
	Information Studies
	Musicology
	Sociology

Table 1: Qualitative coding schema.

THEME	
1	The changing economics of recording
2	The studio as a networked site of cultural production
3	Process and best practices in audio engineering
4	The ears of the engineer
5	The social side of engineering
6	Diversity in audio
7	Learning to engineer
8	Recording is about power
9	The technology, recording practice, and popular music culture marble cake

Table 2: THEMES which emerged from the data reviewed.

CODES	% TAGGED	THEMES
Technological developments influence engineering aesthetics	31	9
Technical developments alter social aspects of studio work	28	9
Production aesthetics	28	9, 3
Relationship between artist and engineer	27	3
Technical skills of the engineer	27	3, 4
Musical skills of the engineer	26	4
Social skills of the engineer	26	5
Economics of recording	25	1
The fall of big studios	22	1, 2
Digital divide	18	1, 6
Musical or stylistic trends determine technology use	17	9
Recording is about power	17	8, 5, 6
From craft to art	16	5, 9, 3
Creativity	16	2, 3
Wearing many hats	15	5
Analytic listening	11	4
Tacit knowledge	11	4, 7
Engineers are understudied	10	5
Apprenticeship	9	7
Women in sound	8	6
Emotional labor	6	5
Race	6	6
Engineers are marginalized	6	1
DIY	5	1
Pedagogy	5	7
Celebrity culture	4	2
Speaking of sound	4	7
Automated mixing	3	3
Synesthesia	2	4
Hearing loss	2	4
New hires	2	7
Trans people	1	6

Table 3: Complete list of CODES and their correspondence to THEMES.

Findings

The bibliometrics of the retained documents was as follows: 66% were peer reviewed articles, 9% entire books, 5% chapters of books, 10% conference papers, 7% feature articles, and one was a text in preprint. The most represented academic publishers were the Audio Engineering Society Press (21%), IEEE (12%), Routledge (9%), SAGE (9%), Cambridge (9%), Springer (5%), and JSTOR (4%). Top publications were the Audio Engineering Society Convention Papers (5 articles), The Journal of the AES (4 articles), World of Music (3 articles), Social Studies of Science (3 articles), Journal of the Art of Record Production (3 articles), Journal of Popular Music Studies (3 articles), Journal of Music, Technology & Education (3 articles), and Environment and Planning (3 articles). Pras and Guastavino were the most represented authors, with three co-authored papers retained in the literature search.

Most of the literature I reviewed used only qualitative data collection methods (101 articles, or 48%). The most common research method was historical research (46, or 22%). Biographical research was common, typically using biography as a tool to structure a broader analysis or as a goal in and of itself. Biographies of sound engineers or producers were targeted towards a range of different audiences from the lay public to other recording professionals. Second came the use of interviews, with 39 (19%) of the relevant articles making significant use of interview material. Interviews were almost always used in conjunction with another research method such as biography, historical inquiry, or ethnography. Ethnography, with or without the use of participant observation, was the next most common method, used in 24 (11%) of the relevant articles. Less-used methodologies were the analysis of audiovisual media, questionnaires, case studies, focus groups, phenomenological analyses, technical reviews, tech-processual analyses, and linguistic corpus analyses.

About half of the articles using quantitative methods (a total of 26 articles, or 12% of the sample) collected both qualitative and quantitative data (13 articles, or 6%). Although I did not dive deeply into the experimental methods of these studies, they produced highly relevant results which either focus on *process and best practices in audio engineering* or *the ears of the engineer*. Mixing experiments were highly represented in these articles (10 articles, 5%).

Of particular interest were four texts describing research methods for studying audio engineers and / or engineered media. One of these methodologies is musicological, one focused on audiovisual media analysis, one on geographical study, and one on ethnographic work within the recording studio. Zagorski-Thomas (2014) presents the basis for a musicology of record production, highlighting issues of interest for the musicologist that are specific to sound recording and reproduction, as well as a curated literature review and history of the field. Kardos (2015) develops a practical methodology for describing timbral gestures in music production with precision and control. This technique, music semiology, can be used to analyze recorded works and placing them within historical and technical context. Wood et al. (2007) reviewed various techniques that they found generative when conducting geographies of music and of music production, paying special attention to the setting of the concert hall. The intimacy of the recording studio poses specific challenges to ethnographic study- Thompson & Lashua (2014) describe barriers that they have faced conducting two studio ethnographies, as well as possible methodological techniques that can be used to overcome these difficulties.

Different genres of music have different norms with respect to the role of the engineer or the producer. For example, the hip-hop producer inhabits some of the same roles that a musician typically would in pop or rock music- singing, beatmaking, composing- while the classical

producer plays a role closer to that of a second conductor (Blake, 2011). For this reason I included tags for MUSIC GENRE while coding the articles. If the article referred extensively to a given genre, it was coded for that genre. Articles could be coded for multiple genres. By far the most common genre referenced in the literature was was popular music (25 articles, or 12%); followed by classical (15 articles, or 7%), rock (14 articles, or 7%), jazz (6 articles, or 3%) and hip hop or R&B (3 articles, or 1%). Finally, electronic music, powwow music, reggae, dub, experimental and punk all had one or two tags in the literature.

Although the majority audio engineers entering the workplace today will work in live sound at some point (Bielmeier, 2017) and mastering recordings has become one of the main sources of income for audio engineers in a contemporary context (Prince & Shankar, 2012), my literature search uncovered only a few articles dealing with issues specific to live or mastering engineers. Only 14 articles (7%) dealt with topics in live sound and two-thirds of these papers also discussed professional studio sound. Even more dramatically, only 4 articles (2%) discussed mastering in any detail.

The overlap between articles dealing with live sound and studio sound suggests that working practices are shared between these disciplines. This flow of techniques and ideas is mainly conceptualized as moving from the studio environment towards the venue or concert hall (Knowles & Hewitt, 2010). The ultimate goal of the live engineer is presented as to ‘bring studio sound quality into the concert, and thus to get as close as possible to the record while keeping the vibe of the live performance’ (Henaff, 2012). The inverse perspective of ‘bringing liveness to studio sound’ has also been studied, if to a lesser extent. Mulder (2015) traces the history of digital technology use in live sound. He notes that despite an initial reluctance to make the switch from analog to digital, live sound engineers have since been forward-thinking in their use

of digital technology because of the advantages it offers in terms of automation and mobility. Work by Henriques (2007) and Knowles & Hewitt (2010) supports this claim.

Topics and Themes

The 32 topics identified during coding were organized into nine themes (Table 2) representing the basic narratives present within the literature. In some cases, themes were associated with specific research methods or general fields of study, but the relationship was not one to one. An individual article might also touch on a range of different themes and any number of topics up to the maximum of 32. I'll discuss each theme in turn, presenting the fields and methodologies most associated with this theme as well as discussing the content with examples from the literature.

I also identified three primary research objects within the literature that were relevant to the research query: the place that engineering occurs (mainly *the recording studio*), the product that is produced (*the project)*, and *the engineer themselves*. The first of these research objects, ***the*** *recording studio*, is a place of collaboration, source of profits, and a node of artistic activity both subject to and influencing upon the global marketplace. It is a historically, spatially, and economically embedded unit. The themes associated with this research object operate at the scale of buildings, financial forces, widespread social trends, and geographical constraints. The second research object is *the project*- be it recording a track, mixing a live artist, or mastering an album. When the sound engineer is discussed with respect to the project it is usually in relation to their skillset- what they bring to the project; be it technical, musical, or social. Literature by engineers for engineers tends to take this project-based approach (Dochtermann, 2010; Hepworth-Sawyer & Hodgson, 2016). The third research object is *the audio engineer* themselves. The themes

associated with this object are concerned with who the engineer is, their skillset, and how they got to where they are.

The changing economics of recording

Fields: Economics, Audio Engineering, Musicology; Methods: History, Ethnography, Interviews, Biography

During the past sixty years, studios have undergone a gradual and well-documented shift from unionized, laboratory-like affairs to project studios which capitalize on nostalgia and emotional labor (Gibson, 2005; Kealy, 1979; Leyshon, 2006). This structural shift is closely tied to a shift in the studio economy's relationship to record labels (Putnam, 1980). Factors antecedent to this shift include the decline of vinyl (Leyshon, 2006), introduction of software to the recording process (Leyshon, 2006; Walzer, 2016), and peer-to-peer file sharing (Leyshon, 2006). Consequences include the development of academic audio engineering curricula (Bielmeier, 2017; Porcello, 2004), economic precarity and boom-and-bust work regimes in audio engineering (Rumsey & McCormick, 2012), and dissolution of the distinction between the roles of producer, engineer, and artist (Kealy, 1979; Porcello, 1991; Shepherd, 2011).

Diversity in audio

Fields: Audio Engineering, Musicology, Sound Studies, Gender Studies, Urban Geography; Methods: History, Ethnography, Interview, Biography

It has been widely remarked upon that gender and ethnic/racial diversity are lacking in audio engineering (Barney, 2007; Bell, 2015; Meintjes, 2003; Rodgers, 2010; Wolfe, 2012). Working with audio technologies can be liberating, facilitating telling one's own story and taking control

of one's own sound (Barney, 2007; Scales, 2002; Wolfe, 2012). These technologies are often made inaccessible via intimidating or toxic work cultures in studios and venues (Barney, 2007; McCartney, 2015; Mathew, 2016; Wolfe, 2012). Financial constraints are also barriers to entry, as it can be difficult for women to obtain entry-level audio jobs and studio equipment is often prohibitively expensive (Barney, 2007; Morris, 2015). These issues reflect persistent negative cultural attitudes towards women working with technology (Mathew, 2016; Thaler, 2010). Women who do 'make it' in audio engineering 'often feel bracketed by environments that define the(ir) work as masculine' and cornered into specific performances of gender including the 'exceptional woman, or the stereotypical woman, and/or the genderless composer, the technical expert, the audio engineer, the macho technologist' (McCartney, 2003).

Women's successes in audio have been linked to the democratizing influence of digital technology (Mathew, 2016; Wolfe, 2012). The relative affordability of digital recording gear has led to more women having the financial capacity to build their own studios, thereby sidestepping the sexism and discrimination that may be present in commercial recording environments (; McCartney, 2003; Rodgers, 2010; Wolfe, 2012). Issues of 'work-life balance'- aka managing childcare responsibilities while continuing to work- are lessened when working from home studios (Barney, 2007; Mathew, 2016). Although there are very few women visibly employed in audio engineering, there are many highly skilled female musicians who produce their own music. These individuals are self-directed audio experts whose skills are on par with that of 'professional' audio engineers (McCartney, 2003; Wolfe, 2012). The growth of academic programs in audio engineering and proliferation of online learning resources have also been suggested to favour women's involvement in audio engineering (Mathew, 2016; McCartney, 2003). By and large, the implication of the research from *learning to engineer* is that without

social learning, aspiring audio engineers will be unable to succeed in the profession. However, work on *diversity in audio* emphasizes the importance to women of having isolated spaces in which to learn and experiment with audio gear. Almost no information was found about queer or trans people in audio engineering, a troubling result especially given the relatively large proportion of sound engineers who self-identified as queer and/or trans in my research (Brooks et al., 2021).

Compared to the relatively energetic discussion of gender in audio, race and ethnicity in the studio have received far less attention. Race relations between both white and BIPOC audio engineers and BIPOC musicians producing heavily color-coded world music have been considered in detail by several authors (Meintjes, 2003; Scales, 2003). Within the context of hip hop studies, engineering and production skills have been shown to contribute to ideas of self-worth and legitimacy for Black producers working within an environment of systemic racism (Harkness, 2014). The availability of cheap, effective home recording technology has also been instrumental to the development of the homegrown hip hop studio (Harkness, 2014; Harrison, 2014), lending further credibility to the argument that cheap digital technology has emancipatory potential.

Recording studios as networked sites of cultural production

Fields: Urban Geography; Methods: History, Ethnography, Network Analysis, Interviews

The studio occupies a pivotal place as a node in the network of musical and cultural creation within a city (Watson, 2009). Despite changes in the formal functions of the recording studio, it has always been a place where style is created and culture is amplified (Meintjes, 2003). The sometimes-hectic environment of the recording studio provides an ideal environment for social

and political connections to be forged (Harkness, 2014). It houses ‘a mix of collective and individual pursuits, as well as routinized and spontaneous activities’ (Harrison, 2014) which create opportunities for creativity and collaboration. Books and articles like Floyd’s (2015) history of Sun Records, Kennedy & Gioia’s (2012) history of Gennett Records, and Fox’s (2009) history of King Records use historical information and interview material to review the lifespan of a single studio. These studio histories all engage in one way or another with the studio as an economic and musical hub, tracing the influx of artistic talent and the efflux of recorded works into and out of the studio.

Process and best practices in sound engineering

Fields: Audio Engineering, Information Studies; *Methods: Experiment, Ethnography, Audiovisual Media Analysis, Interviews*

Articles reflecting this theme present the results from mixing experiments, studies of information use in audio engineering, and creativity studies. A process is a series of steps taken to achieve a particular end, and a best practice is as a process that is agreed upon within the audio industry and is thus marginally standardized. Creativity in audio engineering may be considered a best practice: the audio engineer is expected to exhibit flexible modes of thought and come up with innovative solutions for issues that arise during the recording process. They must be able to effectively mobilize 'knowledge acquired from different experiences, different skills, a kind of lateral thinking that often leads to scientific as well as technical solutions' (Horning, 2013). This creativity is expected to prevail over limitations imposed by the quality of the recording setup (Gibson, 2005). This suggests that the audio engineer is a problem solver. They must also be a

facilitator, creating a structure of limitations and opportunities for a musician to work within to exert their own creative actions (McIntyre, 2007).

Studies of information use in audio engineering projects include both experimental and ethnographic studies. Examples include research into metadata use within a production (McGarry et al., 2014), the impact of producer's comments on recording outcomes (Pras & Guastavino, 2013), and phase changes in the recording project (Slater, 2015). Mixing experiments are experiments wherein multiple audio engineers mix the same track, and their procedural and aesthetic decisions are quantified and discussed. In all three examples of mixing experiments reviewed, the engineers doing the mixing were master's degree students, and the intended application of the experimental results was for automated mixing applications (De Man et al., 2014, 2015; Ronan et al., 2015).

The ears of the engineer

Fields: Social Ecology, Public Health, Music Education, Musicology, Audio Engineering, Sound Studies; Methods: Ethnography, Surveys, Experiments, Interviews

One of the powerful technologies possessed by the audio engineer is extremely personal- the structured listening of the audio engineer, which functions as a data collection tool or technical apparatus (Prince & Shankar, 2012). The trained ear of the audio engineer gives them special authority over the sounds that they hear. Power is enacted through the audio engineer's listening via the capacity to interpret what has been heard. Audio engineers use their ears as diagnostic tools and are likely to undergo at least some formalized ear training (Corey, 2016). They are trained to hear sounds that musicians cannot hear and have fine-tuned this specialized audition with experience and the development of tacit knowledge (Bates, 2009; Henriques, 2007). This

analytic mode of listening is supplemented using monitoring technologies (Reyes, 2010). The listening ears of the producer are materially oriented and represent the ears of the public transported to within the studio (Hennion, 1989). Older audio engineers have the sense that the specialized audition they practice is a dying art. The perceived de-skilling of sound engineering is assumed to be a product of advances in monitoring techniques that render skilled listening obsolete (Reyes, 2010).

Their ears may be instrumental to their livelihood, but audio engineers often work in sonically punishing environments that result in much higher rates of both tinnitus and high frequency hearing loss than present in the general public (El Dib et al., 2008). This is especially true for live sound engineers, who may feel pressure to compensate for sub-optimal sound quality with increased volume (El Dib et al., 2008; Henaff, 2015).

The social side of engineering

Fields: Audio Engineering, Sound Studies, Information Studies; Methods: History, Biography, Ethnography, Audiovisual Media Analysis, Text Media Analysis, Interviews

There is a consensus that social skills are the key to success in audio engineering, and the articles I reviewed often attend to the sociality surrounding music production (Ramone, 2007; Watson & Ward, 2013). Audio engineers themselves tend to possess significant institutional and cultural capital, making them capable of weathering the 'often brutal power relations' (Leyshon, 2009) that may occur during the normal course of their work. Simultaneously, their job is defined by close attention to the emotional register of the other individuals around them (McIntyre, 2012). The importance of congeniality, willingness and ability to do emotional labor, and trustworthiness to success in audio engineering is echoed again and again within the documents

that I reviewed (Bielmeier, 2016; Hesmondhalgh & Baker, 2010; Watson & Ward, 2013). Emotional neutrality and empathetic emotional labor are used to manufacture a ‘vibe’ of trust and tolerance in the studio. This emotional engineering creates an environment that allows for the best possible musical performances to be recorded (Watson & Ward, 2013).

The engineer must also keep in mind technical and musical aspects of the recording (Pras & Guastavino, 2011). This duality can be expressed as living a ‘precarious double life’ or ‘wearing many hats’ (Beer, 2014). The ideal engineer must be considerate of musicians, as well as possess ‘good ears and instincts’ and a flexible, efficient, and patient personality. They must be organized, discreet and quick (Pras & Guastavino, 2011).

Learning to engineer

Fields: Audio Engineering, Musicology, Music Education; Methods: History, Surveys, Interviews

Learning to engineer involves more than learning how to mic different instruments, mix an album, or master a track. It also involves learning to speak like an engineer (Porcello, 2004), learning to interact with musicians and other stakeholders in a recording project (Bielmeier, 2016), and learning to differentiate between good takes and bad performances (Pras & Guastavino, 2013). Historically, these skills were learned through mentorship, observation, and on-the-job practice (Horning, 2004; Porcello, 2004). Mentorship (guidance provided by a more experienced individual within a discipline or organization) has been presented within the audio literature as a mechanism by which 'tacit engineering skills are handed down from mentor to apprentice' (Seay, 2012) and mentors may 'shape [the] whole listening' of their apprentices (Henriques, 2007). Pedagogically, one professional engineer put it succinctly: ‘If you want a kid

to swim, just throw him in the pool. [As] long as it's shallow, he'll learn to swim faster and better than any lesson's gonna teach him' (Porcello, 2004, p. 737).

Since the 1970s, it has become very common for would-be audio engineers to attend a university or college-level audio engineering program (Bielmeier, 2016). These programs may or may not place an emphasis on the STEM aspects of audio. Overall they take an interdisciplinary approach that combines musical and technical study and may overlap significantly with electroacoustics and computer music curricula (Walzer, 2017). Although these programs may do an excellent job at preparing new audio engineers for technical aspects of audio, the literature suggests that they do not adequately prepare new engineers for social and business-oriented aspects.

Recommendations from the literature include the development of business and communication courses for audio engineers (Bielmeier, 2016) and a heavier focus on hands-on, collaborative peer learning (Walzer, 2017). This strategy is intended to fill the gap left by the dissolution of the professional mentorship system. It's suggested that 'colleges and universities give prospective audio engineers an opportunity to work with their peers and to make mistakes in a safe way without major consequences' (Walzer, 2017) – that they tinker together and teach one another.

The 'technology, recording practice, and popular music culture' marble cake

Technological advances in sound reproduction, the aesthetics of sound recording, and the tangible practices of studio work and live performance are closely interleaved. This is reflected across the board in the literature, hence why this theme is not associated with specific fields or methods. I visualized these concepts as a marble cake consisting of technology, aesthetics, and practices combined in a continuous and densely mixed manner: any slice of the cake (ie. text in this review) will have a little of each topic in it. These entities drive and transform one another,

shaping nearly every aspect of how audio engineers work- from their compression choices while mixing, to the extent to which they socialize with the musicians they work with during a project, to their tactile experience of their work environment (Bates, 2009; Croghan et al., 2012; Théberge, 2004). The topics bleed into one another in such a way that it is not always possible to tell where one ends and the other begins. For example, technological advances from outside the studio impact recording practices within the studio (Pras & Guastavino, 2013). Technological innovations from within the music studio impact popular aesthetics (Bielefeldt, 2015), and conversely, expectations and demands for specific production aesthetics have also altered studio design (Putnam, 1980). Aesthetics of high fidelity (Rumsey & McCormick, 2012) and low fidelity (Homer, 2009) are fetishized and necessitate the use of specific recording techniques and technologies. These technologies in turn imply specific socio-spatial configurations (Seay, 2012; Skea, 2002). The marble cake is rich and baked to perfection.

Recording is about power

The division of studio space into a 'live room' and a 'control room' represents a manipulation of decision-making power: the control room allows the audio engineer to listen to and make decisions about recordings in an isolated environment. In contrast, the live room is the place where the data is sampled– musicians test sounds, run takes, and wait while the sound engineer goes about the business of setting up microphones, choosing outboard gear, analyzing recordings and all of the other activities that make up their work (Bennett, 2017; Gander, 2015; Harrison, 2014; Hennion 1989). Recording is 'achieved through establishing spatial and material relations in order to regulate tasks and roles and manage … decision(making) within temporarily assembled teams engaged in tasks characterized by high levels of uncertainty' (Gander, 2015). A musician who is in the live room can't say with certainty that a specific take is good without

going over to the control room and asking the engineer to play back the recording.[5] Another audio engineer might be allowed to intervene and suggest their own interpretation, but only because of the perception that they can hear in the same analytic way. The engineer must maintain control of a recording situation so that things do not get too bogged down by this 'uncertainty' and differing opinions (Pras & Guastavino, 2013). In this sense the engineer exerting power while organizing a recording session is a pragmatic decision, not an ego-driven one. It is nonetheless a decision with consequences for both the recording process and the final recorded product.

The engineer does not only pass through the physical and sonic space of the studio or music venue unhindered, but they also possess privileged knowledge of the technologies within their environment. For a recording artist, the spaceship-like machined milieu of the studio can engender disorientation or intimidation, but for an audio engineer it is quite transparent (Bennett, 2017; Hennion, 1989). For this reason, learning about recording gear can be an empowering activity for musicians in and of itself (Harkness, 2014; Wolfe, 2019). Even if they lack the skills to operate a studio on their own, understanding studio gear in principle allows musicians increased creative control over their own music (Hecker, 2008). The skilled use of recording equipment allows an artist or producer to define their own sonic aesthetic and to capture their own sound without intervention (Barney, 2007; Morris 2015). This point of productive power gestures to a theme universally reflected in the documents I analyzed: recording technologies and

[5] It is worth noting that anecdotally I have encountered engineers who prefer to work within a 'single-room' studio paradigm, which allows for more direct and unencumbered communication between engineer and musicians- indicating that taking on authority may come at the expense of ease of communication.

the practice of audio engineering more generally are inherently and deeply tied to issues of power and control.

Discussion and recommendations for future research

The purpose of this scoping review was to survey the breath, content and methodologies used in the English-language literature on the working practices of sound engineers working in studio and live sound. I wanted to develop a picture of the current literature landscape. In doing so, I also elaborated an image of who an audio engineer is and what they do which has some surprising aspects as well as some which might be familiar to anyone with a cursory interest in audio engineering.

The audio engineer that emerges from the literature I reviewed wears many hats, and is often precarious (*the changing economics of recording*) despite their position at the nexus of cultural creation, style-making and collaboration *(recording studios as networked sites of cultural production*). They're probably a white man (*diversity in audio*). They are a quick, creative problem solver and facilitator who uses their cultural capital and excellent social and emotional skills to survive in the intense environment of the studio and elicit affects of agreeability, trust and tolerance in musicians (*process and best practices in sound engineering, the social side of engineering*). They have excellent ears and musical taste, and can demarcate themself as a legitimate audio engineer using discourse and by exhibiting these tacit skills, which they probably learned from trial and error or via mentorship experiences (*the ears of the engineer, learning to engineer*). They have a strong sense of musical aesthetics and how they relate to technical factors (*the 'technology, recording practice, and popular music culture' marble cake*). All of these aspects of their identity- their skills (social, embodied, and technical) and their

position as privileged style-maker- give them the power and authority necessary to manage people, make decisions, and guide the creative process (*recording is about power*).

This scoping review also revealed several areas where research is scanty and therefore I would suggest scholars of audio engineering consider in their future work. Firstly, I extracted music genre information from the papers that I reviewed and found that the majority of the relevant literature related to Pop, Classical, Rock, and (to a lesser extent) Jazz music. The literature is heavily skewed towards these genres. Given that audio production practices are often genre-specific (Castillo, 2020; Jago, 2019), I suggest that future research into the working practices of audio engineers bear this in mind and place some emphasis on people working in other music styles. This issue is also intimately connected to the theme of *diversity in audio*, because it is precisely the genres that are least represented in the literature (namely Hip Hop/R&B, Indigenous music, Reggae/Dancehall, Dub) which are most strongly associated with Black and Indigenous cultures and musical traditions. This mirrors the neglect of these musics at large within academic music studies.

I also suggest that more research should focus on live sound and audio mastering. This literature search uncovered only a few articles dealing with issues specific to live or mastering engineers (7% and 2% of articles respectively), and as I mentioned earlier, live sound and mastering are increasingly seen as important spaces for career development for new audio engineering graduates.

Finally, I suggest further integration of the literature on *diversity in audio* and *learning to engineer.* By and large, the implication of the research from *learning to engineer* is that without social learning, aspiring audio engineers will be unable to succeed in the profession. However, authors writing on *diversity in audio* emphasize the importance to women of having isolated

spaces in which to learn and experiment with audio gear. Resolving this conundrum may contribute to improving the educational experiences of young women in audio engineering.

Interstitium II

In the following article, I will digress from describing the role of gender in audio engineering to develop a philosophical framework for understanding the relationship between the gendered construction of technical knowledge and the construction of masculine identity via technical knowledge and social techniques in audio engineering. I develop this framework via a diffractive reading of Michael Polanyi and Marjorie Grene's work on Personal Knowledge (PK) through works on feminist philosophy of knowledge, embodiment, and performance - specifically Donna Haraway's work on partial perspectives, Karen Barad's theory of agential realism, and Judith Butler's gender performativity theory. By bringing these texts into dialogue I explore the relationship between knowing how to do gender and knowing how to do other kinds of things. Simultaneous to writing this piece, I interviewed audio engineers about their own experiences with gender crossing and of embodying masculinity at work (see Chapter 3). These interviews brought into focus the overlap between professional and gender performances, and the two articles should be read as in conversation with one another, since they were written simultaneously.

It might seem a bit strange to make a feminist argument about the character of gender with respect to the work of a mid-century thinker like Polanyi, whose association with Keynesian economics and distrust of socialism were well documented (Congdon, 1997; Festré, 2018). Regardless of his attachment to liberalism, I find his philosophy appealing on several levels. When I first read PK it immediately seemed to me that he might be something of a forgotten brother-figure to feminist philosophers of science, espousing as he did an anti-positivist,

personal, partial, affectual understanding of scientific practice[6]. The intellectual vulnerability of his philosophical project is also a strength: admitting that one knows very little, that it's *necessarily* impossible to talk about some of the things that make one oneself- and that there must be a real, actual, reason for that difficulty- is a standpoint from which one can see some interesting things.

Re-framing performativity in terms of personal knowledge

Polanyi's work is most well-known with respect to his concept of tacit knowledge, which I first encountered through Susan Horning's (2004) article *Engineering the performance: Recording engineers, tacit knowledge and the art of controlling sound*. I'd also read Eliot Bates' (2009) piece about synaesthesia, tactility and embodiment in audio. Finally, I read *Gender Trouble* first during my comprehensive exams, and felt a variety of ways about that text: mainly that I liked what Butler had to say about the social construction of gender, but that their schema felt slightly mechanistic. Not only did gender feel like some strict thing one had to escape to live freely, but it also felt simultaneously immaterial and un-playful. From reading various critiques of Butler's work, I felt there was a cultural over-reliance on framing performativity in terms of a dialectic of struggle and difficulty vs. possibility and potential. Rather, as I will argue, performativities are bodies of personal, largely tacit knowledge developed via trial-and-error processes of meaning-making within a social milieu and are therefore simultaneously established in unfaithful dialogue with institutional forces and demands and a site of self-actualization. By re-framing performativity in terms of personal knowledge, I hope to emphasize the power-to implicit in

[6] Plus, Polanyi's work on reaction kinetics was foundational in mathematical biology, which I'd studied during my undergraduate and master's degrees, and so there was something nice for me thinking about the many strange ways connections happen through texts and time.

performatives, as well as to situate performativities as part of a complex landscape of potentials and powers-to which are available to any given person[7].

Dr. Grene figures heavily in the PK project. She is mentioned in many accounts of PK as an important contributor, and apart from her work with Polanyi has written prolifically on a variety of philosophical topics. I sought to understand to what extent she might have been implicated in the PK project beyond her single editorial credit on Polanyi's (1969) book of essays *Knowing and Being*, so I travelled to Chicago to visit the Polanyi Papers at the university there, which I understood to contain a copy of the Polanyi-Grene correspondence. I spent a week reading through their letters in full, as well as reviewing other archival material I suspected might be relevant to understanding their work. I loved reading these letters: Polanyi and Grene clearly had a good time thinking together. I also spent some time reading Grene's own work; she was an extremely accomplished and lively philosopher who continued to work at a high level until the early 2000's. Her book *A Philosophical Testament* (Grene, 1995) in particular is a crisp and catty romp through philosophical history which en route clarifies the historical and philosophical arguments underlying her and Polanyi's particular brand of science philosophy.

I'm indebted to Alexa Tulk and the other helpful people working at the Hanna Holborn Gray Special Collections Research Center of the University of Chicago for helping me find the things I was looking for, and for maintaining the Polanyi Papers in such an orderly and easy-to-access manner. I'm also indebted to my colleagues in the CATDAWG research group for reading

[7] I don't know if someone who hadn't spent so much time trying to figure out how to successfully (and un-intuitively) perform 'being a woman' would necessarily feel the same way, but successfully 'performing a gendered style' (Butler, 1990) has never felt so different to me from performing the scientist, performing the student, or performing the artist.

through this text and offering their supportive and useful feedback, and to them and Eliot Bates for pointing me towards the work of Karen Barad.

Chapter 1: Knowing, doing, and being: revisiting performativity with Michael Polanyi & Marjorie Grene

Abstract

Using a diffractive methodology, I draw out conceptual resonances between Michael Polanyi and Marjorie Grene's theory of personal knowledge and Judith Butler's performativity theory. Personal knowledge describes how the self as an extended entity consists of accumulated residues of acts of knowing, while acts of knowing are always acts of extending the self, emphasizing the foundational nature of knowledge that is tacit or otherwise difficult to articulate. Drawing from archival materials including the correspondence between Polanyi and Grene, I read their work diffractively through feminist epistemology and theory of the subject as articulated by Haraway, Barad and Butler. In this reading, which was informed by a series of interviews I conducted on knowledge-sharing and gender, the material nature of performativity is emphasized, as is its relationship to other kinds of knowledge. Personal knowledges, including performatives, are materially invested power-to that intra-act with and structure each other, constituting partial, cobbled-together subjectivities.

Keywords: tacit knowledge, Michael Polanyi, Marjorie Grene, performativity theory

Introduction

The personal knowledge (PK) project, developed over the twenty-year friendship between noted philosopher of science Marjorie Grene and her collaborator the polymath Michael Polanyi, is an unusual body of work which does not fall neatly into a single discipline: is PK a theory of perception/cognition, of scientific epistemology, or of theology? In this paper, I point in a different direction, and draw out some of the conceptual resonances between Polanyi and Grene's personal knowledge and Judith Butler's performativity theory. Drawing from archival materials including the correspondence between Polanyi and Grene, as well as their published works and those of the small but enthusiastic community of Polanyi scholars writing under the auspices of the Polanyi Society, I read Polanyi and Grene's work diffractively through performativity with Haraway and Barad alongside. Surprising consiliences and propagative differences emerge.

While PK is not usually mentioned in the context of feminist theories of knowledge/power/embodiment, I suggest that its core concepts of anti-objectivity, unspecifiability, and the integration of knowledge into the self are consistent with feminist epistemology and accounts of the subject. Thinking performativity in terms of personal knowledge suggests a synthetic understanding of knowledge, performativity and subject formation that describes knowing, doing, and being as part of a single mechanism, silhouetting (as I will explore later) an inversion of Foucault's power-knowledge relation: performativities as configurations of (personal) knowledge. Configuring performativity as knowledge is not in itself a novel move (Gherardi, 2011), yet I present a few examples from my research that suggest that using the structure of personal knowledge to articulate performativity can facilitate thinking it in material and situated ways.

Diffractive methodology

In this diffractive reading, I bring together Polanyi, Grene and three formidable mainstream feminist theorists: Donna Haraway, Karen Barad, and Judith Butler. I imagine this in terms of a cocktail party taking place/time simultaneously in Polanyi's office at the University of Chicago, Grene's farm during the 1940s, Donna Haraway's dog trainer's competition ring, and so on- a superposition of spacetime locations, the partygoers pulling with them all the residues of their own lived knowing into a landscape of unusual vertigos and familiar comforts. At this diffractive cocktail party, Butler's theory of performativity comes into conversation with Polanyi and Grene's work on PK, in unruly polyphony with the voices of the other merrymakers we'll encounter this evening:

Donna Haraway, polymathic philosopher of science and theorist of posthuman relations, comes to the conversation by way of her critique of objectivity (Haraway, 1988) and stays for the cyborgian possibilities of extended consciousness. Her cyborg theory and her work on human-animal relations welcomes incomplete, unspecifiable subjectivities, and makes clear the relation between cobbled-together selves and partial perspectives: 'The knowing self is partial in all its guises, never finished, whole, simply there and original; it is always constructed and stitched together imperfectly, and therefore able to join with another, to see together without claiming to be another. Here is the promise of objectivity: a scientific knower seeks the subject position not of identity but of objectivity, that is, partial connection' (Haraway, 1988). Rather than objectivity being about views from nowhere, it is about accountability; partial perspective, or a 'feminist objectivity [that] is about limited location and situated knowledge, not about transcendence and splitting of subject and object' (Haraway, 1985).

Karen Barad, another philosopher of science (not to mention practicing theoretical physicist), is really just here to talk with her old friend Niels Bohr. However, Bohr's in deep discussion with Polanyi himself, and so Barad and Grene find themselves thrown into awkward conversation. It gradually picks up steam: why had we never previously met one another? We have so much to talk about! Barad's ontoepistemology of *agential realism*- according to them at once an ontology, epistemology, and ethics based on the radical meanings of quantum physics- is strange sibling to Grene's *ecological epistemology*, which places *situated biological life* at the center of philosophical inquiry. Opposing (as they both do) Cartesian-Newtonian lineages, Barad asserts that 'theoretical concepts are defined by the circumstances required for their measurement', and 'that practices of knowing are material engagements that participate in reconfiguring the world' (Barad, 2007)[8]. Grene responds: 'All knowledge is orientation'… 'we're part of [reality]… we are living beings seeking, in our funny, artifactual, language-borne way, to orient ourselves in our environment' (Grene, 1995; p. 18). Polanyi chimes in: It's clear that 'our imperfect expressions of truth cannot formulate it without distorting some other parts'! (Letter from MP to MG, 12/1939; Polanyi Papers [Box 16, Folder 1] Hanna Holborn Gray Special Collections Research Center, University of Chicago). At this point, an unexpected interloper appears in the form of Helmuth Plessner, who was talking with Butler and Haraway (and the Cyborg, who keeps flickering uncannily in and out of existence) about sensory aesthetics but gets distracted by

[8] Barad drew heavily upon Bohr's work on complementarity in formulating their theory. Bohr's concept of objectivity was not predicated on separation between objects of observation and agents doing the observing, instead being a matter of 'permanent marks' within the experiment'l apparatus.'Barad uses the term "intra-action" to describe this situation: 'to signify *the mutual constitution of objects and agencies of observation 'ithin pheno'ena* (in contrast to "interaction", which assumes the prior existence of distinct entities). In pa'ticular, the diff'rent agencies ("distinct entities") remain entangled' (Barad, 2007).

Grene's reference to orientation. He starts to say something about embodiment, but is interrupted by Butler.

Noted gender studies scholar and political philosopher Judith Butler might superficially seem out of place at a party with so many 'hard' scientists, but they were invited by Plessner and have encountered some familiar faces: is that Foucault over there chatting with Guattari and Suzanne Langer? Butler's gender performativity theory describes how gender identity is created through discursive practices of 'doing gender' or 'performing a gendered style'. Just as Derrida described the formation of a legal subject- 'the anticipation of the experience of juridical power creates the subject before the law'- Butler describes the formation of gendered subjectivity: 'the anticipation of a gendered essence produces that which it posits' (Butler, 1990). What Butler terms 'metalepsis', or mistaking a cause for an effect, a paradigmatic conceptual framework for an assumed ontology- attributes a sense of naturalness to a system of co-constitutive compulsory heterosexuality, psychoanalytic binary gender, and medico-scientific binary sex. Beyond gender specifically, performativities create subjectivities through a process of subjectivation (Butler, 2010) - for example the economic subject, the class subject, the professional scientist- which exist in intersectional collaboration and tension with one another. As we shall see, this process of subjectification through performative repetition is structurally similar to Polanyi and Grene's continuous augmentation of the self through the internalization of articulate frameworks (which they claim, at length and with a proliferation of examples, represents the basic structure of all knowing).

That PK isn't usually mentioned in feminist histories of philosophy isn't that surprising, since neither Polanyi nor Grene's work had explicitly feminist commitments nor were they in the

philosophical mainstream. Grene mainly worked in history of philosophy and philosophy of biology, while Polanyi was a philosophical outsider who relied on Grene to provide historical and theoretical grounding for his work. This article is not an attempt to argue that their exclusion is a major historical oversight, that they were secretly 'good feminists' and should therefore be reconsidered within the historical record as such (although, I think in their own ways both Polanyi and Grene were committed at least to a minimal concept of 'women's liberation')[9,10]. Nor is it a claim to solve extant issues in feminist theory via an 'improved' performativity based on personal knowledge- too close to buying into a narrative of linear history and theoretical progress. Rather, it's just a little trans-historical jaunt along the bank of the teeming delta between epistemology and embodiment with some chatty characters both living and dead, and in either case functionally fictional (Hepler et al., 2019). Along with these figures, and in a shared spirit of feminist meddling, gossipy epistemologies (Adkins, 2017) and connected knowing (Clinchy, 1996), I 'read various insights through one another to produce something new, new patterns of thinking-being' (Barad, cited in van der Tuin 2012: 58).

Rather than foregrounding one text as foundational and proceeding linearly, reading the texts of these authors through one another diffractively highlights their already-entangled nature, their intra-action a seeking root that 'leads in different directions and keeps analysis and knowledge production on the move' (Mazzei, 2014). After all, 'Our readings and writings are always already intertwined, and then we straighten and sort [them] for academic purposes' (Hepler et al., 2019), so rather than proceeding in a linear or causal way, diffractive methodologies function rhizomatically and via 'a kind of mutual performativity' between the reader and the text,

[9] Who wants a 'good feminist' anyway! Much rather a bad, troubling, 'matted and felted' feminist (Haraway, 2016).
[10]This might also be conceived of as an instance of 'Thinking with and through differences rather than pushing away from and solidifying difference as less than' (Murris, 2019).

between one text and another (Barad, 2007). Reading diffractively opens up a differential, expanding field of possibilities. Just a few of the unanswered questions that doing this work carries in its wake[11] are: in coming to know the texts of Polanyi and Grene, what performativities are Polanyi, Grene, and myself engaging in? In their collaboration both remotely and in person- through their own diffractive practices of conversation, editing, and letter writing- how did Polanyi and Grene themselves read through one another, creating dense textures of knowing? This article was informed by a visit I made in 2022 to the Polanyi Papers, an archive housed at the University of Chicago Libraries Hanna Holborn Gray Special Collections Research Center. How does learning the archive create my own subjectivity as a researcher, as a curious and nosy person? What kinds of desire[12] are at play in the material production of such an archive, and in its re-production through my own practices of reading, documentation (photos taken on my cellphone, transcription) and reconfiguration (structuring the transcriptions in excel, data-and-theory-informed qualitative coding)? What kinds of 'plugging in' or 'threading through' (Deleuze & Guattari, 1980 quoted in Mazzei, 2014) am I doing when I come to these texts with the interview material I conducted for my doctoral thesis already in mind, which is itself also diffractively present as another text in this 'assemblage in formation' (Mazzei, 2014)? Knowledge produced by my interview material (explored in more detail in Brooks, 2024) is threaded through the text in loops and skeins; informed as I was by Polanyi, Grene, Haraway and Butler when I designed the interview guide and conducted the interviews, and as I then return to their work with Barad in order to write this article, which then itself suggests further analysis of the interview material: a knitted structure of knowledge, a tightly interleaved texture (Haraway,

[11] Both forward and backwards in time/space/text.
[12] In the sense of Deleuze & Guattari.

2016). Imagine my surprise and pleasure when I find that diffractive reading is itself 'Polanyian', revealing and revelling in the passionate participation (Murris & Bozalek, 2019; Polanyi, 1948) of the researcher in knowledge production, suggesting the necessity of 'liv[ing] without bodily boundaries by: accepting that much is not knowable cognitively and can never be articulated' (Murris & Bozalek, 2019).

Michael Polanyi, quintessential scientist-philosopher

Michael Polanyi (1891-1976) was born in Budapest to Cecile Wohl and Mihaly Pollacsek, the second-youngest of six children[13]. Mihaly was a railroads engineer, while Cecile was an important figure in the Budapest political and literary scene: he 'very much a westerner', she 'very much a Russian revolutionary' (Scott & Moleski, 1995; Ch.1). Polanyi graduated with a Medical Doctorate from the Medical School of Budapest in 1913, and while getting this degree traveled back and forth between Budapest and the Karlsruhe Technical Institute where he pursued additional studies in physical chemistry, notably receiving the approval of Einstein for his work in thermodynamics. In 1914 (when he was 23) he enrolled in the Austro-Hungarian army, where he served as a military doctor. He also met Magda Kemeny, whom he would later marry[14].

Polanyi retired from active service in 1917 due to anxiety and depression resulting from wartime trauma and took a position as a secretary for the Hungarian Ministry of Health. When the Hungarian Communist Party was elected in 1919, he returned to the University of Budapest[15].

[13] Karl Polanyi, the economical anthropologist, was his elder brother.
[14] During this period of his life Polanyi fell in and out with the 'Sunday Afternooners', a group of individualist, nihilistic thinkers led by Marxist philosopher George Lukács. This may have influenced his later negative outlook on Marxism, which he viewed cynically and as itself a very cynical movement.
[15] He was the only person within that institution to refuse to join the red army (Scott, 1995; Ch.2).

The communist reign was short-lived, and the reactionary anti-Semitic government that replaced it soon spurred the whole Polanyi family to emigrate. Following a forcible eviction from his university position, Michael made his way again to Karlsruhe. He renounced his Judaism, was baptised into the Catholic church, obtained an Austrian passport, and commenced work in reaction kinetics. Magda pursued studies in chemical engineering at Karlsruhe, one of the few women in the cohort of several hundred chemistry students (Scott & Moleski, 1995; Ch.3). Polanyi then moved to Berlin, where he joined a group doing work on fiber chemistry. Magda ended her studies without finishing her PhD, and followed him there shortly afterwards. They remained in Berlin for ten years. During this time Polanyi contributed seriously to several fields of chemistry, developed his ideas about economics and social theory, and started a study group for matters of economic and social interest. He and Magda cultivated a vibrant social circle, much as his parents had done when he was young (Scott & Moleski, 1995). By 1932 the political situation in Berlin had degenerated significantly, and when a colleague at the University of Manchester offered him a position there, he took it. In following years he was heavily involved in trying to extract members of his family from deadly persecution by the Nazis (Scott & Moleski, 1995).

He remained at Manchester throughout WWII, writing extensively on politics and the liberal society; and released two short informative propaganda films about the liberal economic system. This endeavour put him in contact with – among others- the National Film Board of Canada's John Grierson. By 1947, he'd wound down his research in chemistry altogether and begun working on the PK project, which would occupy him for the rest of his life and prove one of his

most lasting legacies[16]. This was a far-reaching and unusual project, which attempted to restore the place of the scientist in accounts of science by arguing that *knowing is a skilled practice*. Polanyi noted that when we attempt to describe processes of coming to know things, we find that these processes can't be fully described or that our explanations appear 'flimsy' upon closer examination. Polanyi's attempts to account for these inarticulable parts of knowledge were developed over the course of his twenty-five year friendship with Dr. Marjorie Grene, who he met by chance at a visit to the University of Chicago in 1950 (Mullins, 2009).

Marjorie Grene, 'philosophical gadfly'

Marjorie Grene (1910-2009) had an academic career nearly as mixed as Polanyi's. After completing a zoology Undergraduate at Wellesley in 1931, Grene traveled to Freiburg where she attended lectures by Heiddeger, and then went on to study with existentialist Karl Jaspers in Heidelberg in 1933. She completed her M.A. and Ph.D. in philosophy at Radcliffe college in Cambridge (which she describes as 'as close as females in those days got to Harvard') between 1933 and 1935 under the supervision of C.I. Lewis (Strassfeld, 2022). Her dissertation built on Lewis's *conceptual pragmatism*, which contended (following from Kant) that the mind organizes reality according to categories[17] which are rooted in its interactions with the world and will be maintained or discarded based on their non/correspondence with experience. The subject is fettered by its embeddedness in stubborn materiality, there is an impossibility of a strong intersubjective reality while still accepting that existence involves contact with a meaningfully

[16] 'To lay down at my age my personality as a scientist (or my impersonation of a scientist) does leave you for a moment a bit naked' (Polanyi, quoted in Scott, 1995; Ch.7)

[17] These categories are not *absolutely* a priori, rather they depend on the subject's social background and are thus *pragmatically* a priori (Dayton, 2021).

real world. Grene's dissertation extended this theory by way of Heidegger, rejecting a Cartesian concept of Ego distinct from the world (Strassfeld, 2022).

Grene suffered from setbacks related to sexism within academia and the great depression[18]. Following her doctoral defense she intended to find work in the university, but was told (in her words) 'Goodbye, you're a bright girl but nobody gives work to women in philosophy.'[19] (Grene, 1995; p.5). She applied to positions at 126 institutions, and was finally appointed director of residence at Monticello, a women's junior college (Strassfeld, 2022). She moved through several sub-optimal work situations within universities until 1944, at which point she and her husband, the classicist David Grene, abandoned academia to work as farmers and raise a family, first in Illinois and then in Ireland. Grene described her time working in agriculture as philosophically re-orienting, leading to an even more 'radically realistic' (materially invested) stance on knowledge and being (Grene, 1995; p. 35). During this period she wrote some of the first English texts on the work of Heidegger and Sartre, placing herself as one of a small number of experts on phenomenology (of which she was largely critical) and existentialism (which she 'loathed'[20]) (Strassfeld, 2022). According to Grene her choices of field were pragmatic,

[18] She was also Jewish, which at the time would have further contributed to difficulty finding meaningful academic work. According to (Strassfield, 2022), 'A formal offer of employment [for her first academic job] was made only after Grene endured an interview by an apparently unreliable Bostonian friend of the president of Monticello College, dispatche' to check that she was not a Jew.'

[19] One '1961 letter from the University of Maine reads 'Basically, we are interested in a good man' [emphasis in the original]' (Strassfield, 2022).

[20] 'Every decade or so I was asked to do something in that field and every time I finished by declaring: 'Never again!'' (MG as quoted in Strassfield, 2022)

existentialism representing a field women could sometimes get academic work in (Strassfeld, 2022)[21,22].

Grene was introduced to Polanyi at some point in 1950, having attended at least one of his lectures at the University of Chicago and impressed by his conceptualization of the role of belief in knowing and refutation of logical positivism (Mullins, 2010). Her subsequent contribution to Polanyi's philosophical education and to the PK project specifically cannot be overstated (Scott & Moleski, 1995)[23]. Grene served as confidant, critic, colleague, and philosophical mentor to Polanyi, who considered himself both a novice and outsider within the tradition (Scott & Moleski, 1995; Polanyi Papers, Letter from MP to MG, 04/09/1960; Polanyi Papers [Box 16, Folder 1] Hanna Holborn Gray Special Collections Research Center, University of Chicago). Their voluminous correspondence, curated for relevance to Polanyi's developing philosophy, currently resides at the University of Chicago. At some points during their friendship, they wrote letters up to several times daily, detailing their academic collaborations and solo engagements as well as the minutiae of their personal lives.[24] These letters show Polanyi appealing to Grene over the years both to evaluate the quality of his own work and to indicate how seriously to take other philosophers, ultimately conceding to her on most points of disagreement[25]. At a few points they

[21] While continental philosophy became associated with feminist philosophy during the second half of the 20th century, this did not meaningfully result in philosophy departments and associations in the USA becoming more welcoming to women: firsthand accounts Grene's contemporaries indicate that they remained stubbornly masculinist at least up to the turn of the century (Strassfield, 2022).

[22] Grene was also strongly critical of analytic philosophy, and of 'word games' in general: 'Even in the treatment of 'applied' problems, one can get away with any degree of irreality, so long as one is clever' (Grene, 1995; p. 37).

[23] For a thorough review of her involvement in PK grounded in their correspondence, see Mullins (2009, 2010).

[24] From reading through the archive, it's clear that correspondence lacking any academic context has been purged from the archive, presumably for relevance and family privacy reasons.

[25] He spoke highly of her to colleagues. In a 1964 letter to Grene Sigmund Koch writes: 'Your name was a household word here in Durham last year. You are obviously a constant, luminous presence in Dr. Polanyi's mental field: he quotes you for authority at every turn. And every time I attempted some callow witticism about Existentialist opacity, he re-convinced me that I must have a course at your feet. I therefore already regarded you as friend and teacher before your note arrived' (Breytspraak, 2016).

quarreled in relatively serious ways, but the overall sense presented by their correspondence is of a vivacious and intense collaboration characterized by devotion, respect, and mutual influence.

Following their first encounter, Polanyi obtained a Rockefeller grant in 1952 and used the funds to hire Grene as his research assistant at the University of Manchester (Mullins, 2009; Scott & Moleski, 1995). She helped him to prepare his second series of Gifford lectures in 1952, which they would then later transform into the manuscript for the 1958 book *Personal Knowledge* (Mullins, 2010). Rather frustratingly, neither the Polanyi Papers nor Grene's own accounts of their work together offer much insight into Polanyi and Grene's collaboration prior to the publication of PK; few of their letters from this period remain. However, their correspondence from the 1960's onwards and contemporary accounts of their relationship during this time seem to indicate the continuity of its character over the decades (Mullins, 2010), as does Grene's own account that she 'acted partly as Polanyi's research assistant and chiefly… as editor and as advisor in the history of philosophy' (MG quoted in Mullins, 2010)[26]. Her deep and 'extra-Polanyian' (Grene, quoted in Mullins, 2010) interest in historicity places Polanyi's lateral argumentation in helpful context: 'I found myself fascinated by various figures, and periods, in the history of philosophy, subjects that held little interest for Polanyi. When I was working with him. I did indeed try to assist him with historical information when it was needed; but he thought of history from a scientist's point of view—as a source from which to cull tidbits, but no more' (Grene; quoted in Mullins, 2009)[27].

[26] I would like to suggest that editing can in certain instances be an excellent example of a diffractive method.

[27] Polanyi liked to re-interpret the work of other philosophers in ways that supported his theories, to Grene's frustration. For example, Polanyi read Kant's critiques, and in a 1959 letter he claims that the real theme of Kant's Third Critique (Critique Of Judgement) is that 'all comprehension is informal and personal', to which Grene responds in the margins: 'I don't believe it', adding as a postscript: 'I would merely say: as an exposition of Kant

Given their close collaboration and the extensive contribution of Grene to Polanyi's philosophy, it's curious that she is credited as an editor only on one of Polanyi's books- *Knowing and Being* (1969), a compilation of his essays which Grene assembled. Their correspondence belies the possibility that this was an oversight on Polanyi's part: he clearly adored Grene, held her in very high regard, and sought her more close involvement in the PK project. Rather, she refused or ignored repeated appeals to be paid for her labor and receive additional editing or authorial credits.[28] While Grene described herself as 'taken, most of the time, with unacceptable minority positions… [holding] to the maxim … that the more eminent in academic philosophy, the more likely it is that he (or she) is a fraud' (Grene, 1995; p. 2), it seems she might have been cagey about an on-paper co-authorship with Polanyi. I suspect several factors were at play in this dynamic. Considering the difficulties Grene faced in obtaining academic opportunities and her struggles with being taken seriously as a woman philosopher of science, co-authorship with Polanyi might have represented a subtle career risk given Polanyi's outsider status within philosophical circles, especially the quasi-religious flavor of some of Polanyi's writing. Taken in conjunction with the necessity to differentiate herself in the public eye from Polanyi given his role in aiding her return to academia following her time farming and raising her children, it's perhaps unsurprising that this was her stance. Polanyi himself wasn't shy about expressing frustration with her unwillingness to associate herself more strongly with the project: 'You (Marjorie) are a philosopher, intent on finding out how things stand and you accept the

---

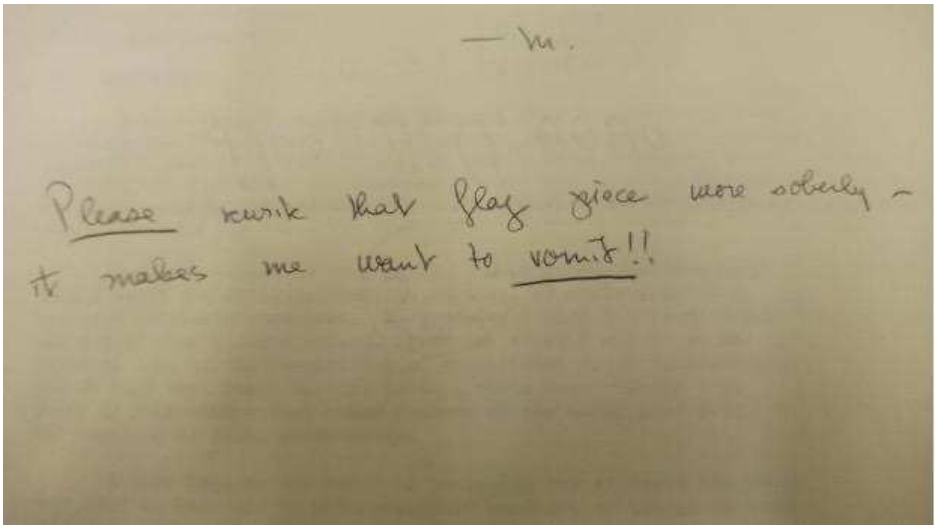
this couldn't be wronger. Surely this isn't what you said to me in Cambridge. Pure hypnotism, obviously.' See Fig. 2 for further evidence of this kind.

[28] 'The situation is obscured by the absence of your name on the title page. I do think you should be described as the editor of this collection. You have, in fact, done quite a bit of editing and I think it would be useful to add a remark on this matter introduction' (Letter from MP to MG, 22/12/1968; Polanyi Papers [Box 16, Folder 3] Hanna Holborn Gray Special Collections Research Center, University of Chicago).
This part of the letter was ignored by Grene in the correspondence that follows, see Appendix C.

framework of dual knowing; you have all the knowledge of philosophy, past and present that I lack- what is your reason for leaving this enormous body of thought unleavened by the new insights which you share with me?' (Letter from MP to MG, 04/09/1960; Polanyi Papers [Box 16, Folder 1] Hanna Holborn Gray Special Collections Research Center, University of Chicago). Grene handled these complaints gently, but was (often hilariously) candid in her critique of Polanyi, especially his typically florid writing (see Fig. 1. for a good example).

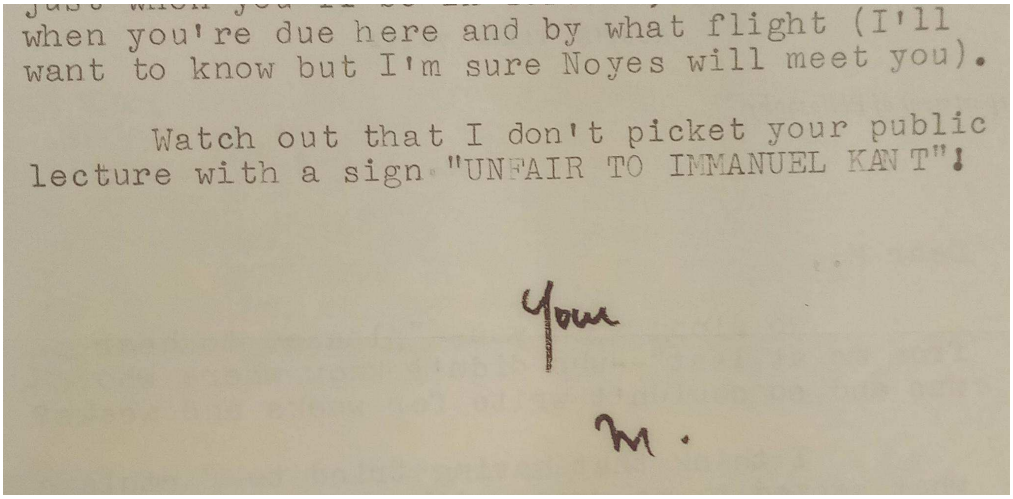
Grene began lecturing again in 1959 at Leeds, and then moved to the University of California Davis, where she lectured until her retirement in 1978. While at UC Davis she completed a series of traveling lectureships, including one at the University of Texas at Austin that notably culminated in a rather nasty department coup in 1966 partially detailed in the Grene-Polanyi correspondence[29]. During her long and prolific academic career, she published thirteen books and at least forty articles, mainly on the history of philosophy, epistemology of science, and the philosophy of biology. She has been widely recognized as one of the few women philosophers to achieve academic success in the early 20th century, and her contributions in philosophy of biology are widely recognized within the field (Strassfeld, 2022).

[29]She wrote to Polanyi in Dec, 1968: 'Dear Michael, It is very good indeed to hear from you; I've been feeling bleakly in need of my friends' support. The Davis department, headed by Bossart, is trying hard, it seems, to push me out. I've been badly shocked and hurt by this… I refuse to be pushed, but it's a very distressing situation. Bossart gave them the impression that I was seriously thinking of leaving, although I had firmly said I would return and then he showed them Silber's letter which I had sent him solely for use in getting the merit increase which he said I was up for, and they blew up. Even if the whole thing should quiet down, it makes the situation at Davis very unpleasant, to say the least.' (Letter from MG to MP, 18/12/1968; Polanyi Papers [Box 16, Folder 3] Hanna Holborn Gray Special Collections Research Center, University of Chicago)


— M.

Please rewrite that flag piece more soberly –
it makes me want to vomit!!

Figure 1. One memorable letter, typewritten except for a handwritten scrawl at the end, finishes: 'Please rewrite that flag piece more soberly- it makes me want to vomit!!' (Letter from MG to MP, 10/12/1969; Polanyi Papers [Box 16, Folder 3] Hanna Holborn Gray Special Collections Research Center, University of Chicago)


when you're due here and by what flight (I'll want to know but I'm sure Noyes will meet you).

Watch out that I don't picket your public lecture with a sign "UNFAIR TO IMMANUEL KANT"!

Yours

M.

Figure 2. Polanyi and Grene had much correspondence about Kant. (Letter from MG to MP, 01/11/1966; Polanyi Papers [Box 16, Folder 1] Hanna Holborn Gray Special Collections Research Center, University of Chicago)

Personal Knowledge

> *Things as we perceive and learn to understand them are always things in the limited perspective through which we have access to them. That's why, knowledge is always partial, the real never exhausted through our lines of access to it, however sophisticated*

and ingenious they become. But neither is our experience atomized, meaningless, without ordering principles, as the empiricist tradition would have it. The place we start from and return to has recognizable shapes and ways of being and becoming. (Grene, 1995; p. 36)

The knowing self is partial in all its guises, never finished, whole, simply there and original; it is always constructed and stitched together imperfectly, and therefore able to join with another, to see together without claiming to be another. Here is the promise of objectivity: a scientific knower seeks the subject position not of identity but of objectivity, that is, partial connection. (Haraway, 1988, p.586)

The four central elements of the PK project that I will foreground in my reading are a critique of objectivity, the from-to structure of knowledge, extension into articulate frameworks, and the unspecifiability/tacit nature of knowing. This reading is informed by my own research interests. For each of these elements, I will first briefly introduce Polanyi and Grene's argument. Then I will bring our companions from the introduction back into the conversation, moving forward and backwards in time and space to knit together their thinking and writing on the nature of knowledge and subjectivity. Polanyi's attitude towards referencing other philosophers leaves PK itself curiously ahistorical and unmoored within 20th century intellectual history, and so when possible I have contextualized these summaries by referring to Polanyi and Grene's correspondence, to Polanyi's personal papers, and to Grene's accounts of working together.[30]

1. *Anti-objectivity*

[30]Polanyi would likely have wanted to see his work contextualized in this way. He writes: 'In writing PK I always felt that my own interpretation was so different from that of earlier writers that it would be excessively laborious to make their mutual relation clear. However, I regret the omission and hope you will be prepared to help me in remedying it' (Letter from MP to MG, 14/01/1963; Polanyi Papers [Box 16, Folder 1] Hanna Holborn Gray Special Collections Research Center, University of Chicago).

The purpose of this book is to show that complete objectivity as usually attributed to the exact sciences is a delusion and is in fact a false ideal. (Polanyi, 1958; p. 18)

The PK project originated in a sustained critique of positivism in science, refusing 'views from nowhere' (Haraway, 1988). Polanyi and Grene argued that objectivity is not 'somewhere totally detached from human practice: it is … the developed [human] capacity to make judgements in accordance with the evidence' (Grene, 1995; p. 18). This conceptualization was materialist in the sense of insisting on an actual present reality that we are a part of and can engage with directly using (Polanyi's words) sensorimotor means, which in their estimation are the source of 'true' objectivity[31]. We infer things about our environment based on our sensorimotor[32] apparatus, which we have developed over time to interpret the rich and varied flow of sensation - it is inflection points, regularities, and changes in this sensation which are interpreted as analogous to structures in the world. Perception involves seeking this flow, perceiving relevant features, and optimizing the mode of its reception via sensorimotor feedback. The sensing process is active: consider for example the stapedial reflex, which by tensing a muscle within the inner ear compresses loud sounds in order to protect the hearing apparatus and allow for a wide range of

[31] Neither Polanyi nor Grene considered PK to be a phenomenological theory. Polanyi differentiated himself from Husserl and phenomenology more broadly by virtue of holding to the idea of unspecifiability: 'All critical philosophy since Descartes has assumed that the roots of our knowing can be explicitly stated and are to be lumped or swallowed as a priori, necessary, etc… and that, to the extent to which we cannot explicate them, or having explicated them, do find them dubitable without self-contradiction, they have to be uprooted, come what may! Hence the absurdity of existence; and since we actually continue to believe what we have falsely proved untenable, hence also our abject scientistic idolatry' (Letter from MP to MG, 15/07/1962; Polanyi Papers [Box 16, Folder 1] Hanna Holborn Gray Special Collections Research Center, University of Chicago). He critiqued Husserl's 'assumed… existence of 'simple evidence' to be 'kept free from all interpretations that read into them more than is genuinely seen' as 'monstrously bad as an epistemology of perception, but highly suggestive towards recognition of complex entities perceived' (Letter from MP to MG, 10/15/1959; Polanyi Papers [Box 16, Folder 1] Hanna Holborn Gray Special Collections Research Center, University of Chicago). Grene, on the other hand, rejected Husserl's phenomenology as idealistic (Honenberger, 2023).

[32] Polanyi's phrasing, later picked up by theorists of enactive and extended cognition.

hearable amplitudes.[33] Conversely, the structuring of our senses that allows us to actually *perceive* depends upon the skilled inference of meaning: '… the very *contents of our sensation* depends on recognizing their meaning. Perception is interpretative' (Polanyi Papers, 'Notes on Prejudice', 28/11/1939; italics mine)[34]. As such, knowledge is always unavoidably personal (hence, Personal Knowledge), and theory need not be universal to be relevant[35]. Therefore, in order to have any semblance of objectivity '… independent observers with as varied previous experience as possible should be used to sum up the contents of reality…their apparently irreconcilable contradictory experiences may possess entirely equal validity' (Polanyi Papers, 11/28/1939, 'Notes on Prejudice').

It is not that Polanyi believed that there is no real shared universe, he was not making an ontological claim to multiplicity- as Haraway said, 'scientists and feminist empiricists do tend to believe that they are describing and discovering real things by means of all their constructing and arguing' (Haraway, 1988, pp. 579)- but rather that good science can only be based on the evidence of the body, even going so far as to explicitly conceptualize 'science as a variant of sensory perception' (Polanyi, 1966). Rather than discarding the possibility of meaningful science under these conditions Polanyi and Grene meant to expose the dishonesty of approaches

[33] See also Polanyi's sight example, wherein as a tiny baby, the muscles of the eye adjust the thickness of the lens in order to produce the sharpest possible image of an object in front of us, by which feedback we come to develop an 'interpretive framework that assumes a ubiquitous existence of objects' (Polanyi, 1958; p.101).

[34] According to Grene far after the fact, this is analogous to Merleau-Ponty's insistence in *Phenomenology of Perception* upon 'the priority of embodied being-in-the -world and of the way things come to us, and we to them, through sensory channels' (Grene, 1995; p.22). Grene first read Merleau-Ponty in 1960 (Grene, 1995), and by 1964 Polanyi confirmed having purchased and begun to study *The Phenomenology of Perception* at her urging (Mullins, 2022). While Grene seems to have suggested that Merleau-Ponty had 'anticipated the two kinds of awareness [focal and gestalt] and their relation to each other' (Letter from MP to MG, 06/06/1964 as quoted in Mullins, 2022), Polanyi expressed dissatisfaction at what he perceived as a lack of structure in Merleau-Ponty's phenomenology. Merleau-Ponty had rightfully identified the importance of tacitness or unspecifiability in knowing, but according to Polanyi he had not identified the structure of tacit knowing. For an excellent and much more thorough treatment of Polanyi and Grene's relationship to Merleau-Ponty (and by extension Husserl), also referencing the Polanyi-Grene correspondence, see Mullins (2022).

[35] Polanyi points to the presence of successful partial scientific theories such as crystallography.

claiming a mechanistic process of science, and to re-center the scientist (with individuality, ingenuity and meaningful understandings and hunches) in accounts of doing science and to illustrate that the capacity to perceive rightness in scientific theory and application is always in terms of passionate participation in a social field. Polanyi describes the desire to make science automatic as 'a craving rooted in the very depths of our culture', and even suggests that paradigms claiming the validity of totalizing computational models of the world are totalitarian in character (Polanyi, 1958; pp. 139-42).

Rejecting accounts of scientific practice that claim access to a totalizing 'objective' truth via overdetermined and fully articulable means, Polanyi and Grene point to how our tools for scientific meaning-making are both well developed and necessarily individual. For Polanyi, having a belief in something (ie. accrediting ones' own knowledge as true based on one's experience) is the only meaningful measure of truth (Polanyi, 1958). This does not mean that he advocated an indiscriminately uncritical stance, but rather that the lifetime accumulation of experiences, information, tacit associations, and beliefs which upon reflection result in evaluating certain things as true, i.e., believing them to be true, is the only useful strategy towards truth. They illustrate the impossibility of taking a perspective without perspective in a way analogous to Haraway's feminist epistemology which conceptualizes knowledge in terms of situatedness and partiality.

2. *From-to Structure*

> *Embodiment is significant prosthesis; objectivity cannot be about fixed vision when what counts as an object is precisely what world history turns out to be about. (Donna Haraway, A Cyborg Manifesto, 1985)*

Polanyi argued that ‘knowing how’ (as in to hammer in a nail) is a fundamentally similar type of thing as ‘knowing what’ (as in to know what is in front of us). ‘All knowledge has a ‘from-to’ structure: it is the groping of embodied beings toward the understanding of something in the world … it is through that from-to relation that knowledge is rooted in the reality of the knower and his (her) world’ (Grene, 1995; p. 122). Knowing involves using one aspect of a scenario or configuration (the ‘from’ element, which typically recedes into the experiential background) to know something about another aspect of the scenario or configuration (the ‘to’ element, which is that-which-is-attended-to). For example, consider how ‘readers tend to attend to the content of a text rather than to the marks (or even, in most cases, the precise words) by which the content is conveyed’ (Honenberger, 2023). Put otherwise, knowledge is about intervention (Barad, 2007).

The Gestalt movement, started in Germany in the 1930s and associated most strongly in PK with the work of Wolfgang Kohler, attempted to develop a framework for understanding how people organize information, create wholes from parts, and recognize patterns from the superstructure downwards. Rather than splitting psychological phenomena into smaller parts, gestalt conceived of them as organized, structured wholes. Using the language of Gestalt in his development of a concept of the from-to structure of knowledge, Polanyi related knowing and the extension into articulate frameworks in terms of the complementary concepts of focal (gestalt, superstructural) and subsidiary (particular, ‘dismembered’) awareness (Polanyi, 1958; p. 63). Employing the illustrative example of hammering in a nail, he describes how we have a focal sense of ourselves driving in the nail, being able to feel the contact with the nail and the hammerhead – we have incorporated the hammer itself into our own body, we ‘indwell’ in it - but we have a subsidiary awareness of the various elements and contact points at play, which we can attend to by shifting our awareness to them:

> ‘When we use a hammer to drive in a nail, we attend to both nail and hammer, but in a different way... When we bring down the hammer we **do not feel that its handle has stuck our palm but that its head has struck the nail**. Yet in a sense we are certainly alert to the feelings in our palm and the fingers that hold the hammer. They guide us in handling it effectively … The difference may be stated by saying that the latter are not, like the nail, **objects of our attention,** but **instruments of it**. … I have a subsidiary awareness of the feeling in the palm of my hand which is merged into my focal awareness of my driving in the nail.’ (Polanyi, 1958; p. 55, emphasis in the original)

Just as an awareness of subsidiary elements transforms into a bigger picture (rather like a magic eye puzzle, where unfocusing the eyes results in a recognizable image emerging from constituent elements which are now assigned meaning with respect to the focal whole) the opposite transformation is also possible. Superstructural, ‘gestalt’ understanding often seems confused or breaks down when we examine the subsidiary particulars which make it up and try to relate them to each other[36]. Moving from focal awareness to attendance of subsidiary elements has a ‘disorganizing effect’ (Polanyi, 1958; p. 63) and is a ‘dismemberment’ or ‘destructive analysis’ (Polanyi, 1958; p. 63) which results in losing the sense of things, losing track of the purpose or meaning of the constituent focal elements, or in a loss of physical or mental coordination[37].

[36] According to Polanyi such ‘destructive analysis’ does not invalidate the superstructure, since actually the isolated particulars are enmeshed in a web of tacit knowledge that is ‘unspecifiable’ or inarticulable but nonetheless meaningful.

[37] The capacity to switch between focal and subsidiary elements can be a useful skill: for example, when mixing a piece of music, it is often necessary to switch between listening ‘musically’ and listening ‘analytically’. In this case, the focal awareness is of the effect of the piece of music (emotionally, pleasurably, in terms of overall balance and feeling) while the subsidiary awareness is to the individual tones, their timbre, volume, dynamics, and so on. Building skill as a sound mixer typically involves learning to switch between these perceptual modes repeatedly, and it is not uncommon for sound engineers to complain of difficulty switching into focal awareness when they have spent excessive time in subsidiary attention.

3. *Extension*[38] *into articulate frameworks (Indwelling and Commitment)*

> *Even in ordinary perception… we [in]dwell- thanks to the structure of tacit knowledge in the objects of our perceptions- they are extensions of ourselves, and we are the concretions of them …this sort of in-betweenness is characteristic also, though in different ways, of language, of systematic knowledge, and of ritual–it's characteristic of everything that makes us human. (Letter from MG to MP, 11/01/1970; Polanyi Papers [Box 16, Folder 5] Hanna Holborn Gray Special Collections Research Center, University of Chicago)*

The from-to structure of knowledge implies the basic act of knowing involves a bi-directional process of indwelling in tools, 'pour[ing] ourselves out into them and assimilat[ing] them as parts of our own existence. We accept them existentially by dwelling in them.' (Polanyi, 1958; p. 61). This augmentation of the self via indwelling he termed *commitment*, rendering personal knowledge subjective in the sense of forming the subject, rather than in the sense of being trivially personal[39]. He underscored that the 'dynamic' assignment of meaning and potential to tools underlies our entire experience of the world around us and within ourselves. Meaning-making is a skillful act (the skills involved coming from previous experiences of meaning-making, all the way back to first experiences of interpreting sensorimotor experience as a baby), and as a project occurs always with respect to what he termed the *articulate frameworks* which we have made into a part of our own selves and which define limiting and enabling potentials. The intention to accomplish a task (hammer the nail, know what frequencies are problematic in a room, calculate the event horizon of a black hole, find out the current price of blackberries in

[38]I do not mean extension in the sense of C.I. Lewis, who distinguished extension (the class of actual things to which a statement applies) and intension (whatever must be true of any possible world in order for that proposition to be true of it). Rather I invoke it in the sense of extended cognition.

[39] Jha (1997) says: In feminist epistemology, subjective is used where personal might as well be.

California) results in the transformation of something that was separate from us (the hammer, a parametric EQ, a theory of relativity, the internet) into a part of us: 'The acts of doing and knowing, the valuation and the understanding of meanings, are thus seen to be only different aspects of the act of extending our person into the subsidiary awareness of particulars which compose a whole' (Polanyi, 1958).

The boundaries of what constitute an articulate framework in a Polanyian sense are quite flexible, it is only necessary that it have the potential to be implicated in meaning-making: 'A valid articulate framework may be a theory, or a mathematical discovery, or a symphony.' (Polanyi, 1958; p. 195) Drawing an analogy between the process of building an interpretive framework by sensory meaning-making and the process of shaping the meanings assigned to words over the course of a lifetime of using them, Polanyi argues that we may interiorize language, 'formal instruments of thought', cultural norms, and 'rules of art' (Polanyi, 1958; p. 70). For example, he describes how the minimal concepts of science are internalized via language:

> 'We assimilate most of these pre-suppositions by learning to speak of things in a certain language, in which there are names for various kinds of objects, names by which objects can be classified, making such distinctions as between past and present, living and dead, healthy and sick, and thousands of others.' (Polanyi, 1958; p. 59)[40]

'Pre-suppositions' remain within subsidiary awareness, and in accordance with the disorganization that occurs when attention switches to subsidiary awareness 'when we try to

[40] Pre-suppositions look rather similar to the pragmatic categories advanced by C.I. Lewis.

formulate them [make them explicit] they appear quite unconvincing' (Polanyi, 1958; p. 59). Nonetheless they allow us to say meaningful things about the world.

Polanyi critiques attempts to address this destabilization by justifying 'pre-suppositions' in terms of the intellectual framework that they undergird, calling this move the creation of a 'pseudo-substitution, which relies for its meaning entirely on our familiarity with the conceptions it is trying to replace' (Polanyi, 1958; p. 372). For example, he identifies scientists' penchant to sublimate their enjoyment of rationality into terms like 'simplicity', 'symmetry', 'elegance', and so on. These terms are 'used for smuggling an essential quality into our appreciation of a scientific theory, which a mistaken conception of objectivity forbids us openly to acknowledge' (Polanyi, 1958; vp. 16). Rather than recognize that what is being discussed is simply a *felt sense of rightness* associated with an aesthetic quality of theory, a pseudo-substitution is used to fold this sense into an objectivist framework- 'by defining scientific merit in terms of its relatively trivial features, and making these function in the same way as the true terms which they are supposed to replace.' (Polanyi, 1958; p.17)[41]

4. *Tacitness/Unspecifiability*

> *The actual foundations of our scientific beliefs cannot be asserted at all. When we accept a certain set of presuppositions and use them as our interpretive framework, we may be said to dwell in them as we do in our own body... They are not asserted and cannot be*

[41] An obvious analogy can be seen between pseudo-substitution and Butler's treatment of sex and gender as metalepsis. In Butler's work 'biological sex' functions as a pseudo-substitution, simply a hologram of the concept it is trying to replace (IE, gender). Polanyi says: 'This power of a system of implicit beliefs to defeat valid objections one by one is due to the circularity of such systems… the circularity of the theory of the universe embodied in any particular language is manifested in an elementary fashion by the existence of a dictionary of language.' (p. 289). Words (as Polanyi points out) imply their own world, a dictionary implies its own ontology- these kinds of systems are self-referential but that does not mean they are not real in the sense of being internalized as 'tools at one's disposal', it simply means they are not originary.

> *asserted, for assertion can be made only within a framework with which we have identified ourselves for the time being; as they themselves are our ultimate framework, they are essentially inarticulable. (Polanyi, 1958; p. 60)*

The 'tools at our disposal' are often *tacit* or *unspecificable.* Unspecifiable knowledge comes from repeated experience, through 'groping in the world' and recognizing regularities in our encounters with it. Polanyi attributes the broad variety of human behaviors to the enormous variety of iterations and possible executions of this process of exploration and experimentation. Grene hashes this out in full in Chapter 1 of *A Philosophical Testament*, and argues that the fundamental issue Polanyi was trying to respond to in *Personal Knowledge* was the difficulty in defining the meaning of *justified* in the justified true belief definition of knowledge, accepting that justification in this context might mean a variety of different things and may sometimes (usually) be impossible to fully codify: 'Knowledge is justified belief, which we have good reason to believe but can never 'know' for sure, is true. Belief, in turn, however carefully defended, is the elaboration by a sentient, embodied being of its perceptions of the structures of its environment. That's why there is always a tacit foundation of knowledge: it cannot be detached from the efforts of living, sentient beings to orient themselves among the salient patterns of things and events offered by a real perceptual world' (Grene, 1995; p.17).

Because judging whether two things are consistent or not requires a personal evaluation, made in terms of one's previous experiences and individual techniques for meaning-making, even the most seemingly objective truths are fundamentally personal. (Of course, previous experiences may have involved other people telling you what they think, or what they think you should think, making up an element in the whole of that experience.) Even seemingly specific knowledge such as being able to recognize an instance of an object or a consistency between two events is

fundamentally unspecifiable: 'Since the world, like a kaleidoscope, never exactly repeats any previous situation (and indeed, if it did we would not know it, as we have no means of telling that time had passed in between), we can achieve consistency only by identifying manifestly different situations in respect to some particular feature, and this requires a series of personal judgements' (Polanyi, 1958; p. 80).

Knowing, doing, and being: a diffractive theory of performative (personal) knowledge

> *Society is a form of existence. It is a way in which people make sense (MP, Polanyi Papers, 7/12/39)*

Performativity theory, or the idea that language does more than simply describe the world or reflect an underlying interior state but can also constitute an action in and of itself, is usually understood to have originated in the work of philosopher of language J.L. Austin (Cavanaugh, 2015). Austin, a contemporary of Polanyi and Grene's[42], conceived of all utterances as performing actions ('communication that does something'). A second lineage for performativity comes from performance theory, for example Erving Goffman's dramaturgical sociology (Smith, 2021).

Although it doesn't seem to be the case that Polanyi and Grene knew Goffman, they had read and were in contact with another theorist of performance, Helmuth Plessner. Before discussing Judith Butler's gender performativity theory, I'll take a moment to discuss Plessner's *philosophical anthropology* in relation to PK. It has been argued that Plessner's work anticipates current queer and feminist approaches in the humanities, as well as extended models of cognition, and so understanding his relationship to Polanyi and Grene is one path by which to

[42] There are several passing references to his work in their correspondence.

connect them to feminist theory in general and gender performativity in particular (De Mul, 2014). Plessner was a theorist of embodiment, his position was that a person's experience in the world is mainly determined by their relationship with their body. According to Plessner, figuring the body, mind and senses as mutually constitutive presents a solution to the question of mind-body dualism, with sensory modalities as the interface between the mind/body, mind/world and body/world (Plessner, 2013)[43]. Looking to aesthetics rather than simple description as the place of human meaning-making through the senses, Plessner presents a philosophical treatment of sensory perception which he terms an *aesthesiology*, with *sensory aesthetics* as the mode of analysis.

> We would never be able to discern the peculiar sense of a sensory modality if we simply proceeded descriptively/analytically and attempted to parse the qualitatively different sensory impressions… Every attempt to clarify it will be disregarded as only a deferral of analysis, [since] it remains something irreducible, [something] merely felt in the impression. (Plessner, 1923/2013)[44]

[43] Plessner's argument around sensing and mind-body dualism was picked up by Polanyi, who also seemed to believe that this approach would iron out the mind-body issue: 'But if the Cartesian dualism can be disproved, as I believe to have done, determinism should vanish. All that need to be said, that: The action of the mind in moving our body is felt by ourselves and it can be observed from outside in the same way as other mental states are observed, namely by indwelling. Objectivization, whether of another person's gestures or of his utterances, cancels our dwelling in them, destroys their meaning, and cuts off communication through them. To demand that we should demonstrate mental action by physiological or physical-chemical observations, is to demand that we observe this action while refusing to look at it' (Letter from MP to MG, 01/08/1966; Polanyi Papers [Box 16, Folder 1] Hanna Holborn Gray Special Collections Research Center, University of Chicago). However, according to Grene he somewhat mischaracterized the argument: 'I now see what you meant to say though it's still the case that you didn't say it clearly and it's not Cartesian dualism you're talking about in any event. Otherwise it's fine!' (Letter from MG to MP, 01/11/1966; Polanyi Papers [Box 16, Folder 1] Hanna Holborn Gray Special Collections Research Center, University of Chicago)

[44] There is a clear correspondence between Polanyi's 'unspecifiable' knowledge and the ineffable element that Plessner suggests is so often used in philosophical treatments of the self to bandage the mind and body together.

His concept of *excentric positionality* - or the double experiencing of self, that humans not only experience their life but also experience themselves experiencing it- renders human activity always already performative, since we are both *in* ourselves and *at a distance observing ourselves*, a distance which is collapsed in moments of intense bodily disorganization such as uncontrollable laughter (Veleten, 2009). In Barad's terms, excentric subjectivity constitutes an intra-acting apparatus, a material-discursive phenomenon: *the mutual constitution of objects* (I, observed) *and agencies of observation* (I, observing myself) *within phenomena* (the subject), constituted through repeated, variable, and changing practices including cultural practices and technologies in the extended sense. Plessner's 'law' of *natural artificiality* further states that that technology and culture are fundamental to the project of bridging the distance between the self and others implied by our excentric positionality, and therefore to being a human person. He argues that humans are, and have always been, composed of both organic and technological components (De Mul, 2014).

Polanyi read Plessner's work, though seemingly only after they met in person. Plessner was a participant in Polanyi's Study Group on Foundations of Cultural Unity, which assembled at Bodoin College in 1965 for a week of discussion and writing on the theme of conceptual reform within science, art and the humanities; thus, this influence would have occurred after the publication of PK and contemporaneously with the publication of *The Tacit Dimension*. Plessner is first directly mentioned by Polanyi in a 1966 letter to Grene in which he tries to describe objects as embodying aggregates (eg. a flag embodying a nation), suggesting the role of ritual and aesthetic experience in producing interiority.

> 'A tune, a line of poetry that grips and of course the humble recital of an ancient rite, all of these and a hundred other well-known means of gripping our whole person achieve the

> transition [from external knowledge to self-knowledge]… This links up of course with the phenomenology of play acting and of allied manifestations surveyed by Plessner' (Letter from MP to MG, 30/06/1966; Polanyi Papers [Box 16, Folder 1] Hanna Holborn Gray Special Collections Research Center, University of Chicago).

In this letter and afterwards Polanyi seems to have struggled with the relationship between indwelling and *embodiment;* 'embodiment' seems to have functioned as a stand-in for either indwelling or for sensing in Plessner's sense. Indeed, Polanyi's extensivity and Plessner's natural artificiality share with Haraway's Cyborg a fuzzy and porous external membrane, an enriching and pleasurable constitutive relationship with technologies and sensorimotor techniques and a generalized confusion about what exists inside vs. outside of the self - though the Cyborg is more fractured, less serious, and certainly more profane than either Plessner or Polanyi's conceptions[45].

They also anticipate Butler's work on how performativities generate subjectivities. While Grene had read Foucault, I have found no textual evidence that she read Butler, who brought Foucauldian concepts of power to bear on performativity to understand this relation, first in the context of the phenomena of gender and later with respect to political and economic subjectivities. According to Butler, the creation of gendered subjects is a historical process that depends on repetition and reiteration: the gender binary is performatively produced, with 'its apparently seamless regeneration bring[ing] about a naturalized effect' (Butler, 2010). This implies a possibility of failure: 'performativity never fully achieves its effect, and so in this sense

[45] For an example of this confusion between inside and outside, in one letter from Grene, she urges him to abandon the claim that the viewer of a piece of art is 'embodied' in the piece of art (Letter from MG to MP, 17/09/1969; Polanyi Papers [Box 16, Folder 4] Hanna Holborn Gray Special Collections Research Center, University of Chicago).

'fails' all the time; its failure is what necessitates its *re*iterative temporality' (Butler, 2010). In terms of natural artificiality, gender is one of the tools that humans use to reach outside of themselves and stabilize their innately excentric positionality (Schöndube, 2023). On an individual level a person performs gender because the activity of doing so allows them certain affordances and provides a sense of internal cohesion: in Plessner's terms, in our excentric positionality we see ourselves enacting our felt gender and see it being received as successful.

Gender illegibility upsets and destabilizes a sociality based on a stable gender hierarchy. Conversely, one learns through trial and repetition that gender legibility can be a powerful tool for stabilizing one's position in a gendered power structure and creating a sense of safety, intensifying the coercive power of gender hierarchy. This cuts several ways. For example, I showed how women working in a male-dominated field use performances of masculinity to construct a *gender-crossed* masculine identity which affords them power and authority (Brooks, 2024). In a slightly different move, Berner (2008) shows how machine workers use masculine performances in conjunction with performances of technical prowess to ward off feelings of class-based powerlessness and subjugation: because powerlessness is culturally placed at odds with 'being a man' (Jefferson, 1994), 'workers often 'play out the drama of manliness in work settings' as a way of [psychologically and socially] coping with degrading work conditions and a loss of control' (Berner, 2008)[46]. Performing technical expertise can be understood as constitutive accessory to performing masculinity, by positioning themselves as technical experts Berner's machine workers figure themselves as in control of the means of production, a position

[46] Within Berner's framework, the successful performance of professional excellence depends upon what she calls 'working knowledge', or 'the practical achievement of performing the right bodily and mental activities together with machines.' This embodied knowledge involves learning and enacting scripts in dialogue with technology, a mutual performativity with technology.

that allows them to maintain a sense of their own success at 'being a man' (Berner, 2008; Connell, 2015).

We have seen that expertise can constitute a performance, that knowledge can be a performativity (Berner, 2008; Koltun, 2015). Looking to the other side of Foucault's power-knowledge relation, performativities can be understood as (personal) knowledge in action. Through repeated performances we interpellate our own identities, performativities represent articulate frameworks integrated into our assembled, cyborgian, always-partial subjectivities. From this perspective, developing knowledge-power can be conceptualized both as an act of creative self-augmentation and as an acting out of the potentials implied by already incorporated frames.

What could thinking performativity in terms of personal knowledge look like, and what diffractive potentials are revealed by formulating it in this way? First I'll present a brief synthesis, and then an argument of relevance which emerged from this reading. The correspondence is not perfect, my goal is not perfection but rather to diffractively re-vision performativity and PK in terms of each other (and in terms of the other partygoers at this historical-theoretical party) rather than proceeding algebraically by substituting the terms of PK into the terms of performativity and seeing what cancels out. These are nonlinear, hysteretic systems, and diffractive methodology is about difference and entanglement. The ragged seams between concepts are where theories jostle and grind, and so this procedure is undertaken keeping in mind that the places where ideas are in seeming misalignment may be potent departure points for further thought.

What can conceptualizing performativity in terms of PK do for performativity, and what can conceptualizing PK in terms of performativity do for PK?

> *The disciplined body is one that has to co-ordinate its movements in the most minute detail…The schoolboy Foucault describes has to pay attention to the placement of his feet, the extension of his spine, the grip of his pencil, the formation of his letters. These movements are a training because they become habits, sustaining the attentions of power without passing through consciousness... In Foucault's power/knowledge regimes, the knowledge is taken in, folded into the subject's very being.' (Bell, 2006)*

I will step out of the frame for a moment to talk about how my own research has informed this reading, 'threading through' insights from a series of interviews on gender and knowledge I conducted in 2020-2021 (Brooks, 2024). I interviewed women, men and non-binary people about their experiences of performing gender while working in the highly masculinized field of audio engineering. The goal of these interviews was to try to understand why audio engineering has remained so male-dominated for such a long time. Based on my experiences working in the field, I knew that professional knowledge was somehow implicated in gender performance, and that gender performance might be implicated in bodies of professional knowledge such as those associated with audio engineering. I remember at one point writing that audio engineers were very literally learning gender performances in audio school and at work (along with more typical things that come to mind such as learning to patch a stage, set levels and listen analytically) and then backtracking: that couldn't be right, far too obvious a mechanism for the fields' continued masculinization! And plus (per the multiplicity and contextuality of gender) what even *is* a successful masculine or feminine performance anyway? Then I conducted the interviews, and the participants related having recognized the expectation that they should perform masculinity in

certain kinds of ways quite explicitly, an expectation that was communicated both in pedagogical settings and in workplaces. Indeed, masculine performativities comprise some of the key interpersonal skills that are necessary for success within the field, and learning these social techniques constitutes both knowledge creation and the formation of masculine subjectivities (Annetts, 2015). This project highlighted the continuity and constitutive intra-action of gender performativities and other kinds of performativities, other instances of knowing-how; see Albarracin & Poirer (2022) for a complementary treatment.

Returning to this reading, taking as a departure point that performativities are themselves one kind of personal knowledge, then according to Polanyi they will necessarily be partial, have a from-to structure, constitute articulate frameworks, and will have foundations that are inarticulable. I address these points one by one.

First, the partial and personal nature of objectivity. Learned performatives become standpoints from which we can know the world, they have analytic power (Kraus, 2017) and their simultaneous availability to us constitutes our patchwork subjectivity. Simultaneously acknowledging the performative aspects of knowledge we might not usually think of as such- for example listening, which can take on a performative quality when it is observed (Srader, 2015), or may be actively performed as part of professional identity, as in the case of the audio engineers I studied- highlights how subjectivity involves continually becoming a certain configuration of sensory techniques and physical strategies in a material world. This subjectivity is developed via embodied sensorimotor practices of knowing, a.k.a. personal knowledge. Performativities always exist within a context of other internalized tools and frameworks, knowledge that comes from 'groping in the world' and recognizing regularities in sensory experience. As such, they are intractably bound up in tacit, unspecifiable, embodied knowledge

that reaches back into the past to the earliest moments of sensory structuring even before birth. Of course, babies are also political subjects in the sense that they have political implications, and gendered subjects in that they are implicated by coercively normalizing institutions and practices ranging from 'corrective' genital surgeries to gender reveal parties. But Butler's melancholic subject who experiences these coercions, seeks self-expression via conformity and subversion, is subjectified by certain performativities, and makes (or is denied) choice among social positions always emerges in intra-action with the learning/sensing subject with intentional motility, who moves, learns, seeks regularity in sensory experience, and is subjectified by seeking to decode the world in a coherent way. They are both/together constituted in intra-action with autonomic body functions, with reflexes and motile patterns that are controlled 'below the brain stem', functions that become subsidiarily part of the gestalt of being a self and can be experienced by intentional attentional practices such as meditation, drug-taking and so on.

Secondly, its from-to structure. We're always trying to do something with performativities, using one aspect of a scenario (a bodily comportment, a certain mode of speech) to probe another aspect of a scenario (achieving an intended reception, producing an affect or effect in oneself or another). This explains the iterative nature of performativities and their always-disjoint articulation and rearticulation through materiality. Performances are perlocutive, and 'perlocution implies risk, wager, and the possibility of having an effect … certain kinds of effects can possibly follow if and only if certain kinds of felicitous conditions are met' (Butler, 2010). The 'from' recedes into subsidiary awareness, very rarely are we actively aware of the details of our own bodily movements and habits which constitute performance- our bodies have become disciplined, we have practiced. The 'to' is also sometimes naturalized into a sense of

identity or ‘I am’ but comes into clear focus in moments of social stress (moments of heightened emotion, unstable relations, or insecurity).

For example, my research participants related using deliberate performances of masculinity to create a sense of authority and being the one in charge in the unstructured environments they work in, deliberately tending to an end (leveraging the power afforded by masculinity) via their bodily movements and performative utterances. When we practice a performativity to achieve an end - for example, performing masculinity in such a way that we place ourselves in proximity to a hegemonic form to leverage power within a structured gender field - we interpellate ourselves, in this example as gendered subjects with a defined and stable position in the pecking order. While these gender performances were not always understood as ‘successful’- the reception of a gender performance is often out of the control of the performer- the act of extension into a gender concept also creates meaningfully real gendered experience.

Third, we internalize performativities into ourselves, and they define a certain sense of identity that becomes naturalized. We perform in ‘the mode of belief’ (Butler, 1990), in the ‘fiduciary mode’ (Polanyi, 1958). Grene says of the dense repetitiveness of sociality: ‘Certain performances make the person who he or she is in a given social order. Ritual … retains a certain substantive material existence in the bodies manipulated under its rule’ (Grene, 1995; p. 162). When she says ritual retains ‘substantive material existence’, she’s saying that the self is constituted through what it does; performatives inscribe themselves upon the body. Polanyi says: ‘Like the tool, the sign or the symbol can be conceived as such only in the eyes of a person who *relies on them* to achieve or to signify something… Every act of personal assimilation by which we make a thing form an extension of ourselves through our subsidiary awareness of it, is a commitment of ourselves; a manner of disposing of ourselves.’ (Polanyi, 1958, p. 61) Put otherwise, relying on a

tool, sign or symbol (performative act) in order to accomplish something incorporates that act into oneself, thereby forming the self.

Thinking also constitutes a performative practice, thought is performative in the sense of contributing to the repeated practice of the self which is the self, the formation of subjectivity. Butler says: 'Thinking itself has a performative dimension… in this process of thought… I explicitly constitute myself a person, and I shall remain one to the extent that I am capable of such constitution ever again and anew' (Butler, 1990; p. 95). In other words, the type of performing that is thought re-subjectifies the self continually, forming the self through internal discourse. This self-subjectification was identified by Foucault as manifesting in the Western sense that one should always be searching for the 'truth' about oneself; it is Plessner's excentric subjectivity all over again. The self-regulatory practice of making oneself an 'object of discourse and therefore an object of power/knowledge [takes place] in the very process of producing knowledge about oneself and constituting oneself as an individual subject' (Basumatary, 2020).

Returning to language and communication, performativity as Butler theorized it conceives language as both semantic and bodily, thinking language in the anti-abstract, in full materiality, such that it 'must be spoken or written, heard or seen (or touched if one is blind) …. It exists, as we all do, bodily or not at all' (Grene, 1995; p. 83). In Polanyi's framing of language as an articulate framework or aggregate of articulate frameworks, it is a toolkit by which we extend into reality. 'It is not words that have meaning, but the speaker or listener who means something by them' (Polanyi, 1958; p. 252). As Grene says, 'submersion in language is not necessarily, or even usually, a process of detaching from reality: it is our road of access to it' (Grene, 1995; p. 123).

Fourth, the unspecifiability and tacitness undergirding performative knowledge. Performative modes that are highly embodied are easily identifiable as having tacit dimensions. Gender is an easy example: it's very difficult to specify what one is doing when we perform gender, one just learns to do it through observation and repetition - as is characteristic of tacit knowledge. The tacit nature of gender has been commented upon explicitly by researchers working in enactive cognition and pedagogical performance studies, one of a very few instances where Polanyi's work is brought up both in a form true to his central argumentation and in an explicitly feminist context (Lund, 2013; Kraus, 2017). Lund (2013) argues in their work on using 'learning through movement' to share gender knowledge that 'The gendered body can be seen as a form of tacit knowledge that might be possible to articulate by way of the body.' I would rearticulate this in terms of *personal* knowledge resting on *tacit* foundations, because not only are there some elements of the gendered body that can be communicated explicitly through speech but also the gendered body is not intersubjective and incommunicable, rather it is extremely personal and contextual and communicated all the time through tacit means. Regardless, their thesis remains that a way to effectively share gender knowledge is by performing it together, because it cannot *all* be explicitly articulated, it has to be seen and felt.

It is also precisely because it is difficult to describe exactly what is happening when one is performing gender that the pseudo-substitution of a gendered category for a set of gendering practices is so invisible and pernicious. There is a fluid exchange between performance and identity, where one is naturalized as the other, sign becomes signified, a naturalized category is dropped in as an explicit tag for a tacit performance. This sleight of hand is revealed by looking at professional performativity as a site of unsubtle delineation. In professional performativity, the work of 'You are an X' is made obvious, since any professional identity is clearly constructed

and somewhat fictive, a writing-over of a complex contiguous field of personal experience and skill, and the boundaries of what constitutes professionalism are constantly written and rewritten according to granular historicity and social context. (This is also true for gender, but professional identities are comparatively unstable and so they make the pseudo-substitution obvious).

Read this way, the PK project relates the twin processes of skilled knowing and subjectification, bridging performativity theory (which connects repeated action to subjectivity) and a feminist epistemology based on partial perspectives. Personal knowledge, including performatives, are knowledge-power that is co-constitutive with and structuring of subjectivity. The extension of the self into articulate frameworks (their repeated, iterative reinscription into the self) involves continually re-subjectifiying in ways that involve various degrees of rebellion, humor, and in/fidelity to normative articulations. By enacting the potentials implied in internalized articulate frameworks, in fidelity to them and in duplicitous ways, we re-create our subjectivity according to the allowances implied by these tools. Performativities, as with all personal knowledge, function in the fiduciary mode and rest on largely tacit foundations.

Disrupting a critique

There is a commonly-levied critique of performativity theory that I think can be partially addressed by thinking knowledge and performativity in terms of each other. This has to do with the existence and character of agency – specifically, whether agency can be more than simple resistance or a struggle between hegemonic / non-hegemonic performative modes.

According to Butler, a 'psychic theory of performativity' relates performatives to formation of the subject through repetition and reiteration, transforming features of the world into features of the self (Butler, 1990). This is typically articulated in terms of power: juridical power shapes the

subject, and performativities afford certain powers-to to the performer. The melancholic subject is stuck in fitful conflict with the affordances allowed her by whatever powers she is subjectified by. If only juridical power is considered, subjectivity forms only with respect to relations of domination: ‘Subject formation is the modality by which power operates and it follows that the psychic interiority of the desiring subject is merely a result of the operation of power' (Boucher, 2006). Resistance takes on the character of a ‘choose your own adventure’, wherein a ‘melancholic’ subjectivity practices ‘the precarious assertion of identity through an always-ambiguous demarcation of mainstream subjectivity from marginalised alternatives’ (Boucher, 2006)[47]. This restrictive picture seems to imply a deterministic universe wherein the social reproduction of a performativity involves inescapable, unwilling cooperation from the subjectivities it creates: ‘The power/knowledge relations that produce the subject require that subject … to respond in ways that in turn sustain those power/knowledge relations’ (Bell, 2006; p.215).

Simultaneously, Butler’s account of resistance seems to refer to a primary individualism- that the subject primarily seeks identity: 'I' comes 'into social being ... because I have a certain inevitable attachment to my existence, because a certain narcissism takes hold of any term that confers existence' (Quoting Boucher quoting Butler). These two ideas of agency as simultaneously deterministic and voluntaristic seem to be in contradiction: the pre-discursive subject seeks itself,

[47] A note on Boucher’s critique of Butler: I am largely in agreement with his Marxist materialist critique of Butler’s work on hate speech. However there are other parts of his critique that I explicitly don’t like – especially one specific argument around illocution and perlocution that has a flavor of trans panic to it. He writes: ‘Specifically, the theory of performativity supposes that illocutionary declaratives miraculously transform not only the social status of the speaking subject, but also the sexed materiality of the *res cogitans*. For Butler (somewhat incredibly), the performative character of social identity suggests that the ontological characteristics of the body are conferred by the discursive matrix which constitutes its gender.’ A critique that boils down to ‘speech does not illocutionarily transform the position of the speaker, because bodies objectively have certain parts’ is not very useful- the whole point is to recognize that ontologies of gender and sex *are* in fact constructed socially *through* materiality, and by speaking, we modify the ontology we work with while also recreating it.

the individual 'somehow selects from a range of socially scripted alternatives in an auto-production of self-identity' (Boucher) while simultaneously being constituted *through* discourse, with resistance existing as a mechanistic response to the transgressive space implied by any system of power. Because agency exists only in terms of symbolic structures while also 'gravitat[ing] to the pre-social kernel of the individual', it tends to be both abstract and individualistic in a liberal sense while failing to consider materiality and institutional complexity (McNay, 1999). This argument can be summarized as: 'Although dethroned from the position of generative origin and constitutive subject, the individual in the theory of performativity nonetheless remains the motor of political subversion' (Boucher, 2006)- the subject is formed only in submission to power, but is somehow not reducible to it.

This reading is unsatisfying on several levels. First, it fails to describe how performatives 'are lived in relation to the web of social practices in which they are enmeshed … reduc[ing] the politics of the performative to a series of dualisms- signification versus resignification, norm versus abjection- which are far from adequate in capturing the complex dynamics of social change and how this impacts on identity formation' (McNay, 1999). Secondly, it fails to account for the role of power-to in structuring subjectivity, representing a cynical viewpoint that rests upon a core concept of authenticity wherein performing the self involves struggling to be authentically legible in a context of repression and overdetermination.

Polanyi was aware of this paradox, going so far as to describe a sort of prototypic melancholic subject subject to the strictures of society, always aware of the lives not lived. He deliberately tried to shake determinism by describing a pre-discursive primordial selfhood - an 'active principle' who learns, originating in 'our innate sentience and alertness… self-moving and self-satisfying impulses of both purpose and attention which antedate learning in animals and

themselves actuate learning' (Polanyi, 1958; p. 96). This active principle initiates a process of sensory structuring and exploration in which early acts of sensing and perceiving the limits of what can be sensed and known define a subjectivity that is expanded in non-deterministic ways through coming to know things, which for Polanyi is the engine of subject formation.

Reframing performativities as personal knowledge gestures to how the subjectification that takes place through them exists in a pluripotent and co-creative milieu with other instances of subject-formation through personal knowledge, defining a complex field of potentials that has materiality baked into it from the start. In the case of gender, rather than only gesturing to how knowledges are gendered due to the naturalized gender of the normative knower, thinking performativity this way also illustrates how knowledge can itself generate and shape gendered subjectivities. Considering the recording studio as an example, the technologies and techniques of music production are a powerful site for the production of masculinity: audio technology is coded as masculine via its historical association with mastery, tinkering, and exploration; and so men use technical knowledge of audio equipment as a performative to iteratively produce their own masculinity (Bates, 2022), and masculinity is prerequisite to being identifiable as a 'legitimate' user of such equipment (Annetts, 2015). However, there is also the necessity of producing an environment characterized by positive affect and trust via skilled performances of masculinized emotional labor (Watson & Ward, 2013). Taken together, these performative elements- which themselves are constituted by domain-specific knowledge- constitute a preferred configuration for masculinity in audio, and also the knowledge required in order to succeed in the field in the first place (Marshall, 2020; Bielmeier, 2016, 2017).

Conclusion

Polanyi and Grene's theory of personal knowledge describes how knowledge is created by extending the borders of the self into tools (including but not limited to physical tools, ontologies, language, 'rules of art', and norms). The self as an extended entity consists of accumulated residues of acts of knowing, while acts of knowing are always acts of extending the self. It also emphasizes the primacy of tacit knowledge, or knowledge that is 'inarticulable'. Reading this theory through Judith Butler's performativity theory- which develops a mechanism describing the performative production of identity- and alongside the works of Donna Haraway and Karen Barad suggests an interpretation wherein knowing, doing, and being are conceptualized as part of a single mechanism. In this reading, which was diffractively informed by a series of interviews I conducted with audio engineers on knowledge-sharing and gender, the material, complex and situated nature of performativity is emphasized, as is its relationship to other kinds of knowledge.

Presenting performativity as a kind of personal knowledge is one illustration of the theoretical consistency between performativity theory and a feminist conception of knowledge based on partial perspectives, perspectives which are always in the end about developing tools for intra-acting within an ever-changing world. It also sidesteps thinking of the self only in terms of struggle. In this rendition, the subject remains a byproduct of power, since considering something (such as a sensory technique) a 'tool at one's disposal' implies power-to, but this is a very material and specific power. Instead, the incorporation of articulate frameworks shape the subject, and personal knowledge affords certain tools to the knower. Personal knowledges, including integrated performatives, are materially invested power-to that intra-act with,

constitute and structure subjectivity. Rather than being limited to norm/anti-norm moves, performative knowledge defines spaces for agency and surprise.

Bibliography

Adkins, K. (2017). Gossip, epistemology and power. *Springer International Publishing AG, Gewerbestrasse*, *11*, 6330.

Albarracin, M., & Poirier, P. (2022). Enacting gender: an enactive-ecological account of gender and its fluidity. *Frontiers in Psychology*, *13*, 772287.

Annetts, A. (2015). *Masculinity and gear fetishism in audio technology community discourse* (Doctoral dissertation, Anglia Ruskin Research Online (ARRO)).

Barad, K. (2007). *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Duke University Press.

Basumatary, J. (2020). Michel Foucault on regenerative relatedness of power/knowledge and truth. *Journal of Indian Council of Philosophical Research*, *37*(3), 323–341. https://doi.org/10.1007/s40961-020-00224-4

Bates, E., & Bennett, S. (2022). Look at all those big knobs! Online audio technology discourse and sexy gear fetishes. *Convergence*, *28*(5), 1241-1259.

Bell, V. (2006). Performative knowledge. *Theory, Culture & Society*, *23*(2-3), 214-217.

Berner, B. (2008). Working knowledge as performance: On the practical understanding of machines. *Work, employment and society*, *22*(2), 319-336.

Bielmeier, D. (2016). Audio recording and production education: Skills new hires have and where they reported. *Journal of the Audio Engineering Society*, *64*(4), 218-228.

Bielmeier, D. (2017, October). Audio education: Audio recording production students report skills learned or focused on in their programs. In *Audio Engineering Society Convention 143*. Audio Engineering Society.

Boucher, G. (2006). The politics of performativity: A critique of Judith Butler. *Parrhesia*, *1*(1), 112-141.

Breytspraak, G., & Mullins, P. (2016, June). Michael Polanyi and the Study Group for Foundations of Cultural Unity (SGFCU) and the Study Group on the Unity of Knowledge (SGUK). In *Panel for Polanyi Studies: Past, Present, and Future, 2016 Polanyi Society Conference, June* (pp. 8-11).

Brooks, K. (2024). 'I'm still just a girl in boots holding a multitool': brokering masculinity in audio engineering. *Article in preparation.*

Butler, J. (1990). *Gender trouble: Feminism and the subversion of identity*. Routledge.

Butler, J. (2010). Performative agency. *Journal of cultural economy*, *3*(2), 147-161.

Cavanaugh, J. R. (2015). *Performativity*. Oxford University Press.

Clinchy, B. M. (1996). Connected and separate knowing: Toward a marriage of two minds.

Connell, R. W., & Messerschmidt, J. W. (2005). Hegemonic masculinity: Rethinking the concept. *Gender & society*, *19*(6), 829-859.

Dayton, E. (2021). *CI Lewis*. Oxford University Press.

De Mul, J. (2014). Plessner's philosophical anthropology: perspectives and prospects.

Gherardi, S. (2011). Ways of knowing: Gender as a politics of knowledge. *Handbook of gender, work and organizations*, 37-49.

Grene, M. G. (1995). A philosophical testament. Open Court.

Haraway, D. (1988). Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective. *Feminist Studies*, *14*(3), 575–599. https://doi.org/10.2307/3178066

Haraway, D. (2016). *Staying with the trouble: Making kin in the Chthulucene.* New York: Duke University Press.

Haraway, Donna. 'A manifesto for cyborgs.' (1985): 65-107.

Hepler, S., Cannon, S., Hartnett, C., & Peitso-Holbrook, T. (2019). Undoing and doing-with: Practices of diffractive reading and writing in higher education. *Posthumanism and higher education: Reimagining pedagogy, practice and research*, 141-151.

Honenberger, P. (2023). All Knowledge Is Orientation: Marjorie Grene's Ecological Epistemology. In *Canguilhem and continental philosophy of biology* (pp. 39-60). Cham: Springer International Publishing.

Jefferson, T. (1994). Theorizing masculine subjectivity. *Just boys doing business? Men, masculinities and crime*, 10-31.

Jha, S. R. (1997). A New interpretation of Michael Polanyi's theory of tacit knowing: Integrative philosophy with 'Intellectual Passions'. *Studies in History and Philosophy of Science Part A*, *28*(4), 611–631. https://doi.org/10.1016/S0039-3681(96)00013-1

Kołtun, A. (2015). *Can knowledge be (a) performative? Performativity in the studies of science*. Wydawnictwo UMCS.

Kraus, A. (2017). Gender as a Form of Tacit Knowing in the Fields of Pedagogy. *Culture, Biography & Lifelong Learning*, *3*(1), 12-19.

Lund, A. (2013) Staging gender: the articulation of tacit gender dimensions in drama classes in a Swedish context, Gender and Education, 25:7, 907-922, DOI: 10.1080/09540253.2013.860430

Marshall, O. (2020). Shibboleths in the studio: Informal demarcation practices among audio engineers. *Social studies of science*, *50*(6), 881-900.

Mazzei, L. A. (2014). Beyond an Easy Sense: A Diffractive Analysis. Qualitative Inquiry, 20(6), 742-746. https://doi.org/10.1177/1077800414530257

McNay, L. (1999). Subject, psyche and agency: The work of Judith Butler. *Theory, Culture & Society*, *16*(2), 175-193.

Mullins, P. (2009). In Memoriam: Marjorie Grene. *Tradition and Discovery: The Polanyi Society Periodical*, *36*(1), 55-69.

Mullins, P. (2010). Marjorie Grene and personal knowledge. *Tradition and Discovery: The Polanyi Society Periodical* , *36*(2).

Mullins, P. (2022). Polanyi and Grene on Merleau-Ponty: historical notes with footnotes to Charles Taylor, Francis Walshe, FS Rothschild, and Gilbert Ryle.*Tradition & Discovery*, *48*(3).

Murris, K., & Bozalek, V. (2019). Diffracting diffractive readings of texts as methodology: Some propositions. *Educational Philosophy and Theory*, *51*(14), 1504-1517.

Plessner, H. (1923/2013). The Objectivity of the Senses. *Phenomenology and Mind*, (4), 16-26.

Polanyi, M. (1958). *Personal knowledge : towards a post-critical philosophy*. Routledge.

Polanyi, M. (1966). The tacit dimension. Routledge.

Polanyi, M. (1969). Knowing and being: essays by Michael Polanyi.

Schöndube, F. (2023). Taking Oneself in Earnest, Plessner's Philosophical Anthropology and Trans discourse. *The New Scholar*, *1*(2), 1-10.

Scott, W. T., & Moleski, M. X. (2005). Michael Polanyi: scientist and philosopher.

Smith, G. (2021). Dramaturgical frameworks and interactionism. In *The Routledge International Handbook of Interactionism* (pp. 70-81). Routledge.

Srader, D. W. (2015). Performative listening. *International Journal of Listening*, *29*(2), 95-102.
Strassfeld, J. (2022). ' I am aware that this letter may be offensive': The Unapologetic Achievements of Ruth Barcan Marcus and Marjorie Glicksman Grene. *Journal of the History of Ideas*, *83*(4), 579-600.

Tuin, I. V. D., & Dolphijn, R. (2012). *New materialism: Interviews & cartographies*. Open humanities press.

Velten, H. R. (2009). Laughing at the body: Approaches to a performative theory of humor.

Watson, A., & Ward, J. (2013). Creating the right 'vibe': emotional labour and musical performance in the recording studio. *Environment and Planning A*, *45*(12), 2904-2918.

Interstitium III

Through the literature review and Chapter 1 I've sought to understand some of the structuring contextual factors at play within the ongoing masculinization of audio engineering: namely, that successful audio engineering relies on being able to exercise power in order to guide the musical process, the naturalization of the audio engineer as masculine, the importance of emotional labor and tacit knowledge in audio engineering, and the relationship between gender and knowledge. In order to connect these elements to a specific, contextualized understanding of gender and power in audio - and thereby to a structural understanding of why there are so few women in audio - it's also necessary to understand the norms within education and work settings that link identities and specific kinds of experience (eg., a workplace culture of sexual harassment or microaggressions), and the influence of being a member of a subordinated group on long-term career prospects and felt experiences.

The following article dials in on one of these elements by determining how widespread experiences of discrimination and microaggressions really are within audio engineering. It was part of a research project with Dr. Amandine Pras, Dr. Athena Elafros, and Monica Lockett, all at the time working at the University of Lethbridge. The part of this larger project that I was involved in consisted of developing, administering, and analyzing the data from the first international survey documenting the experiences of discrimination and microaggressions faced by subordinate groups in audio engineering. The research primarily focuses on women, but also draws attention to the experiences of LGBTQ2S+ people, racial/ethnic minorities, migrants, and disabled people, as well as age-based discrimination.

Dr. Pras and Dr. Elafros employed me as a research assistant at the University of Lethbridge to work on this project in 2019. We worked closely together on the survey instrument, which was based on Lewis and Neville's Gendered Racial Microaggressions Scale (Lewis & Neville, 2015). I implemented the survey in Qualtrics, an online survey-making tool, and I publicized it using a variety of methods: online (mainly on Facebook groups such as 'Hey Audio Student'), via email correspondence to key individuals who I knew would forward the survey within their networks, university listservs, in person with Dr. Pras at the AES general convention in NYC and a series of short talks I gave about the project while living in Europe. Dr. Pras also promoted the survey via her social networks and enlisted the aid of some of her students from the University of Lethbridge to help administer the survey at the AES convention. The talks I gave took place at HAW Hamburg, a London AES chapter meeting, the University of York, and the Royal Conservatory in the Hague. I had many meaningful conversations during this process, it was an extremely valuable opportunity to 'test the waters' and explore both students' and audio educators' attitudes related to gender and discrimination in audio. The transition out of the relative stability of the education system and into professional employment is a critical and delicate moment for new audio engineers (Bielmeier; 2016), and the students were clearly aware that they were walking out into a social field in flux.

Following administering the survey I cleaned the dataset and conducted a statistical analysis of the survey data using Matlab. I worked mainly with the quantitative data from the survey, using a combination of non-parametric ANOVAs and descriptive statistics; while Monica Lockett conducted a qualitative coding of the open-ended text-based questions included in the survey, which has not yet been published. The paper included here was written collaboratively, in the interdisciplinary spirit of the project, but I was the first author. As first author I had final say in

everything included in this paper, and I have my co-authors approval to include this article as one of the chapters in this thesis.

Beyond just gender-based discrimination, we also noted significant discrimination based on racial/ethnic difference, disability, and age (with younger engineers reporting significantly more microaggressions than older engineers). We also found some things we weren't initially expecting to find - notably the overall severity of the financial precarity faced by audio engineers of all genders, supporting the theory that audio engineering is a site of exclusionary closure. Despite this financial precarity, careers in audio engineering remain highly sought after (Watson, 2013; Porcello, 2004). Given the conditions of extreme scarcity it is perhaps unsurprising that discrimination is so rampant: only by excluding anyone they can (i.e. those who are already vulnerable to systemic discrimination) can audio engineers protect the exclusivity of their profession and remain solvent. This is consistent with other work describing exclusionary closure, where under conditions of precarity a threatened social group may deliberately exclude certain identities to maintain cohesion.

There was a good deal of lively online conversation about the paper when it came out, some of it of the 'never read the comments' variety, but some very thoughtful, engaged, and sympathetic. In the two years since it was published, it's been featured by popular audio YouTubers, cited in three books (one on popular music pedagogy (Anthony, 2022), one on the musicology of code (Crowdy, 2022), one on recent advances in spatial audio (Katz, 2022)) and more than a dozen articles – some dealing with topics related to the masculinized nature of audio culture, and some not. Notably, Pi, and Yang's (2022) AES convention paper used our survey instrument to conduct a similar survey in an East Asian context, finding related but different results and pointing to an abusive studio culture in Japan and China.

Chapter 2: Do we really want to keep the gate threshold that high?

Grace Brooks,[1,2] *AES Student Member (Grace.brooks@mail.mcgill.ca) ;* Amandine Pras,[1,3,4] *AES Member (Amandine.Pras@uleth.ca); Athena Elafros,*[5] (Athena.Elafros@uleth.ca); Monica Lockett,[5] (M.Lockett@uleth.ca)

[1] Centre for Interdisciplinary Research in Music Media and Technology (CIRMMT), Montreal, Quebec [2]School of Information Studies, McGill University, Montreal, Quebec
[3] Digital Audio Arts program, Department of Music, University of Lethbridge, Lethbridge, Alberta
[4] Centre George Simmel, School of Advanced Studies in the Social Sciences (EHESS), Paris, France [5] Department of Sociology, University of Lethbridge, Lethbridge, Alberta

Abstract

Drawing upon the survey instruments of Lewis and Neville [1], Nadal [2], and Yang and Carroll [3], we conducted an online survey that captured experiences of discrimination and microaggressions reported by 387 recording engineers, producers, and studio assistants living in 46 different countries. Our statistical analyses reveal highly significant and systemic gender inequalities within the field, e.g., cisgender women experience many more sexually inappropriate comments ($p < e\text{-}14$, large effect size) and unwanted comments about their physical appearance ($p < e\text{-}12$, large effect size) than cisgender men, and they are much more likely to face challenges to their authority ($p < e\text{-}13$, large effect size) and expertise ($p < e\text{-}10$, large effect size). A comparison of our results with a study about women's experiences of microaggressions within STEM academia [3] indicates that the recording studio workplace scores 33% worse on the silencing and marginalization of women, 33% worse on gender-related workplace microaggressions, and 24% worse on sexual objectification. These findings call for serious reflection on the part of the community to progress from awareness to collective action that will unlock the control room for women and other historically and systemically marginalized groups of studio professionals.

0 INTRODUCTION

In a podcast entitled *The Midwife of Audio*,[48] mixing engineer Tom Elmhirst defines his role as a facilitator in the process of music delivery that is audio production. This title obviously invokes associations with gender, birth, and social reproduction. Yet women comprise less than 5% of audio engineers according to the Women's Audio Mission [4] and between 5% and 10% of audio engineers according to AES [4]. A recent study investigating gender composition by presentation type at AES Conventions from 2012–2019 shows that very few women and non-binary authors are represented in Invited Papers (1.96%), Keynotes (8.51%), and Workshops (9.73%) [6]. Also, an Annenberg study showed that only 2% of the record producers credited on 2012– 2017 Billboard top 100 hits are women, only 0.3% of these producers (2 out of 651) are women from underrepresented racial/ethnic groups, and no woman producer was *Grammy* nominated from 2013–2018 [7].

To challenge these harsh gender inequalities (among other social discrimination and equity issues), the AES created a *Diversity & Inclusion* (*D&I*) *Committee* in Oct. 2017 that "strives to ensure diversity in the AES worldwide and the audio industry as a whole by improving accessibility, welcoming diverse genres, embracing emergent audio fields and research, and radiating inclusiveness to all races, genders and gender identities, physical abilities, ages, and nationalities."[49] With the aim of providing this committee with detailed and global data to inform their future actions, our study elicits music producers', audio engineers', and studio assistants' experiences of social discrimination and microaggressions in the commercial recording studio.

We begin with a literature review that explores aspects of studio work that may contribute to or

[48] https://www.gear-club.net/episodes/2019/tom-elmhirst
[49] http://www.aes.org/community/diversity/

intensify inequalities within the field, placing our survey and participants in context. Our methodological approach draws upon microaggression scholarship [8], [9] and intersectionality [10]–[14] to understand how gender, sexual orientation, race/ethnicity, migration, level of ability, and age impact studio professionals' work conditions and prospects of pursuing a successful career. Also, since our survey instrument mirrors one that was used for a study in Science, Technology, Engineering, and Mathematics (STEM) fields [1]–[3], we are able to compare the percentages of women producers, engineers, and assistants who face specific dimensions of gender-related microaggressions in the studio with those from STEM academia to underline the grim reality of our field.

1 LITERATURE REVIEW

1.1 Emotional and Invisible Labor in the Studio

Results from a 2008 online survey of an international cohort of young professional musicians (mean age = 26, n = 16) showed a shared expectation that producers and engineers exhibit strong interpersonal and communication skills. These skills, which "allow trust and honesty in the studio" and "create a good atmosphere for performance," took precedence over technical, listening, and musical skills [15].

Similarly, based on semi-structured interviews with London-based producers and engineers (men, between the ages of 20 and 65, n = 19), Watson and Ward [16] described the intimacy of recording studios as "emotional spaces characterized by *trust* and *tolerance*." They applied sociologist Hochschild's concept of *emotional labor*—the management of feelings and expressions based on the emotional requirements of jobs in the service industry [17]—to understand the job requirements of producers and engineers who, in the commercial recording

studio, are "evokers of and witnesses to [musicians'] emotional displays that in most other work-based contexts, or even social contexts, would be considered inappropriate" [16]. To illustrate the scope of this *emotional labor*, producer Afanasieff [18] mentioned the need to be interchangeably like a doctor, spiritual adviser, psychologist, or bartender to help singers overcome their insecurity.

Jarrett's ethnography of jazz and country producers highlighted the position of the 'self-effacing producer' who "inhibits the emergence of 'the producer' as an animated body—a self or subjectivity who breathes life into sound" as opposed to the 'visible' producer, e.g., Phil Spector [19]. Findings from semi-structured interviews in Canada, France, and the USA with six renowned producers with more than 20 years of studio experience showed that they employ self-effacing methods to cope with musicians' sensitivities, including the possibility "to divert aggressiveness towards themselves" [20]. They compared their mission to the one of photographers "who aim to capture the most meaningful moments and then bring them together."

They also identified with "cleaners, servants, captains of a ship, firemen, and midwives," professions that engage in many forms of *invisible labor*[50] and that are crucial to the functioning of the recording studio yet are elided or "invisible to those who are its beneficiaries." For instance, recording sessions require a great deal of preparation before the musicians arrive [21] and clean-up after the musicians leave (e.g., discarding coffee cups, rolling cables, backing up files). In short, music producers, audio engineers, and studio assistants engage in high levels of emotional and in visible labor that is underappreciated and unacknowledged.

[50] http://micemagazine.ca/issue-one/what-invisible-labour -mice-issue-01

1.2 Intermediaries Between Musicians and the Industry

In addition to developing a *thick skin* [22] and demonstrating resilience in their capacity to handle intimate and uncomfortable situations while performing emotional and invisible labor, studio professionals must follow the rules and conventions of the music industry in pursuing a studio career [23]. These rules and conventions are historically gendered [24], [25] and mirror the *heteropatriarchal*[51] structure of this industry. Indeed, studio professionals act as "cultural intermediaries between production and consumption" [28], thus at the intersection of two male-dominated groups whose expectations and bias reinforce the gendering of the commercial recording studio, i.e., musicians across genres [29], [30] and music industry professionals [22].

Recent work emphasizes that the music industry's *genius system* maintains women and other historically and systemically marginalized groups of studio professionals in undermined and powerless positions [31], [32], to the point that Wolfe advocates for home-studio self-isolation as the healthiest solution for women producers to develop their skills and self-confidence before facing the gendered and heteropatriarchal commercial recording studio [22]. Furthermore the decline of global recording revenues since the early 21st century has resulted in decreased budgets for recording projects, the need for producers to reinvent their profession [33], and the requirement to handle three jobs at once [34]. In this highly competitive industry, studio professionals are likely to be extremely protective of their clients, which further intensifies the exercise of exclusionary gendered power.

1.3 The Power of Controlling Sound

[51] Patriarchy is "a system of social structures and practices in which men dominate, oppress, and exploit women" [26]. Het eropatriarchy is a social system "...in which heterosexuality and patriarchy are perceived as normal and natural, and in which other configurations are perceived as abnormal, aberrant, and abhorrent" [27]

Whether sound recordists identify as ‘tonmeisters’ [35], ‘traditionalists’ who focus on capturing music performances, or ‘technophiliacs’ whose creative process is primarily technology driven [36], their work involves the control of sounds through audio technology. Horning emphasized the centrality and extent of tacit knowledge required to “engineer the performance” [38]. The power of controlling sound is thus connected with the legitimacy of coaching artists’ performances. For instance, an ethnography of dig ital studios in Bamako (Mali) linked studio owners’ access and ability to use technologies that are still rare and new in a low-income country and their legitimacy to coach artists and control the arrangement and composition process [39]. Wolfe [22] argues that the desire to retain control of the *sound* of the artist’s voice and *how* that voice is presented is gendered and that “for the male producer to have held these particular creative reins for such a long time has also resulted in [...] an unwillingness to not only let go of them but also in a tendency to overlook and or dismiss the artist who takes control of them herself.” From his observations of three recording sessions for the creation of a pop song in a mid-sized studio, Gander spotlighted how the location of the producer’s chair (‘captain’s chair’) at the sonic sweet spot underlines the producer’s control of space, restricting the musicians’ involvement in the production process—judgments and decisions take place in the control room while the musicians are performing in the live room [40].

Minchella stated from a musician’s perspective, “Space is so much more than the realm of surveyors and measurement; rather, it is central to our whole experience and is an intrinsic factor in the process of creativity itself” [41]. The link between the control of sound and the control of space is somewhat reminiscent of Keightley’s study of systemic sexism in Hi-Fi equipment ads in the mid-20th century, e.g., “You are the Sultan with 70 Watts in your harem” [42]. Thus the space of the recording studio is intimately connected to issues of power, gender, and control.

2 THEORETICAL FRAMEWORKS

2.1 Microaggression Theory

The term *microaggression* was originally defined by Pierce, who was a professor of education and psychiatry at Harvard Medical School, to describe brief indignities that convey hostility toward a racialized group [43]. Importantly, *micro* refers to *everyday* rather than being lesser or insignificant [8]. Sue, professor of counseling psychology at Columbia, defined microaggressions as "everyday verbal, nonverbal, and environmental slights, snubs, or insults, whether intentional or unintentional, that communicate hostile, derogatory, or negative messages to target persons based solely upon their marginalized group membership" [9]. Sue and his team recently summarized the impacts of microaggressions on targets, ranging from increased stress, depression, and heavy toll on physical and emotional well being to impeded learning and problem solving [44].

2.2 Intersectionality

Rooted in the writings of Black feminists and critical race scholars such as Crenshaw [10], Collins [11], [13], McCall [12], and Misra et al. [14], *intersectionality* is a theoretical approach, methodological orientation, and praxis. Rather than focus on a single form of social difference, intersectionality focuses on the 'matrix of domination' [11], and how systems of oppression are interlocking in nature. The guiding premises of intersectionality's "cognitive architecture" include: 1) Race, class, gender, sexuality, ability, and other systems of power are interdependent; 2) intersect ing power relations produce complex social inequalities; 3) intersecting power relations shape group experiences; and 4) solving social problems requires intersectional analyses [13]. Specifically our project aims to document "the workings of power relations in producing

social inequalities and the social problems they engender" [13] within the commercial recording studio by examining experiences of microaggressions through an intersectional lens.

2.3 Research Questions

RQ1. How do demographic categories such as gender (GEN), sexual orientation (SOR), race/ethnicity (RET), migrant status (MIG), gross national income of country of residence (GNI), disability (DIS), and the continuous demographic variable age (AGE) impact what tasks audio engineers accomplish within the studio (TAS), how well they are paid (DRA), and how often they are properly credited for their work (CRE)?

RQ2. How do demographic categories and variables impact music producers', audio engineers', and studio assistants' experiences of social discrimination and microaggressions in the commercial recording studio?

RQ3. How do women's experiences of microaggressions in the commercial recording studio compare with women's experiences of microaggressions in STEM academia?

RQ4. Within a framework of intersectionality, how do sex ual orientation (SOR), race/ethnicity (RET), migrant status (MIG), gross national income of country of residence (GNI), disability (DIS), and age (AGE) intersect with gender (GEN) in impacting these experiences?

3 METHODS

3.1 Survey Instrument Design

Our survey design applies McCall's recommendations to use analytical categories strategically in order to docu ment relationships of inequality among studio professionals ('intercategorical

complexity') [12]. We constructed a survey instrument that includes a *demographic portion* and a *microaggressions portion* with the option to opt out of the survey once the demographic portion is complete. In the *demographic portion* featuring 17 close-ended and 10 open ended questions we asked our respondents to self-identify in terms of gender (GEN), sexuality (SOR), race/ethnicity (RET), and disability status (DIS) and to answer questions about their age (AGE), country of origin and country of residence (MIG), years on the job (YOB), remuneration (DRA), how they were properly credited for their work [CRE, on a five-point Likert scale (LS1) from *Almost always* to *Almost never*], whether they received awards, and which studio tasks they were involved in (TAS, e.g., *Tracking; Mixing; Assisting, Production*).

In the *microaggressions portion* featuring 53 closed-ended questions using a five-point Likert scale (LS2) from *Strongly disagree* to *Strongly agree*, we captured studio professionals' experiences of microaggressions in the workplace. These 53 items drew upon 3 distinct survey instruments. Yang and Carroll [3] provided us with a breakdown of how they constructed their survey instrument. We also adapted Lewis and Neville's [1] factors—Assumptions of Beauty and Sexual Objectification (SOB), Silenced and Marginalized (SAM), and Strong Black Woman Stereotype (STE)—and Nadal's [2] Workplace and School Microaggressions (MGEN, MSOR, MRET, MAGE, MCUL, MDIS). We met with the AES Diversity & Inclusion Committee at the AES Conventions in Milan in May 2018 and New York in Oct. 2018 to implement changes to the survey instrument based on members' feedback. These changes included the possibility for respondents to share specific examples of microaggressions and how their experience of discrimination may have evolved over time. A week before we launched the survey we sent it to our personal network of 100+ studio professionals and asked for feedback. Several changes were integrated, including the addition of two open-ended questions about having witnessed or caused

microaggressions in the studio. The survey questions and recruitment material were translated from English into 19 languages. The survey was available on Qualtrics from October 1st, 2019 to January 30th, 2020.

3.2 Respondent Recruitment

Aiming to capture a current and recent *snapshot* of studio professionals' experiences of discrimination in the commercial recording studio, our target population was individuals who had worked as producers, engineers, or studio assistants on other people's music in the last ten years. The primary group we intended to reach was the 12,800 members of the AES (about 9,100 professionals and 3,700 students), the largest professional society devoted exclusively to audio engineering. However, taking into account the realities of AES membership and participation [6], we also administered the survey to other communities of au dio practitioners who more or less overlap with AES but who were likely to include more women and non-binary and/or gender non-conforming people, e.g., the Women's Audio Mission (WAM), SoundGirls, Audio Girl Africa, and female:pressure.

Our recruitment strategy involved three main aspects: emails to personal contacts, in-person recruitment of participants, and online dissemination of the survey via formal and informal channels. In-person recruitment took place at the 2019 AES New York Convention with a group of volunteers from a variety of gender and racial/ethnicity groups and at a series of four events organized by AES student chapters promoting the survey in the UK, Germany, and the Netherlands. The survey was disseminated online via emails to AES chapters worldwide and an email on the VDT (Verband Deutscher Tonmeister) listserv and was included in an AES newsletter. Finally posts were made on group social media pages, including Hey Audio Student

and Tape Op Magazine. Our goal was to collect a sample of roughly 1,000 respondents from across the globe. We did not expect nor desire to obtain a representative sample of the demographics of audio engineering globally but rather to obtain adequate sample numbers in order to understand the experiences of members of the various demographic categories of interest.

3.3 Demographic Categories and Discrimination

We defined six demographic categories and one continuous demographic variable as the independent variables for statistical analysis. The six demographic categories and their corresponding codes were gender (GEN), sexual orientation (SOR), race/ethnicity (RET), disability status (DIS), migrant status (MIG), and gross national income of country of residence (GNI). Age (AGE) was the final continuous demographic variable.

We defined fourteen dependent variables geared toward understanding the experiences of studio professionals' discrimination. The first five dependent variables were tasks undertaken in the studio (TAS), daily rate when working in the studio (DRA), crediting (CRE), AES membership (AESM), and awareness of the AES Diversity & Inclusion Committee (AESD). Then followed nine microaggression factors, namely Assumptions of Beauty and Sexual Objectification (SOB); Silenced and Marginalized (SAM); Stereo typed (STE); and Workplace Microaggressions around Gender (MGEN), Age (MAGE), Race/ethnicity (MRET), Culture (MCUL), Sexual Orientation (MSOR), and Disability (MDIS).

3.4 A Mixed-Method Analysis Approach

3.4.1 Descriptive Statistics

We adopted a grounded approach [45] in order to code respondents' self-definitions into

appropriate strategic categories. Gender (GEN) was coded from respondents' sex assigned at birth and their current gender identity into three categories: trans/non-binary, cisgender woman, and cisgender man. Sexual orientation (SOR) was coded into heterosexual and non-heterosexual (including but not limited to lesbian, gay, bisexual, queer, pansexual, and asexual). Based on responses to two questions that asked participants to specify their race/ethnicity and self-identify whether they were a racial minority in their workplace, categories of race/ethnicity (RET) detailed whether the respondent was a racial minority at their place of work and included: no, yes (BIPOC—Black, Indigenous, People of Color), and yes (white). This was further broken down into two categories: no (either white, or BIPOC and not part of a racial/ethnic minority in their place of work) and yes (both BIPOC and part of a racial/ethnic minority in their place of work). Note that BIPOC participants who did not identify as a racial minority in their place of work would here be included in the 'no' category for RET. Migration status (MIG) was coded as 'no' if a respondent's country of residence was the same as their country of origin and 'yes' if they differed. We used the World Bank's classification of the economies of the country of residence into four income groups (GNI): high, upper middle, lower middle, and low. Disability status (DIS) was coded using responses to two questions, i.e., asking participants whether they identify as someone with disabilities and to further self-identify if they selected 'yes' to the previous question. For the purposes of statistical analysis we coded respondents into three categories: no (no disability), yes (yes invisible), and yes (visible). Age (AGE) and years on the job (YOJ) were calculated by subtracting the year of birth and year they started working in the studio, respectively, from 2020. There are ethical and methodological issues involved in this strategy of categorization and aggregation. For example, the practice of including in one group both participants who are non-binary and those who have a binary gender (man or woman) but are also

transgender is inherently problematic [46], [47]. Although the participants who we included in the category of 'trans/non-binary' had a wide variety of individual gender identities and experiences— trans woman, trans man, demigendered, non-binary, gen derqueer, genderfluid, non-binary woman, and so on— aggregating allowed us to obtain statistically significant results.

The same issues apply to the other strategic categories we employed. As critical race theorists and feminist scholars have pointed out, "race and gender frequently function as *proxies*: variables that reduce the complexities of biosocial bodily experience to more quantifiable forms of data" [46]. As with any strategic coding, these categories should be understood as permeable containers for complex and nuanced data. Note that in our forthcoming qualitative paper we unpack these strategic categories and analyze how these individuals experience microaggressions and discrimination through an intersectional lens.

The survey contained three questions related to income that were combined in order to calculate an average daily rate (DRA) in USD for each participant. Individuals who free-lanced in music production reported their normal daily rate as a freelancer and participants on payroll reported their normal yearly income, which we converted to a daily income. We normalized these numbers by the total percentage of their income that these participants reported making from audio engineering as opposed to other types of work. In the case of those who were both freelancers and on payroll we took an average value. We converted the currency to USD based on the value of that currency on the closing date of the survey. Six outliers who reported a freelancing daily rate of over 2,000 USD/day were removed, since inspection of their responses indicated that they had misinterpreted the question to refer to either a monthly or yearly income. Finally for the statistical tests we discarded the income information from participants who reported making less than 50% of their income from audio engineering.

For the coding of the Audio Engineering Society membership (AESM) we used the responses to a multiple choice question on AES membership. The three categories for this variable include: no (never), yes (current member), and yes (former member). Participants were then asked to indicate whether they were aware of the AES Diversity & Inclusion Committee (AESD). Responses were coded based on the coding assigned to AESM and included: no (current AES member), no (non-AES member), no (former AES member), yes (current AES member), yes (non-AES member), yes (former AES member), and N/A for those who skipped the question or left it blank.

3.4.2 Statistical Analyses

One-way Kruskal-Wallis tests and ANOVAs were used to relate demographic categories to CRE, DRA, AESM, and AESD. A logistic regression was used to relate AGE to TAS and χ^2 tests for independence and cross tabulations were used to relate demographic categories other than AGE to TAS. Effect sizes for these χ^2 tests were estimated using Cramer's V. For each of the nine microaggression factors we took the average of all subsidiary questions in order to obtain an aggregate score for that factor. For each combination of demographic category and microaggression factor aggregate score we subsequently ran both one-way Kruskal-Wallis tests and one-way ANOVAs, followed by a Dunn's multiple comparison post-hoc test. Type III (sigma-restricted) sum of squares error terms were used for all ANOVAs. Use of ANOVAs was justified by making the approximation that Likert-scale measurements can be treated as continuous [48]. In the cases where the Kruskal-Wallis tests disagreed with the ANOVA findings, we reported the findings from the more conservative non-parametric Kruskal-Wallis test. We estimated the effect size for each test using bootstrapped η^2 values, referring to Cohen's [49] criteria for boundaries on low, medium, and large effect sizes. For the continuous variable AGE, we ran a linear regression against each of the aggregate scores. Effect size was estimated using R^2

statistics, again referring to Cohen for boundaries on effect size categories [50].

While aggregate scores were used to understand the overall impact of demographic categories upon microaggression factors, we were also interested in which of the specific microaggression statements were highly associated with demographic categories (e.g., the microaggression 'I have been told I was too sassy and straightforward' with its implications of racial stereotyping). As such we ran a second round of Kruskal-Wallis tests and ANOVAs on the disaggregated microaggressions data.

3.4.3 Comparison With STEM Study

To compare our findings with those obtained by Yang and Carroll [3], who measured the experiences of women working within STEM academia, we reproduced their calculations. However, while our survey tool employed a 5-point Likert scale ranging from *Strongly disagree* to *Strongly agree*, theirs employed a 7-point scale on the same range, with their score of 4 (*Neither agree nor disagree*) corresponding to our score of 3 (*Neither agree nor disagree*).

3.4.5 Intersectional Analyses

To explore how the demographic categories intersect with gender in experiences of microaggressions in the studio, we ran two-way ANOVAs with Type III sum of squares error to test for the following interactions: GEN/SOR, GEN/RET, GEN/DIS, GEN/MIG, and GEN/GNI. To investigate the intersection between GEN/AGE, we ran an ANCOVA with hierarchical error terms.

4 RESULTS

4.1 Descriptive Statistics

A total of 1,141 participants started the survey. We analyzed only the data from participants who completed the *demographic portion* (GEN, SOR, RET, DIS, MIG, GNI, AGE, TAS, CRE, DRA, AESM, and AESD) of the survey in its entirety, resulting in 387 usable responses, 373 of which included usable age data (Table 1). Out of these 387 participants, 281 completed the *first microaggressions portion* (SOB, SAM, and STE) and 234 completed the *second microaggressions portion* (MGEN, MSOR, MRET, MDIS, MCUL, and MAGE). Despite not reaching our goal in terms of participation, proportionally more participants from underrepresented populations than are present in the profession at large allowed us to obtain meaningful results from the data nevertheless.

4.1.1 GEN, SOR, RET, DIS, MIG, GNI, AGE

Out of the 387 participants who filled out the *demographic portion*, 71% (n = 275) of participants were cisgender men, 22% (n = 86) were cisgender women, and 7% (n = 26) were transgender/non-binary. We received responses from approximately 15% more cisgender women than have been estimated to comprise the overall gender makeup of AES [4]. Also, 17% (n = 47) of cisgender men, 44% (n = 38) of cisgender women, and 73% (n=7) of trans/non binary participants identified as non-heterosexual. Out of the 387 participants, 8% (n = 31) were both BIPOC and part of a racial/ethnic minority in their place of work—45% of whom had migrated from their country of birth—while 89% (n = 344) did not identify as part of a racial/ethnic minority in their place of work. Finally 3% (n = 12) were white but also identified as a racial minority in their place of work. In the statistical analysis that follows, this cohort was combined with the group that did not identify as a racial minority in their workplace.

Our sample was international, comprising data from participants born in 36 countries of origin and

residing in 46 countries of residence, 94% from upper middle and high income GNI countries (Table 1). Out of the 387 participants, 16% (n = 63) reported living in a country different from the one they were born in. Of these, 22% identified as both BIPOC and part of a racial/ethnic minority in their place of work. Three times as many cisgender men from low and low-middle income GNI countries participated in the survey, as did cisgender women or transgender/non-binary people (2% difference). Out of the 387 participants, 8% (n = 32) identified as having a disability. Of these individuals just over half reported having a visible physical disability while the rest reported having an invisible physical or non-physical disability. The mean age that the participants started working in audio engineering was 25 [± 5] years old. There was no significant difference in this value with respect to gender. The youngest participant was 20 years of age and the oldest was 89 years of age (Fig. 1).

Participants were given a space to indicate whether they identified as part of a minority in their place of work other than the demographic categories included in the survey (Fig. 2). We did not include the demographic categories featured in the responses to this question in our statistical analysis because either the number of respondents was very small (for *audible minority*, *religious minority*, and *class minority*) or because while the participants answered that they were part of another minority group they did not specify what kind. Additionally, while we included a question about Indigenous status in the survey, we did not include the results in our statistical analysis because this question was misinterpreted (sometimes in ways that seemed intentionally provocative or anti-Indigenous) by a large number of participants.

4.2 Tasks, Incomes, and Credits

4.2.1 Tasks (TAS)

Statistically significant differences in the distribution of tasks accomplished in the studio (TAS) were found for gender (GEN), sexual orientation (SOR), disability (DIS), and AGE (Table A1). Overall, cisgender women were 25% more likely to answer *assisting* than cisgender men; however when we included only participants under the age of 30 in the analysis, we found the result to not be statistically significant, indicating that this finding was mainly due to the small number of older women who participated in the survey. Cisgender men were 21% more likely to answer *mastering* than cis gender women; this result was independent of age ($p <$ e-2).

Heterosexual participants were 17% more likely to answer *mastering* ($p <$ e-2), 11% more likely to answer *producing* ($p = 0.05$), 9% more likely to answer *mixing* ($p <$ e-2), and 17% less likely to answer *assisting* ($p <$ e-2) than non-heterosexual participants; these results were independent of age. Participants who did not identify as having a disability were more likely to respond mixing than participants with an invisible or visible disability (19% and 16%, respectively, with $p = 0.01$). Age had a significant impact on how often participants responded *mixing* (increased with age, $p <$ e-8), *mastering* (increased with age, $p < 0.05$), and *assisting* (decreased with age, $p <$ e-18).

4.2.2 Incomes (DRA)

Both gender and age were significantly associated with differences in daily rate (GEN, $\eta^2 = 0.07$ [0.01:0.10], medium effect size; AGE, $R^2 = 0.14$, medium effect size). Cisgender men making over 50% of their income from audio made an average of 74 ± 4 USD/day, while trans/non binary people made an average of 56 ± 13 USD/day and cisgender women made an average of 51 ± 7 USD/day. Daily rate increased with age at a rate of 3.74 USD/day per year (Fig. 3, Table 2).

4.2.3 Crediting (CRE)

Gender, race/ethnicity, disability, migrant status, and age were found to be significant predictors of being properly credited for work (CRE) (Fig. 4). Cisgender women were twice as likely as cisgender men to report being *almost never* properly credited and half as likely to report being *almost always* properly credited (Tables 2 and A2; $\eta^2 = 0.06$ [0.02:0.12], medium effect size). Participants who were both BIPOC and part of a racial/ethnic minority in their place of work were just under twice as likely as participants who were not to report *almost never* being properly credited and under half as likely to report being *almost always* properly credited ($\eta^2 = 0.02$ [0.002:0.06], small effect size).

Participants with an invisible disability were almost four times more likely than participants without a disability to respond *almost never* and one-fifth as likely to respond *almost always* being properly credited for their work ($\eta^2 = 0.02$ [0.005:0.07], small effect size). Participants who had emigrated were 10% more likely to respond *almost never* or *rarely* and 10% less likely to respond *almost always* being properly credited than those who had not emigrated ($\eta^2 = 0.02$ [0.001:0.06], small effect size). Older participants reported being properly credited significantly more often than younger participants ($R^2 = 0.02$, small effect size). Additionally two-way analysis of GEN/AGE vs. CRE revealed that there was a significant interaction term for GEN*AGE. While the overall effect of increasing age was to positively affect how often participants were properly credited, the intersection of gender and age had a small additional mediating effect—in the case of cisgender participants this effect was negative, while for trans/non-binary participants it was positive.

4.3 AES Membership

The only significant predictor of AES membership (AESM) was GNI of country of residence

(Tables 2 and A2). Participants from low and lower-middle income GNI countries were significantly less likely to be AES members than participants from upper-middle and high-income GNI countries (Table A2). Only 55% of current AES members who took part in the survey were aware of the AES D&I committee. None of the demographic categories we tested were significant predictors of knowledge of the AES D&I committee.

Of the participants who indicated that they had never been a member of AES, about 33% provided a reason why. Reasons included already being members of the VDT, considering becoming members in the future, not being interested in joining AES, not being able to afford a membership, stating that the membership was not worth the return on investment, participating in AES but not as a member, not being able to register for a membership on the AES website, and not knowing what AES is. For participants who were formerly members of AES but no longer active, about 85% explained why. Some cited fiscal reasons for not continuing their membership, such as not being able to afford dues, not having a return on investment, and not being interested in the benefits. Several respondents indicated that they had an AES student membership during their studies but did not renew it after their graduation.

Other reasons given for not having a current membership included letting their membership lapse/forgetting to renew, not being a part of the audio industry anymore, and having a grievance with the society (i.e., not feeling supported, issues with exclusion, and too oriented toward technical or social aspects). Lastly eight respondents included comments on their answer to their awareness of the Diversity & Inclusion committee (three who answered ‘no’ and five who answered ‘yes’). Of the ‘no’ responses, reasons included not being aware of the committee, not being aware of the society, and not supporting the committee’s endeavors. Of the ‘yes’ responses, two were from active committee members, two wrote in support of the committee, and one

acknowledged its existence.

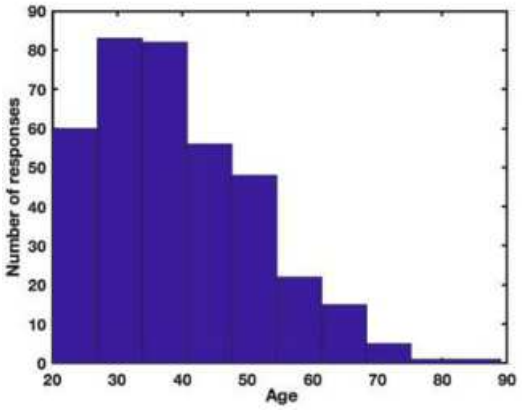


Fig. 1. AGE demographics of survey respondents, n=373.

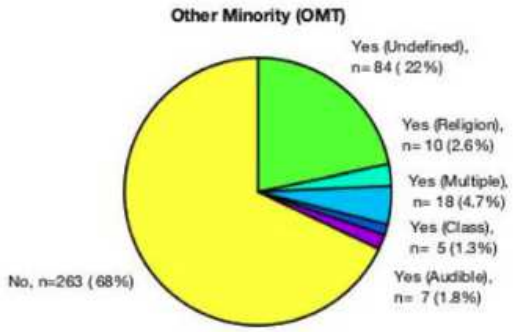


Fig. 2. Other minority statuses reported by study participants.

Table 1. Demographic breakdown of strategic categories.

Demographic Categories	Cisgender Man	Cisgender Woman	Trans/Non Binary	Total
Total	**275**	**86**	**26**	**387**
Low GNI	10	0	2	**12**
Lower Mid GNI	9	4	0	**13**
Upper Mid GNI	42	14	2	**58**
High GNI	214	68	22	**304**
Immigrant	46	12	5	**63**
Both BIPOC & part of racial/ethnic minority in place of work	18	11	2	**31**
Non-heterosexual	47	44	19	**110**
Person with disabilities	15	12	5	**32**
AES member	108	30	6	**144**
Aware of AES D&I Committee	61	14	7	**82**

4.4 Microaggression Statistical Analyses

4.4.1 Gender (GEN)

Of the demographic categories considered in this analysis we found that gender was by far the strongest predictor of experiences of discrimination and microaggressions in the recording studio (Table 2), having large and medium effects upon aggregate scores for all microaggression factors except Race/Ethnicity Workplace Microaggressions (MRET). Four microaggression factors displayed large effect sizes for GEN: Assumptions of Beauty and Sexual Objectification (SOB, $\eta^2 = 0.25$ [0.19:0.38]), Silenced and Marginalized (SAM, $\eta^2 = 0.21$ [0.13:0.30]), Stereotyped (STE, $\eta^2 = 0.17$ [0.10:0.26]), and Gender Workplace Microaggressions (MGEN, $\eta^2 = 0.48$ [0.44:0.67]), corresponding to an explained variance of 25%, 21%, 17%, and 48%, respectively.

For microaggression factors SOB, SAM, STE, MGEN, MAGE, and MSOR, the aggregate scores for cisgender women and trans/non-binary participants were significantly higher than those of cisgender men but not significantly different from one another. However trans/non-binary participants responded similarly to cisgender men for MDIS while cisgender women reported experiencing significantly more microaggressions from this factor. The opposite was true for MCUL, where cisgender women and cisgender men did not respond significantly differently from one another but where trans/non-binary participants reported higher incidences (Table A2).

4.4.2 Sexual Orientation (SOR)

Non-heterosexual participants reported experiencing significantly more microaggressions from factors SOB, SAM, MGEN, MAGE, and MSOR than heterosexual participants (Tables 2 and A2). The most influenced factors associated with SOR were MSOR ($\eta^2 = 0.13$ [0.07:0.28], medium/large effect size) and MGEN ($\eta^2 = 0.07$ [0.03:0.18], medium effect size).

4.4.3 Race and Ethnicity (RET)

Participants who were both BIPOC and part of a racial/ethnic minority in their place of work reported experiencing significantly more microaggressions from factors SAM, MGEN, and MRET than participants who were not (Tables 2 and A2). The most influenced factors associated with RET were MGEN ($\eta^2 = 0.03$ [0.0003:0.06], small effect size) and MRET ($\eta^2 = 0.03$ [0.007:0.18], small effect size).

4.4.4 Migrant Status (MIG)

Participants who had migrated were significantly more likely to experience Culture Workplace Microaggressions (MCUL) than participants who had not (Tables 2 and A2; $\eta^2 = 0.03$ [0.003:0.13], small effect size).

4.4.5 Gross National Income of Country of Residence (GNI)

Participants living in low and lower-middle income countries experienced significantly more microaggressions for factors STE, MCUL, and MRET than those living in upper middle and high-income countries (Tables 2 and A2). The most influenced factor associated with GNI was MRET ($\eta^2 = 0.03$ [0.001:0.11], small effect size).

4.4.6 Disability (DIS)

Participants with an invisible disability were significantly more likely to experience microaggressions from factors SOB, SAM, STE, MGEN, MSOR, MCUL, and MRET than participants with no disability (Tables 2 and A2). Additionally participants with either visible or invisible disabilities were significantly more likely to experience Disability Workplace Microaggressions (MDIS, $\eta^2 = 0.07$ [0.04:0.16], medium effect size).

4.4.7 Age (AGE)

Age had a significant negative association with experiences of microaggressions from factors SOB, SAM, MGEN, MAGE, and MDIS (Table 2). For these factors, increasing age was associated with a decrease in reported experiences of microaggressions. The most influenced factors associated with AGE were SAM ($R^2 = 0.05$, small effect size) and MAGE ($R^2 = 0.05$, small effect size).

4.5 Comparison With STEM

We compared our findings with those reported by Yang and Carroll's study [3] and found that cisgender women working in the studio reported experiencing more microaggressions and discrimination than cisgender women working in STEM academia (Table 3). Specifically, 24%, 33%, and 33% more cisgender women working in the studio responded with an average of *Neither disagree nor agree* or over for microaggression factors SOB, SAM, and MGEN, respectively. Also, 9%, 17%, 11%, and 14% more of the cisgender women we surveyed had experienced one or more microaggressions from factors SOB, SAM, STE, and MGEN, respectively.

4.6 Intersection Analyses

We found significant simultaneous effects and interactions with gender for all demographic categories: GEN/SOR (Fig. A1), GEN/RET (Fig. A2), GEN/MIG (Fig. A3), and GEN/GNI (Fig. A4), GEN/DIS (Fig. A5), and GEN/AGE (Fig. A6). Microaggressions with simultaneous effects (figure titles in black) were unidirectionally impacted by both demographic categories. For example cis gender women and trans/non-binary participants reported experiencing the microaggression 'People have imitated the way that I speak' more than cisgender men, and non-

heterosexual participants experienced this microaggression less than heterosexual participants (Fig. A1). Microaggressions with an interaction term (purple and orange figure titles) showed more complex relationships to the demographic variables, e.g., 'I have been disrespected,' for which there was a significant term for GEN (cisgen der men were the least likely to experience this microaggression) but none for SOR. However non-heterosexual cisgender women and trans/non-binary people reported experiencing this microaggression more than their hetero sexual counterparts, whereas non-heterosexual cisgender men reported experiencing the microaggression less than heterosexual cisgender men—a dynamic captured by the GEN*SOR interaction term.

4.6.1 Intersection GEN/SOR

In the majority of cases where there was a simultaneous effect of GEN and SOR, non-heterosexual participants experienced the microaggression in question more than their heterosexual peers, and this difference was bigger for cis gender women and trans/non-binary people than cisgender men. However for the microaggressions 'People have imitated the way that I speak' and 'I have been told I was too sassy and straightforward,' non-heterosexual participants experienced these microaggressions less than heterosexual participants. Non-heterosexual cisgender women and trans/non-binary people experienced the SAM microaggressions 'I have been disrespected' and 'People have challenged my authority' more than their heterosexual peers whereas the opposite was true for cisgender men.

Finally, for the SOB microaggression 'People have made sexually inappropriate comments,' non-heterosexual cis gender participants experienced this microaggression less than heterosexual cisgender participants, whereas non heterosexual trans/non-binary participants experienced it more than heterosexual trans/non-binary participants. *P* values and effect sizes for the two-way

ANOVA results for GEN/SOR can be found in Table A3, APPENDIX A.

4.6.2 Intersections GEN/RET, GEN/MIG, GEN/GNI

Participants who were both BIPOC and part of a racial/ethnic minority in their place of work experienced the MCUL microaggression 'People have treated me differently from other cultural groups' more often than those who were not. Cisgender men and trans/non-binary participants who were both BIPOC and part of a racial/ethnic minority in their place of work experienced the STE microaggression 'I have been told I was too independent' more than their peers who were not, while the opposite was true for cisgender women.

Participants who had migrated were more likely than those who had not to experience the STE microaggression 'People have made me feel exotic' but less likely to experience the SOB microaggression 'People have assumed I was sexually promiscuous.' They were also more likely to experience the MCUL microaggressions 'People have assumed my work would be inferior to people of other cultural origins,' 'People have been unfriendly or unwelcoming toward me because of my cultural origin,' and 'My opinion has been overlooked in a group discussion because of my cultural origin'; this effect was greater for cisgender women than cisgender men or trans/non-binary people.

Participants from low and lower-middle GNI countries were more likely than those from upper-middle and high GNI countries to have experienced the microaggressions 'People have imitated the way that I speak,' 'People have treated me differently than people of other cultural groups,' and 'People have treated me differently than people of other racial groups,' and less likely to have experienced the microaggressions 'People have made sexually inappropriate comments' regardless of gender. Cisgender participants from low and lower-middle GNI countries were more

likely than those from upper-middle and high GNI countries to have experienced themicroaggressions ‘I have been disrespected,’ ‘People have challenged my authority,’ ‘I have been ignored because of my cultural origin,’‘I have been ignored because of my race,’ and ‘People have been unfriendly or unwelcoming towards me because of my level of ability,’ whereas trans/non-binary participants from low and lower-middle GNI countries were less likely to have experienced these microaggressions. Finally cisgender women from low and lower-middle GNI countries were more likely than those from upper middle and high GNI countries to have experienced the microaggressions ‘My opinion has been overlooked in a group discussion because of my sexual orientation’ and ‘People have assumed my work would be inferior to people of other levels of ability,’ whereas the opposite was true for cisgender men and trans/non-binary participants. Note that there were only two trans/non-binary respondents from lower GNI countries, so further investigation is required to generalize these results for transgender and non-binary people.

4.6.3 Intersection GEN/DIS

Participants with visible or invisible disabilities experienced the microaggressions ‘People have objectified me based on my physical features,’ ‘I have received unwanted comments about my physical appearance,’ ‘I have received unwanted comments about my hair and/or makeup,’ ‘People have tried to “put me in my place,”’ and ‘I have been told I was too emotional’ more than participants without disabilities. Participants with invisible disabilities were more likely than those with visible disabilities to report the first three of these microaggressions while the opposite was true for the last two.

Cisgender men with invisible disabilities were more likely than any other group to report the

microaggression ‘People have made me feel exotic.’ Along with trans/non binary people with invisible disabilities, they were also more likely to report ‘People have been unfriendly or unwelcoming towards me because of my cultural origin’ or ‘People have been unfriendly or unwelcoming to wards me because of my race’—but the very low number of invisibly disabled trans/non-binary respondents to these questions (n=1 for the first and n=2 for the second) means it is difficult to generalize these results for the trans/non-binary case.

4.6.4 Intersection GEN/AGE

Seven microaggressions showed simultaneous effects for both GEN and AGE, four from factor SAM and three from factor AgeWorkplace Microaggressions (MAGE). Younger cisgender women and trans/non-binary people reported experiencing these microaggressions more than older cisgender men. Older cisgender women also reported experiencing the microaggressions ‘People have made me feel exotic’ and ‘My professional expertise has been questioned,’ whereas middle-aged participants of all genders reported experiencing the microaggression ‘People have been unfriendly or unwelcoming towards me because of my cultural origin’ while younger and older participants did not.

Table 2. P-values for **χ2** values (one-way Kruskal-Wallis tests; GEN/SOR/RET/DIS/MIG/GNI) and R2 values (linear regressions; AGE), color coded by effect size. Entries with background in dark gray/red indicate large effect size (η2 >= 0.1379 or R2> 0.26), entries in medium gray/orange indicate medium effect size (η2 >= 0.0588 or R2>0.13), entries in light gray/yellow indicate small effect size (η2 >= 0.0099 or R2>0.02). Non-significant entries are in white with gray text. Slope entry color indicates direction of relationship of dependent variable with AGE (light gray/pink positive, dark gray/blue negative)

		N	GEN	SOR	RET	DIS	MIG	GNI	AGE	
			p (χ^2)						p(R^2)	Slope
Daily rate	DRA	135	0.01	0.96	0.09	0.47	0.43	0.29	5.86E-06	3.74
Properly credited	CRE	373	1.05E-03	0.11	0.005	0.01	0.01	0.64	0.01	0.01
AES membership	AESM		0.27	0.43	0.31	0.24	0.29	0.05	0.49	2.19E-3
Aware of D&I committee	AESD		0.43	0.34	0.92	0.39	0.26	0.15	0.50	4.46E-3
Sexual objectification	SOB	283	1.20E-16	5.05E-04	0.14	1.68E-03	1.00	0.34	0.01	-0.01
Silenced and marginalized	SAM	284	1.26E-13	0.03	0.03	0.01	0.44	0.20	8.68E-05	-0.02
Stereotyped	STE	281	4.96E-11	0.15	0.56	0.02	0.81	0.03	0.14	-0.01
Gender W.M.	MGEN	234	3.15E-25	3.15E-05	0.01	0.02	1.00	0.99	4.26E-03	-0.02
Age W.M.	MAGE		2.28E07	0.04	0.64	0.08	0.96	0.24	4.73E-04	-0.03
Sexual orientation W.M.	MSOR		1.06E--06	2.99E-08	0.10	0.00	0.66	0.50	0.11	-0.01
Cultural W.M.	MCUL		0.02	0.73	0.09	0.01	0.01	0.02	0.97	-2.10E-4
Disability W.M.	MDIS		4.35E-04	0.07	0.34	2.26E-04	0.78	0.68	0.01	-0.02
Racial W.M.	MRET		0.05	0.52	0.01	0.04	0.51	0.01	0.42	-3.99E-3

Table 3. Comparison with Yang and Carroll's study [3] of experiences of microaggressions in STEM academia.

Percentage of women respondents whose answers within a microaggression factor resulted in an average of *'Neither agree or disagree'* or over.				
Study	**SOB**	**SAM**		**MGEN**
Yang & Carroll	31%	47%		44%
Current	55%	80%		77%
% Difference	+24%	+33%		+33%
Percentage of women respondents who answered at least once *'Agree'* or above within a microaggression factor				
Study	**SOB**	**SAM**	**STE**	**MGEN**
Yang & Carroll	73%	76%	76%	68%
Current	82%	93%	87%	82%
% Difference	+9%	+17%	+11%	+14%

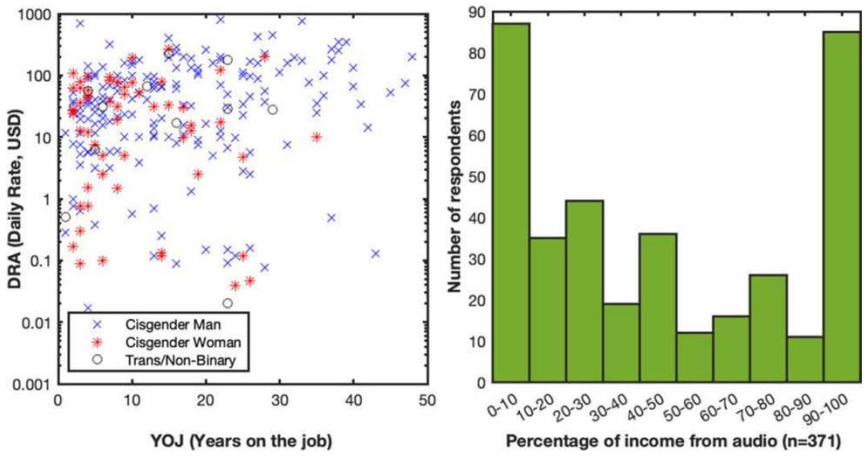


Fig. 3. Left: daily rate (DRA, USD/day) vs. years on the job. Right: percentage of their income that participants reported making from audio engineering.

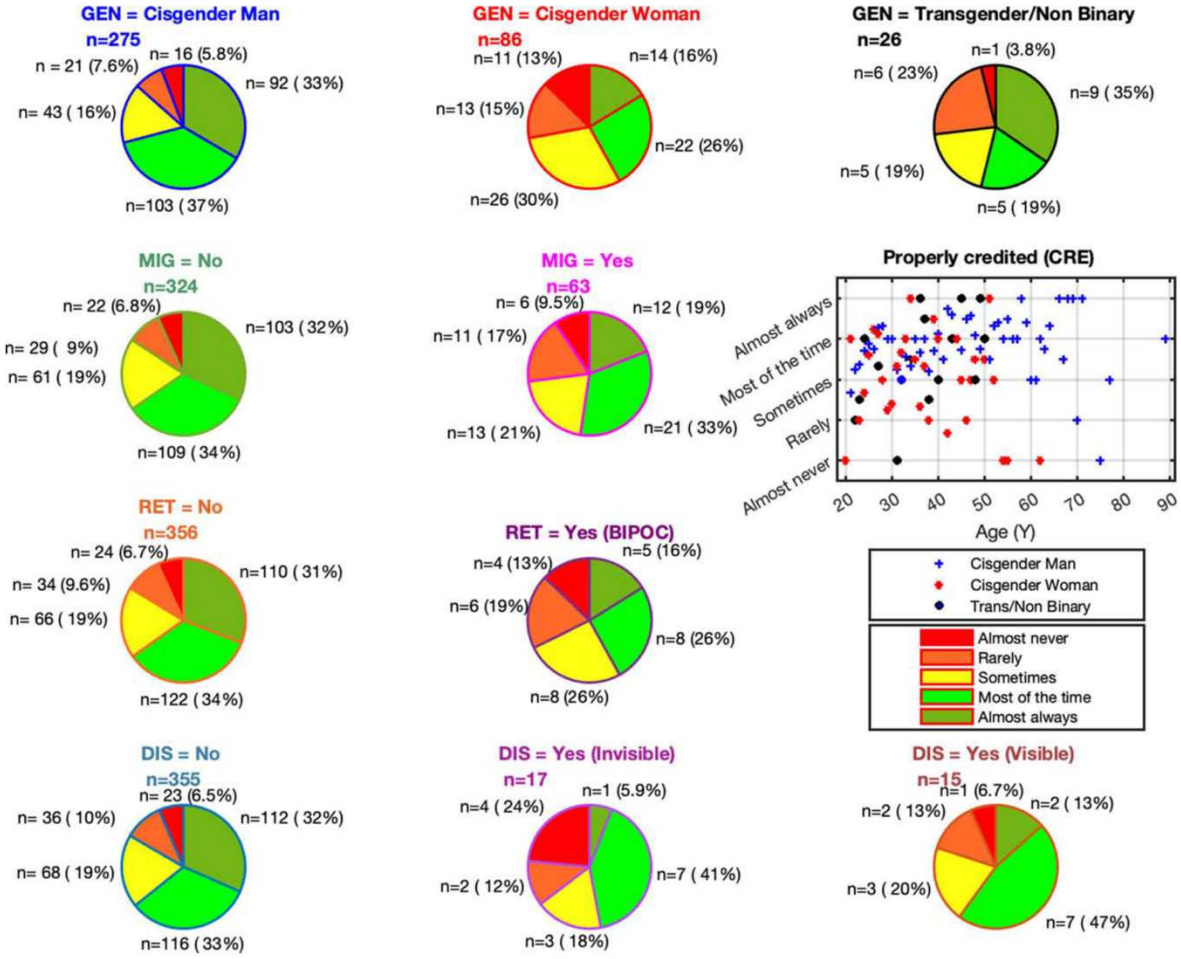


Fig. 4. Demographic factors associated with difference in CRE. For AGE subplot, markers represent the mean response for a given gender at a given age.

5 DISCUSSION

5.1 Limitations

In this survey, we strategically used intercategorical complexity [12] to document social inequalities between differ ent social groups within the commercial recording studio. From our perspective we use quantitative methods as a tool to advocate for change within the audio industry. This is akin to gear or technology in the studio. Although there are economic, social, and historical reasons that have resulted in gear and technology being racialized and gendered in particular ways, similar to methods, this does not exclude marginalized groups from using these tools in productive ways [14].

The biggest limitation of our survey is the low number of BIPOC participants. As an all-white research team of non-binary people and cisgender women, it is important to seriously examine this limitation of our dataset. First, it is possible to argue that the racial and ethnic make-up of our survey merely reflects the white supremacist heteropatriarchy nature of the audio industry. However we know the industry is also male-dominated and this did not stop women and non-binary people from participating.

Second, perhaps we can say that the underrepresentation of BIPOC is the result of recruitment issues. Several BIPOC AES student members assisted with our recruitment efforts (both in-person at the 2019 NY AES Convention and virtually through their social networks). However we know that recruitment practices can reflect systemic inequities. For example in medical research a study showed that Black respondents are less trusting of investigators than white respondents [51]. Similar issues of distrust may have been at play in our recruitment process.

Third, perhaps it is the nature of the methods themselves. We know that many theories, structures,

and methods in academia show the bias of racism and white supremacy [52] and are also colonialist in nature [53], [54]. We suggest that BIPOC may have purposefully chosen not to participate in our survey as a result of this history and due to ongoing racist and colonial legacies in the academy. In conclusion, further studies investigating how BIPOC experience microaggressions in the recording studio are needed.

5.2 'Under Pressure': Emotional and Invisible Labor

Our findings point to an apparent contradiction between studio professionals' ability to regulate their own emotions in order to provide the trust and tolerance necessary to help musicians perform at their best [15], [16], [18]–[20], and the lack of trust and tolerance that trans/non-binary people, cisgender women, younger people, BIPOC, people with disabilities, and sexual minorities face when working in the studio. The adverse effects of emotional labor such as displaying accepted rather than real emotions may explain this contradiction. Indeed, the accompanying experience of emotional dissonance is associated with negative outcomes within the workplace, including emotional exhaustion, decreased organizational attachment, and burnout [55], all of which are predictors of *workplace incivility* [56]–[59].

While our findings show that women and other equity deserving groups are less credited and compensated for their studio contributions, we also found that just under 15% of cisgender men reported being *Almost never* or *Rarely* credited for their work, and regardless of demographic category, the majority of studio professionals made an income of well under 100 USD/day, with an increase of about 40 USD/day of their general revenues every ten years. Perceived job insecurity has been shown to be a motivating factor for workplace incivility [59], and experiencing incidents of workplace incivility is a predictor of instigating workplace incivility

oneself [57]. This suggests that some studio professionals who silence, belittle, harass, or insult their peers may be responding to their own frustration and insecurities related to the precarious and invisible nature of their labor.

5.3 Dangers of Heteropatriarchy in the Studio

Following the highly significant impact of gender, our analysis indicates that age is the second most important factor influencing experiences of discrimination and microaggressions in the commercial recording studio. This mirrors the heteropatriarchal structure of the studio that requires young professionals to develop a 'thick skin' [22] and embrace the rules and conventions of the workplace to pursue a career in this informal industry [23]. While masculinity is not intrinsically harmful and can be associated with positive and prosocial traits such as helpfulness, courage, and responsibility [60], some typically masculine workplace behaviors such as competitiveness, assertiveness, and ruthlessness can become toxic when they are performed in "socially destructive" and dominating ways [61]. In male-dominated and competitive fields, toxic masculinity presents itself through extreme behaviors of competition and control, often an attempt to "prove manhood" at work [61], [62].

One of the outcomes of male-dominated toxic workplace cultures are 'queen bee behaviors,' which are "a response to the discrimination and social identity threat that women may experience in male-dominated organizations"[63]. This phenomenon leads women "to achieve career success in the field by derogating other women while simultaneously emphasizing their own career commitment and masculine qualities" [64]. This may explain the finding from a recent study exploring the factors contributing to gender imbalance in the audio industry that shows how women employees were less likely than men employees to believe that women would be suitable

for technical and managerial roles [65].

This may also provide insight toward interpreting a result from another gender bias study that explored the experience of women in the music industry, which found that the 7% of the surveyed women who listed their occupation as ‘music production and recording’ reported a higher level of job satisfaction than average [25], [66]. These observations suggest that structural changes are needed to avoid the ‘thick-skinned resignation’ [22] that results from the ‘queen bee’ [63], [64] and ‘tokenism’ [67] phenomena.

5.4 Toxic Masculinity as Gate Threshold

Together our statistical results demonstrate how harsh and toxic the climate of the commercial recording studio can be for women, trans/non-binary people, BIPOC, immigrants, disabled people, non-heterosexual people, and younger people working in the field. As previously noted the association between masculinity and audio technology has insidious implications ranging from Hi-Fi addictions that repulse spouses within the home [42] to the mobilization of gear fetishism that excludes women from the workplace. ‘Audiomania’ may also be accompanied by a certain risk aversion for new technologies [36] and is reflected in ‘informal demarcations among audio engineers,’ such as knowing how to roll cables over/under or being able to hear autotune artifacts [68]. Our findings contradict and challenge the ‘genderless’ central mission of audio engineering and music production, which has been conceived of as the use of technology in the service of art [69], i.e., to ‘catch a vibe’ [22] or ‘elicit emotions’ [16].

Within the last ten years the audio community has succeeded at standing up for sonic subtleties and musical details by fighting for level harmonization against the Loudness War [70]. We advocate for the next community move to consist of releasing the gate of toxic masculinity to

include the artistry of women and other historically and systematically marginalized groups of studio professionals. We argue that this progress would also positively impact the artistic quality of the work, e.g., in an interview by Fournet, producer Geffen reflected that "many of the male producers she started out with are now working in the industry, but very few of them are dedicated to projects that are really meaningful to them" [71].

6 TOWARD STRUCTURAL CHANGE

Building upon intersectional [10]–[14] and microaggressions scholarship [1]–[3], [8], [9] we have sought to offer a macro-level snapshot of experiences of discrimination within the commercial recording studio. Our research highlights how heteropatriarchy structures all aspects of the recording studio from experiences of microaggressions and discrimination, to inequalities in terms of pay and credits.

During the course of this research we encountered a critique suggesting that investigating discrimination in audio engineering from the perspective of microaggressions might have the paradoxical effect of 'making things worse,' either by indicating that women and other equity-deserving groups within the field are not 'tough enough' to succeed within the competitive world of audio engineering and music production, or that conducting a survey of this kind re produces the inequalities that it seeks to document. To this, we can only point to the poor representation of women and other historically and systematically marginalized groups within the industry [4], [6], [7] and ask the question: how could it get worse?

We also encountered the response, 'Look at that famous engineer who is a woman/transgender person/racial minority: they did just fine.' While we recognize and celebrate the achievements of those who have been able to make a name for themselves despite facing the barriers described in

this study, we would like to see a future where historically underrepresented groups can thrive in the studio without having to be absolutely exceptional and without the accompanying baggage of trauma that was so eloquently captured in our open-ended responses.

We are currently working on a qualitative study based on the open-ended survey responses that will highlight how marginalized individuals experience toxic workplace cultures in their daily lives, involving experiences of harassment, discrimination, and challenges to expertise, and the outcomes of these experiences, which include both adaptation behaviors and leaving the business. We believe that our research benefited hugely from sociological and psychological perspectives that informed us what is happening in the commercial recording studio. These research results should help design future actions to address the wide range of issues that we have identified. We also hope that this collaborative project will provide a baseline picture of the work climate in the studio and inspire more interdisciplinary studies to examine other audio workplaces such as R&D laboratories, live events, sound design studios, or video game companies.

7 ACKNOWLEDGMENTS

For more details, our statistical results are available in full at:
https://opus.uleth.ca/bitstream/handle/10133/ 5813/Brooks-additional-document.pdf?sequence=8& isAllowed=y

We would like to thank the translators who generously gave their time to ensure the survey was available in 19 languages—Yuval Adler, Areti Andrepolou, Francesco Bigoni, Rut Elliot Blovmquist, Toby Bol, Julia Borelli, Luciane Cardassi, Fei Fei Du, Nicola Giannini, Thomas Gorne, Ollie Haller, Ventsislav Ivanov, Paul Jeukendrup, ¨ Kieu Kieu, Ausma Lace, Cesar Lamschtein, Haruka Na gata, Aggie Nichols, Senem Pirler, Kasia Płaczkowska, Carolina

Rodriguez, Shulamit Sarid, Soojeong Seo, Maria Sokolova, and Jordis Weilandt; the student volunteers who ¨ helped us promote the survey at AES NY 2019—Toby Bol, Mariana Mejia, Ricardo Morejon, Nate Thomas, and Kieran Turner; and all those who helped us promote the survey, including but not limited to Sam Bennett, Larry Crane (Tape Op Magazine), Martha de Francisco, Matt Dempsey, Leslie Gaston-Bird, Thomas Gorne, Jan Herbst, ¨ Paul Jeukendrup, Mary Mazurek, Eliezer Oubda, Burc¸ Kostem, and Melina Stephan. Thank you to Ilja Frissen for contributing his statistics expertise and to Jodie Asselin, Adam Patrick Bell, Jean-Phillippe Berrou, Tiffany Boulton, Christopher Churchill, James Goddard, Jason Laurendeau, Gulden Ozcan, and Jonathan Sterne for their valuable insights into our survey construction and/or analysis. This study was funded by a Partnership Engage Grant from the Social Sciences and Humanities Research Council of Canada (SSHRC) to be conducted in partnership with AES.

8 REFERENCES

[1] J. A. Lewis and H. A. Neville, "Construction and Initial Validation of the Gendered Racial Microaggressions Scale for Black Women," *J. Counsel. Psych.*, vol. 62, no. 2, pp. 289–302 (2015). https://doi.org/10.1037/cou0000062.

[2] K. L. Nadal, "Gender Microaggressions: Implications for Mental Health," in M. A. Paludi (Ed.), *Feminism and Women's Rights Worldwide, Volume 2: Mental and Physical Health*, pp. 155–175 (Praeger, Santa Barbara, CA, 2010).

[3] Y. Yang and D. W. Carroll, "Gendered Microaggressions in Science, Technology, Engineering, and Mathematics," *Lead. Res. Ed.*, vol. 4, pp. 28–45 (2018).

[4] A. P. Bell, "DAW Democracy? The Dearth of Diversity in 'Playing the Studio,'" *J. Music Tech. Ed.*, vol. 8, no. 2, pp. 129–146 (2015 Jul.). https://doi.org/10.1386/ jmte.8.2.129_1.

[5] M. Mathew, J. Grossman, and A. Andreopoulou, "Women in Audio: Contributions and Challenges in Music Technology and Production," presented at the *141st Convention of the Audio Engineering Society* (2016 Sep.), paper 9673.

[6] K. Young, M. Lovedee-Turner, J. Brereton, and H. Daffern, "The Impact of Gender on Conference Authorship in Audio Engineering," (2019) https://tibbakoi.github.io/ aesgender/.

[7] S. L. Smith, M. Choueiti, and K. Pieper, "Inclusion in the Recording Studio? Gender and Race/Ethnicity of Artists, Songwriters & Producers Across 600 Popular Songs From 2012–2017," USC Annenberg (2018 Jan.).

[8] D. W. Sue, *Microaggressions in Everyday Life: Race, Gender, and Sexual Orientation* (Wiley & Sons, Hoboken, NJ, 2010).

[9] D. W. Sue, C. M. Capodilupo, G. C. Torino, J. M. Bucceri, A. M. B. Holder, K. L. Nadal, and M. Esquilin, "Racial Microaggressions in Everyday Life: Implications for Clinical Practice," *Am. Psychol.*, vol. 62, no. 4, pp. 271–286 (2007 May/Jun.).

[10] K. Crenshaw, "Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory, and Antiracist Politics [1989]," in*Feminist Legal Theory*, pp. 139–167 (Routledge, Oxfordshire, UK, 1991), 1st ed. https://doi.org/10.4324/ 9780429500480-5.

[11] P. Hill Collins, *Black Feminist Thought: Knowledge, Consciousness, and the Politics of Empowerment, Revised 10th Anniversary Edition* (Routledge, Abingdon, UK, 2000).

[12] L. McCall, "The Complexity of Intersectionality," *Signs J. Women Culture Soc.*, vol. 30, no. 3, pp. 1771–1800 (2005).

[13] P. H. Collins, *Intersectionality as Critical Social Theory* (Duke University Press, Durham, NC, 2019). https://doi.org/10.1515/9781478007098.

[14] J. Misra, C. V. Curington, and V. M. Green, "Methods of Intersectional Research," *So*

ciol. Spec., vol. 41, no. 1, pp. 9–28 (2020 Jul.). https://www.tandfonline.com/doi/full/10.1080/02732173.

[15] A. Pras and C. Guastavino, "The Role of Music Producers and Sound Engineers in the Current Recording Context, as Perceived by Young Professionals," *Musicae Scientiae*, vol. 15, no. 1, pp. 73–95 (2011 Mar.). https://doi.org/10.1177/1029864910393407.

[16] A. Watson and J. Ward, "Creating the Right 'Vibe': Emotional Labour and Musical Performance in the Recording Studio," *Environ. Plan. A*, vol. 45, no. 12, pp. 2904– 2918 (2013 Dec.). https://doi.org/10.1068/a45619.

[17] A. R. Hochschild, *The Managed Heart: Commercialization of Human Feeling* (University of California Press, Berkeley, CA, 2012). https://doi.org/10.1525/ 9780520951853.

[18] H. Massey, *Behind the Glass: Top Record Producers Tell How They Craft the Hits* (Miller Freeman Books, San Francisco, CA, 2000).

[19] M. Jarrett, "The Self-Effacing Producer: Absence Summons Presence," in S. Frith and S. Zagorski-Thomas (Eds.), *The Art of Record Production: An Introductory Reader for a New Academic Field*, pp. 128–148 (Routledge, Oxfordshire, UK, 2012), 1st ed. https://doi.org/10.4324/ 9781315612638.

[20] A. Pras, C. Cance, and C. Guastavino, "Record Producers' Best Practices for Artistic Direction—From Light Coaching to Deeper Collaboration With Musicians," *J. New Music Res.*, vol. 42, no. 4, pp. 381–395 (2013 Dec.). https://doi.org/10.1080/09298215.2013.848903.

[21] A. Pras, "What Has Been Left Unsaid About Studio Practices: How Producers and Engineers Prepare, Manage, and Direct Recording Sessions," in A. King and E. Himonides (Eds.), *Music, Technology, and Education*, pp. 27–44 (Routledge, Oxfordshire, UK, 2016), 1st ed.

[22] P. Wolfe, *Women in the Studio: Creativity, Control and Gender in Popular Music Production* (Rout ledge, London, UK, 2019), 1st ed. https://doi.org/10.4324/ 9781315546711.

[23] P. Thompson, *Creativity in the Recording Studio: Alternative Takes* (Palgrave Macmillan, London, UK, 2018). https://doi.org/10.1007/978-3-030-01650-0.

[24] P. W. Peterson, "History of Women in Audio," presented at the *66th Convention of the Audio Engineering Society* (1980 May), paper 1625.

[25] L. Gaston-Bird, *Women in Audio* (Focal Press, Waltham, MA, 2019). https://doi.org/10.4324/ 9780429455940.

[26] S. Walby, *Theorizing Patriarchy* (Basil Blackwell Limited, Oxford, UK, 1990).

[27] M. Arvin, E. Tuck, and A. Morrill, "Decolonizing Feminism: Challenging Connections Between Settler Colonialism and Heteropatriarchy," *Feminist Formations*, vol. 25, no. 1, pp.

8–34 (2013). https://doi.org/10.1353/ ff.2013.0006.

[28] A. Hennion, “An Intermediary Between Production and Consumption: The Producer of Popular Music,” *Sci. Technol. Human Values*, vol. 14, no. 4, pp. 400–424 (1989 Oct.). https://doi.org/10.1177/ 016224398901400405.

[29] A. K. Fournet, “Women Rockers and the Strategies of a Minority Position,” *Music Arts Action*, vol. 3, no. 1, pp. 20–47 (Editions des archives contemporaines, Paris, France, 2010).

[30] M. Buscatto “Jazz Criticism: A Man’s World,” in *Gender in Art Criticism/Du Genre dans la Critique d’Art*, pp. 17–29 (2017 Jan.).

[31] K. Marie, “Conversations With Women in Music Production,” in R. Hepworth-Sawyer J. Hodgson and M. Marrington (Eds.), *Producing Music*, pp. 311– 328 (Routledge, Oxfordshire, UK, 2019), 1st ed. https:// doi.org/10.4324/9781315212241-19.

[32] H. Marstal, “Slamming the Door to the Recording Studio – Or Leaving It Ajar?” in R. Hepworth Sawyer J. Hodgson, L. King, and M. Marrington (Eds.), *Gender in Music Production*, pp. 127–144 (Focal Press, Waltham, MA, 2020), 1st ed. https://doi.org/10.4324/ 9780429464515-10.

[33] R. J. Burgess, “Producer Compensation: Challenges and Options in the New Music Business,” *J. Art Record Prod.*, vol. 3, pp. 1–9 (2008 Nov.).

[34] K. Neuenfeldt, “Learning to Listen When There Is Too Much to Hear: Music Producing and Audio Engineering as ‘Engaged Hearing,’” *Media Int. Aus.*, vol. 123, no. 1, pp. 150–160 (2007 May). https://doi.org/10.1177/ 1329878x0712300114.

[35] A. Pras, C. Guastavino, and M. Lavoie, “The Impact of Technological Advances on Recording Studio Practices,” *J. Am. Soc. Inf. Sci. Technol.*, vol. 64, no. 3, pp. 612–626 (2013 Mar.). https://doi.org/10.1002/asi.22840.

[36] S. Bennett, *Modern Records, Maverick Methods – Technology and Process in Popular Music Record Production 1978–2000* (Bloomsbury Academic, London, UK, 2019). https://doi.org/10.5040/9781501344138.

[37] B. Sandstrom, “Women Mix Engineers and the Power of Sound,” in P. Moisala and B. Diamond (Eds.), *Music and Gender*, pp. 289–305 (University of Illinois Press, Champaign, IL, 2000).

[38] S. S. Horning, “Engineering the Performance: Recording Engineers, Tacit Knowledge and the Art of Controlling Sound,” *Social Studies Sci.*, vol. 34, no. 5, pp. 703–731 (2004 Oct.). https://doi.org/10.1177/ 0306312704047536.

[39] A. Pras, K. Turner, T. Bol, and E. Olivier, “Production Processes of Pop Music Arrangers in Bamako, Mali,” presented at the *147th Convention of the Audio Engineering Society* (2019 Oct.), paper 10296.

[40] J. M. Gander, “Situating Creative Production: Recording Studios and the Making of a Pop Song,” *Management Decision*, vol. 53, no. 4, pp. 843–856 (2015).

https://doi.org/10.1108/md-03-2014-0165.

[41] D. Minchella, “The Poetics of Space: The Role and Co-performance of the Spatial Environment in Popular Music Production,” in S. Bennett and E. Bates (Eds.), *Critical Approaches to the Production of Music and Sound*, pp. 41–61 (Bloomsbury, Lon don, UK, 2018). https://doi.org/10.5040/9781501332074. 0009.

[42] K. Keightley, “‘Turn it Down!’ She Shrieked: Gender, Domestic Space, and High Fidelity,” *Popular Music*, vol. 15, no. 2, pp. 149–177 (1996 May). https://doi.org/10.1017/s0261143000008096.

[43] C. Pierce, “Offensive Mechanisms,” in F. B. Barbour (Ed.), *The Black Seventies*, pp. 265–282 (Porter Sargent, Boston, MA, 1970).

[44] D. W. Sue, D. Sue, H. A. Neville, and L. Smith, *Counseling the Culturally Diverse: Theory and Practice* (John Wiley & Sons, Hoboken, NJ, 2019), 8th ed.

[45] K. Charmaz, *Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis* (SAGE, Thousand Oaks, CA, 2006), 1st ed.

[46] C. Labuski and C. Keo-Meier, “The (Mis)Measure of Trans,” *Trans. Studies Quarter.*, vol. 2, no. 1, pp. 13–33 (2015 Feb.).

[47] J. J. Cameron and D. A. Stinson, “Gender (Mis)Measurement: Guidelines for Respecting Gender Diversity in Psychological Research,” *Social Pers. Psych. Compass*, vol. 13, no. 11, e12506 (2019 Nov.).

[48] G. Norman, “Likert Scales, Levels of Measurement and the “Laws” of Statistics,” *Adv. Health Sci. Ed.*, vol. 15, no. 5, pp. 625–632 (2010). https://doi.org/10.1007/ s10459-010-9222-y.

[49] J. Cohen, *Statistical Power Analysis for the Behavioral Sciences*, 2nd ed. (L. Erlbaum Associates, Hillsdale, NJ, 1988). https://doi.org/10.1016/b978-0-12-179060-8. 50005-0.

[50] J. Cohen, “A Power Primer,” *Psych. Bulletin*, vol. 112, no. 1, pp. 155–159 (1992). https://doi.org/10.1037/ 0033-2909.112.1.155.

[51] G. Corbie-Smith, S. B. Thomas, and D. M. M. St. George, “Distrust, Race, and Research,” *Arch. In tern. Med*., vol. 162, no. 21, pp. 2458–2463 (2002 Nov.). https://doi.org/10.1001/archinte.162.21.2458.

[52] T. Zuberi and E. Bonilla-Silva (Eds.), *White Logic, White Methods: Racism and Methodology* (Rowman & Littlefield Publishers, Inc., Lanham, MD, 2008). [53] M. Kovach, *Indigenous Methodologies: Characteristics, Conversations, and Contexts* (University of Toronto Press, Toronto, Canada, 2010).

[54] L. T. Smith, *Decolonizing Methodologies: Research and Indigenous Peoples* (Zed Books Limited, Auckland, New Zealand, 2013).

[55] U. R. Hulsheger and A. F. Schewe, “On the Costs and Benefits of Emotional Labor: A

Meta-Analysis of Three Decades of Research," *J. Occup. Health Psych.*, vol. 16, no. 3, pp. 361–389 (2011). https://doi.org/10.1037/a0022876.

[56] V. -Y. Koon and P. -Y. Pun, "The Mediating Role of Emotional Exhaustion and Job Satisfaction on the Relationship Between Job Demands and Instigated Workplace Incivility," *J. Appl. Behav. Sci.*, vol. 54, no. 2, pp. 187–207 (2018 Jun.). https://doi.org/10.1177/ 0021886317749163.

[57] G. Blau and L. Andersson, "Testing a Measure of Instigated Workplace Incivility," *J. Occup. Or ganiz. Psych.*, vol. 78, no. 4, pp. 595–614 (2005 Dec.). https://doi.org/10.1348/096317905x26822.

[58] D. D. van Jaarsveld, D. D. Walker, and D. P. Skar licki, "The Role of Job Demands and Emotional Exhaustion in the Relationship Between Customer and Employee Incivility," *J. Manage.*, vol. 36, no. 6, pp. 1486–1504 (2010 Nov.). https://doi.org/10.1177/0149206310368998.

[59] J. E. Bartlett II, M. E. Bartlett, and T. G. Reio, Jr., "Workplace Incivility: Worker and Organizational Antecedents and Outcomes," in *Proceedings of the Academy of Human Resource Development International Research Conference in the Americas* (Panama City, FL) (2008 Feb.).

[60] A. H. Eagly, "The His and Hers of Prosocial Behavior: An Examination of the Social Psychology of Gender," *Am. Psych.*, vol64, no. 8, pp. 644–658 (2009). https://doi.org/10.1037/e669392012-012.

[61] T. A. Kupers, "Toxic Masculinity as a Barrier to Mental Health Treatment in Prison," *J. Clin. Psych.*, vol. 61, no. 6, pp. 713–724 (2005 Jun.). https://doi.org/10.1002/ jclp.20105.

[62] J. L. Berdahl, M. Cooper, P. Glick, R. W. Livingston, and J. C. Williams, "Work as a Masculinity Contest," *J. Social Issues*, vol. 74, no. 3, pp. 422–448 (2018 Sep.). https://doi.org/10.1111/josi.12289.

[63] B. Derks, C. Van Laar, and N. Ellemers, "The Queen Bee Phenomenon: Why Women Leaders Distance Themselves From Junior Women," *Leader. Quarter.*, vol. 27, no. 3, pp. 456–469 (2016 Jun.). https://doi.org/ 10.1016/j.leaqua.2015.12.007.

[64] B. Derks, N. Ellemers, C. van Laar, and K. de Groot, "Do Sexist Organizational Cultures Create the Queen Bee?" *Brit. J. Social Psych.*, vol. 50, no. 3, pp. 519–535 (2011 Sep.).

[65] S. A. M. Buckingham and M. Ronan, "Factors Contributing to Gender Imbalance in the Audio Industry," presented at the *146th Convention of the Audio Engineering Society* (2019 Mar.), paper 10159.

[66] B. Prior, E. Barra, and S. Kramer, "Women in the US Music Industry" (2020). http://datasim.info/wp-content/uploads/2019/04/Women-in-the -U.S.-Music-Industry-Report.pdf.

[67] M. Duguid, "Female Tokens in High-Prestige Work Groups: Catalysts or Inhibitors of

Group Diversification?" *Organiz. Behav. Human Decision Process.*, vol. 116, no. 1, pp. 104–115 (2011 Sep.). https://doi.org/10.1016/ j.obhdp.2011.05.009.

[68] O. Marshall, "Shibboleths in the Studio: Informal Demarcation Practices Among Audio Engineers," *Social Studies Sci.*, vol. 50, no. 6, pp. 881–900 (2020 Dec.).

[69] F. E. Toole, "Audio - Science in the Service of Art," *The Audio Critic*, vol. 28, pp. 5–14 (2002).

[70] F. Camerer, "On the Way to Loudness Nirvana – Audio Levelling With EBU R 128," *EBU Tech. Rev.* (2010).

[71] A. Fournet, *Women Music Producers: Sonic Innovation From the Periphery of a Male-Dominated Industry*, Ph.D.

A.1: Additional Tables and Figures

Table A1. P-values for TAS analysis, color-coded by effect size. No large or medium effect sizes were found. Entries in light gray/yellow indicate small effect size (Cramer's V > 0.07 or 0.1). Non-significant entries are in white with gray text. Slope entry color indicates direction of relationship of dependent variable with AGE (light gray/pink positive, dark gray/blue negative).

		N	GEN	SOR	RET	DIS	MIG	GNI	AGE	
			p (χ^2)						P(t)	Slope
			ALL AGES							
Task accomplished in the studio (TAS)	Tracking	387	0.25	0.07	0.15	0.09	0.83	0.94	0.06	-0.02
	Editing		0.43	0.18	0.96	0.08	0.19	0.09	0.07	-0.02
	Mixing		0.70	9.68E-3	0.20	0.01	0.12	0.98	0.02	-0.03
	Mastering		2.09E-3	3.67E-3	0.35	0.21	0.67	0.90	0.02	0.02
	Producing		0.34	0.05	0.34	0.28	0.12	0.77	0.84	0.00
	Assisting		2.06E-5	3.05E-3	0.05	0.73	0.95	0.56	8.16E-19	-0.13
	Other		0.52	0.36	0.95	4.49E-04	0.90	0.01	0.93	0.00
			AGE < 30							
	Tracking	98	0.75	0.04		0.01				
	Editing		0.33	0.32		0.38				
	Mixing		0.96	0.02		0.42				
	Mastering		0.04	0.01		0.12				
	Producing		0.30	0.01		0.36				
	Assisting		0.09	0.01		0.64				
	Other		0.24	0.38		2.23E-03				

Table A2. Dunn's post-hoc test findings for one-way Kruskal-Wallis tests on aggregate microaggressions scores. δ is equal to the score for demographic category 2 minus the score for demographic category 1 – so for example, the δ value reported for CM/CW indicates the score for cisgender women minus the score for cisgender men. For Likert-scale questions, a δ of 1 indicates a difference of one point. For DRA, δ>0 indicates more often being properly credited. For microaggressions factors, δ>0 indicates more often experiencing microaggressions from that factor. For AESM, δ>0 indicates more often being an AES member. For AESD, δ>0 indicates more often being aware of the AES D&I Committee. Significant differences are in gray, non-significant differences are in white with gray text. Abbreviations: CM=cisgender man; CW=cisgender woman; TNB=trans/non binary; H=heterosexual; NH=non-heterosexual; RN=Either white, or BIPOC and not part of a racial/ethnic minority in place of work; RY=Both BIPOC and part of a racial/ethnic minority in place of work; ND=non-disabled; ID=invisible disability; VD=visible disability; MN=lives in country of birth; MY=lives in country other than country of birth; L=low/lower middle income country; H=upper middle/high income country.

	UNIT	N	GEN			SOR	RET	DIS			MIG	GNI
			δ: CM/CW	δ: CM/TNB	δ: CW/TNB	δ: H/NH	δ: RN/RY	δ: ND/ID	δ: ND/VD	δ: ID/VD	δ: NM/MY	δ: L/H
	USD	138	-58.60	-49.40	9.20	19.24	-66.21	-61.47	71.77	133.24	3.46	45.35
	LS1	387	-0.68	-0.49	0.19	-0.18	-0.65	-0.91	-0.36	0.54	-0.45	0.08
AESM	N->Y		0.16	0.05	-0.11	-0.06	0.15	0.26	0.26	0.00	0.10	0.33
AESD	N->Y		-0.25	-0.17	0.08	-0.23	-0.19	0.50	-0.29	-0.79	0.25	0.64
SOB		283	1.14	1.23	0.08	0.50	0.34	1.14	0.52	-0.62	-0.02	-0.18
SAM		284	1.04	1.04	0.00	0.31	0.51	0.96	0.42	-0.54	0.13	-0.33
STE		281	0.82	1.01	0.18	0.17	0.20	0.79	-0.10	-0.90	0.07	-0.67
MGEN		234	2.30	1.61	-0.69	0.92	0.87	1.27	0.50	-0.77	0.03	0.17
MAGE			1.05	1.03	-0.01	0.43	0.12	1.06	0.34	-0.72	-0.02	-0.39
MSOR			0.42	1.02	0.60	0.82	0.22	0.78	0.57	-0.20	0.05	0.02
MCUL			0.16	0.58	0.42	-0.02	0.47	1.12	0.20	-0.93	0.52	-0.67
MDIS			0.61	0.76	0.15	0.37	0.38	1.57	0.95	-0.63	0.01	-0.21
MRET	LS2		0.11	0.42	0.32	0.01	0.88	0.94	0.24	-0.70	0.21	-0.72

Table A3. P-values for ***f***-statistics from 2-way ANOVA of GEN/SOR for intersection analysis, color coded by effect size. Entries with background in dark gray/red indicate large effect size (η^2 >= 0.1379), entries in medium gray/orange indicate medium effect size (η^2 >= 0.0588), entries in light gray/yellow indicate small effect size (η^2 >= 0.0099). Non-significant entries are in white with gray text.

			N	GEN	SOR	GEN*SOR
				p (f)		
Workplace Microaggressions	SOB	I have received unwanted comments about my physical appearance	282	5.11E-11	0.34	0.62
		I have received unwanted comments about my hair and/or make-up	283	7.07E-09	0.82	0.44
		I have received unwanted comments about my skin tone	283	0.09	0.54	0.91
		People have objectified me based on physical features	282	4.02E-19	0.07	0.05
		People have made me feel unattractive because of my physical appearance	283	4.79E-06	0.40	0.26
		People have made sexually inappropriate comments	281	1.36E-12	0.01	4.22E-03
		People have assumed I was sexually promiscuous	282	4.11E-06	0.97	0.75
	SAM	People have imitated the way that I speak	284	2.84E-03	9.68E-03	0.66
		People have assumed I speak a certain way	283	1.16E-03	0.15	0.65
		I have felt unheard	281	4.55E-13	0.33	0.24
		My comments have been ignored	283	5.21E-09	0.18	0.47
		People have challenged my authority	282	1.73E-14	0.30	0.03
		I have been disrespected	283	7.18E-10	0.12	0.02
		People have tried to "put me in my place"	282	5.35E-09	0.74	0.06
		I have felt excluded from networking opportunities	282	4.55E-04	0.92	0.58
		People have assumed I did not have much to contribute to the session	281	1.88E-10	0.73	0.31
		My professional expertise has been questioned	281	3.15E-11	0.70	0.32
	STE	I have been told that I was too assertive	280	2.26E-03	0.16	0.75
		I have been told that I was too emotional	278	1.38E-09	0.60	0.78
		I have been told that I was too independent	280	7.70E-04	0.21	0.79
		People have assumed that I was going to be nurturing and caring	279	3.64E-06	0.12	0.17
		I have been told that I was too sassy and straightforward	281	1.93E-05	0.02	0.23
		People have made me feel exotic	277	3.86E-07	0.32	0.85
	MGEN	People have been unfriendly or unwelcoming toward me because of my gender.	233	2.97E-30	0.02	0.06
		My opinion has been overlooked in a group discussion because of my gender.	234	5.83E-35	0.02	0.21
		I have been ignored because of my gender.	234	1.31E-25	0.04	0.15
		People have assumed that my work would be inferior to people of other genders.	232	1.63E-31	0.20	0.62
		People have treated me differently than people of other gender groups.	232	5.40E-18	0.02	0.09
	MAGE	People have been unfriendly or unwelcoming toward me because of my age.	232	1.26E-06	0.20	0.43
		My opinion has been overlooked in a group discussion because of my age.	233	2.11E-04	0.35	0.37
		I have been ignored because of my age.	233	0.02	0.68	0.08
		People have assumed that my work would be inferior to people of other ages.	230	2.94E-05	0.38	0.74
		People have treated me differently than people of other age groups.	232	1.27E-04	0.83	0.48
	MSOR	People have been unfriendly or unwelcoming toward me because of my sexual orientation.	232	0.02	5.96E-07	0.29
		My opinion has been overlooked in a group discussion because of my sexual orientation.	231	0.01	1.88E-03	0.43
		I have been ignored because of my sexual orientation.	233	0.01	0.01	0.50
		People have assumed that my work would be inferior to people of other sexual orientations	232	1.38E-03	0.18	0.21
		People have treated me differently than people of other sexual orientation groups.	230	0.35	3.78E-04	0.83
	MCUL	People have been unfriendly or unwelcoming toward me because of my cultural origin.	233	0.10	0.29	0.89
		My opinion has been overlooked in a group discussion because of my cultural origin.	233	0.08	0.19	0.62
		I have been ignored because of my cultural origin.	232	0.04	0.73	0.93
		People have assumed that my work would be inferior to people of other cultural origins.	231	0.33	0.48	0.93
		People have treated me differently than people of other cultural groups.	230	6.54E-03	0.30	0.66
	MDIS	People have been unfriendly or unwelcoming toward me because of my level of ability.	234	0.02	0.14	0.62
		My opinion has been overlooked in a group discussion because of my level of ability	232	9.03E-03	0.25	0.66
		I have been ignored because of my level of ability	230	0.03	0.87	0.96
		People have assumed that my work would be inferior to people of other levels of ability.	232	6.18E-03	0.83	0.68
		People have treated me differently than people of other levels of ability.	232	0.02	0.72	0.76
	MRET	People have been unfriendly or unwelcoming toward me because of my race.	232	0.48	0.09	0.82
		My opinion has been overlooked in a group discussion because of my race.	233	0.19	0.70	0.78
		I have been ignored because of my race.	233	0.09	0.36	0.77
		People have assumed that my work would be inferior to people of other races	230	0.49	0.46	0.78
		People have treated me differently than people of other race groups.	231	0.05	0.58	0.52

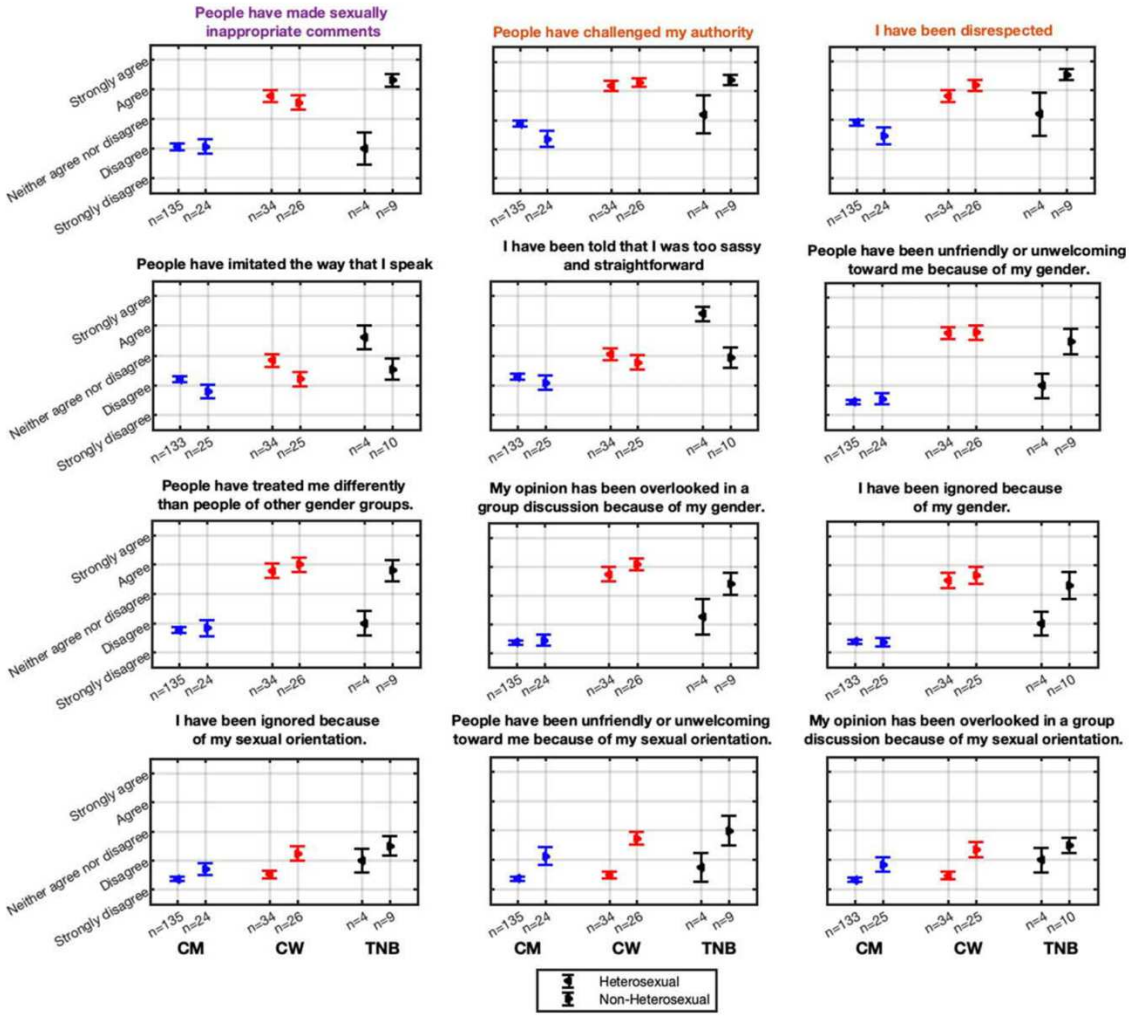


Fig. A1. Microaggressions with a simultaneous effect for GEN/SOR (black titles) and/or a GEN∗SOR intersection term (dark gray/purple indicates both simultaneous effect and interaction term; light gray/orange indicates only intersection term).

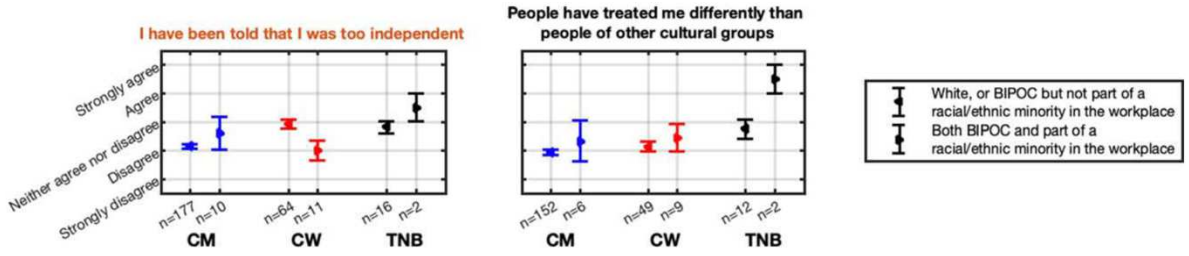


Fig. A2. Microaggressions with a simultaneous effect for GEN/RET (black title) or a GEN∗RET intersection term (light gray/orange title).

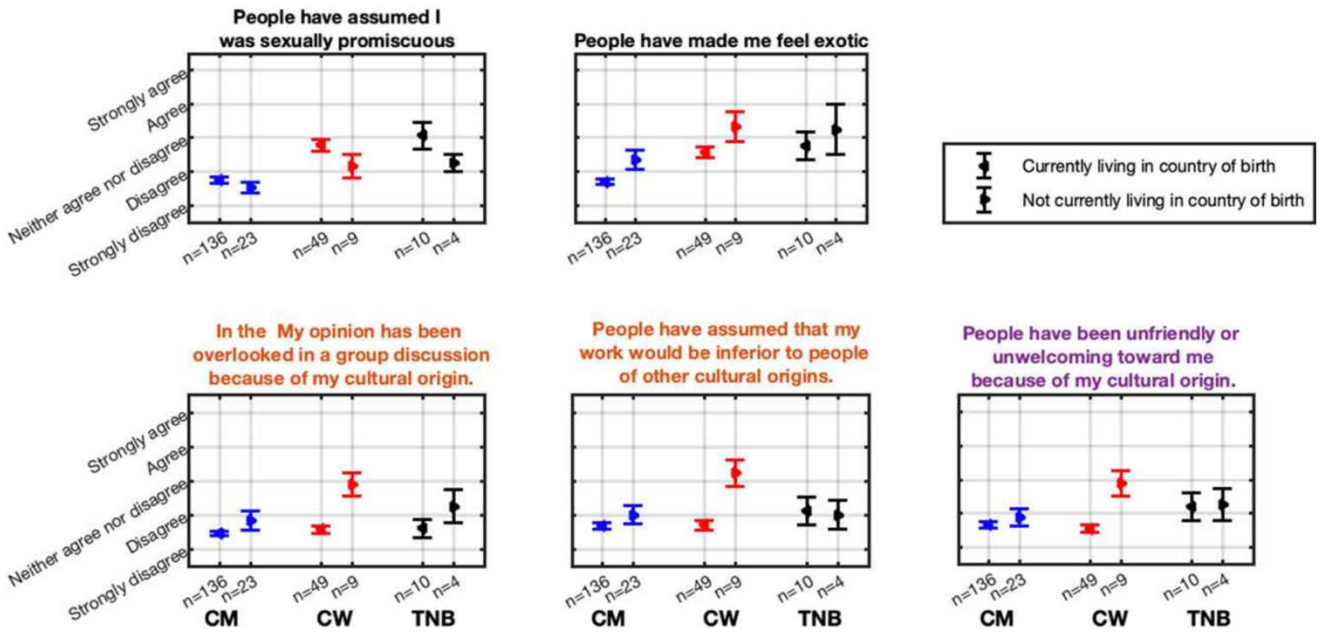


Fig. A3. Microaggressions with a simultaneous effect for GEN/MIG (black titles) and/or a GEN∗MIG intersection term (dark gray/purple indicates both simultaneous effect and interaction term; light gray/orange indicates only intersection term).

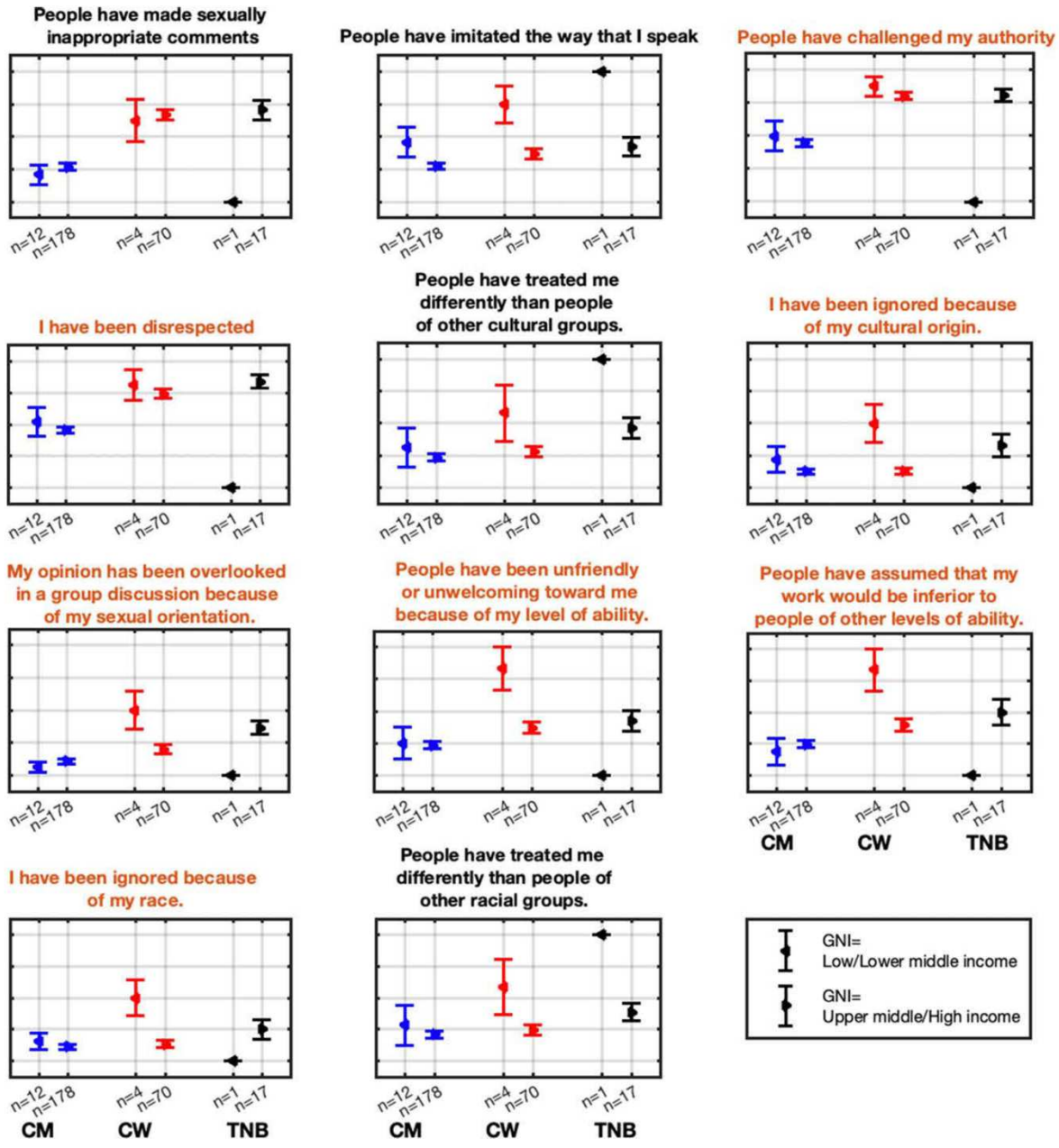


Fig. A4. Microaggressions with a simultaneous effect for GEN/GNI (black titles) or a GEN∗GNI intersection term (light gray/orange titles). No microaggression had both a simultaneous effect and an intersection term for GNI.

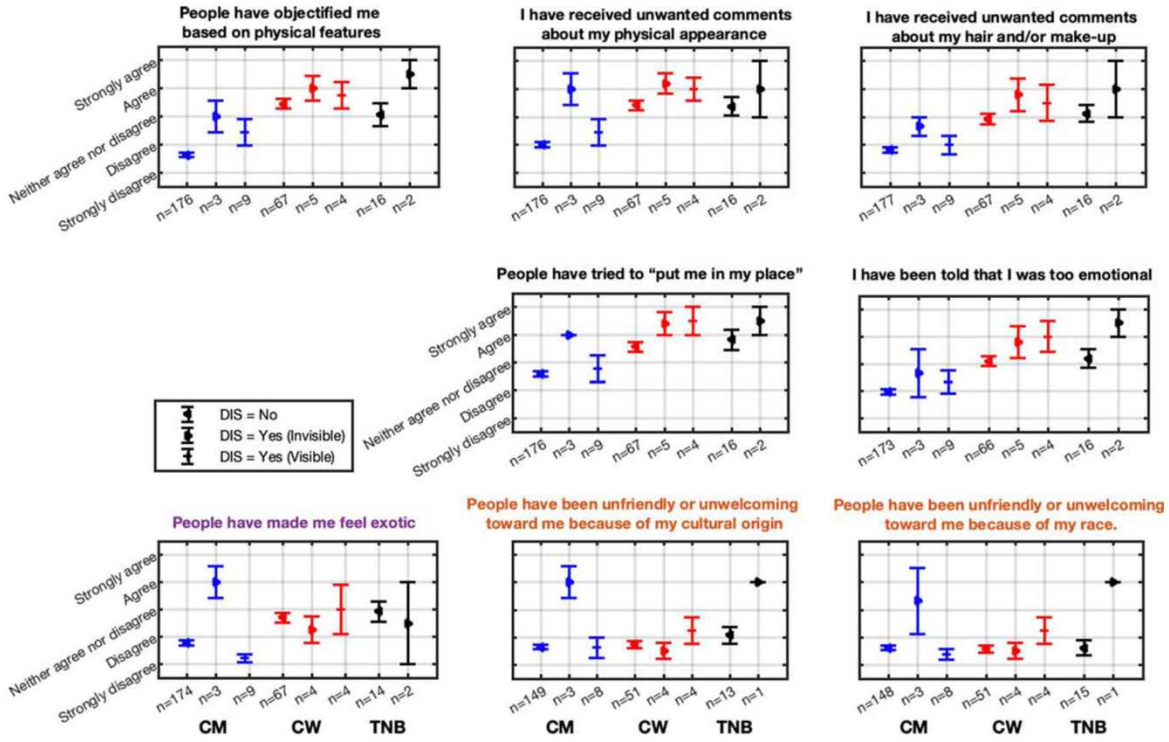


Fig. A5. Microaggressions with a simultaneous effect for GEN/DIS (black titles) and/or a GEN∗DIS intersection term (dark gray/purple indicates both simultaneous effect and interaction term; light gray/orange indicates only intersection term). Note that no trans/non-binary participants identified as having a visible disability.

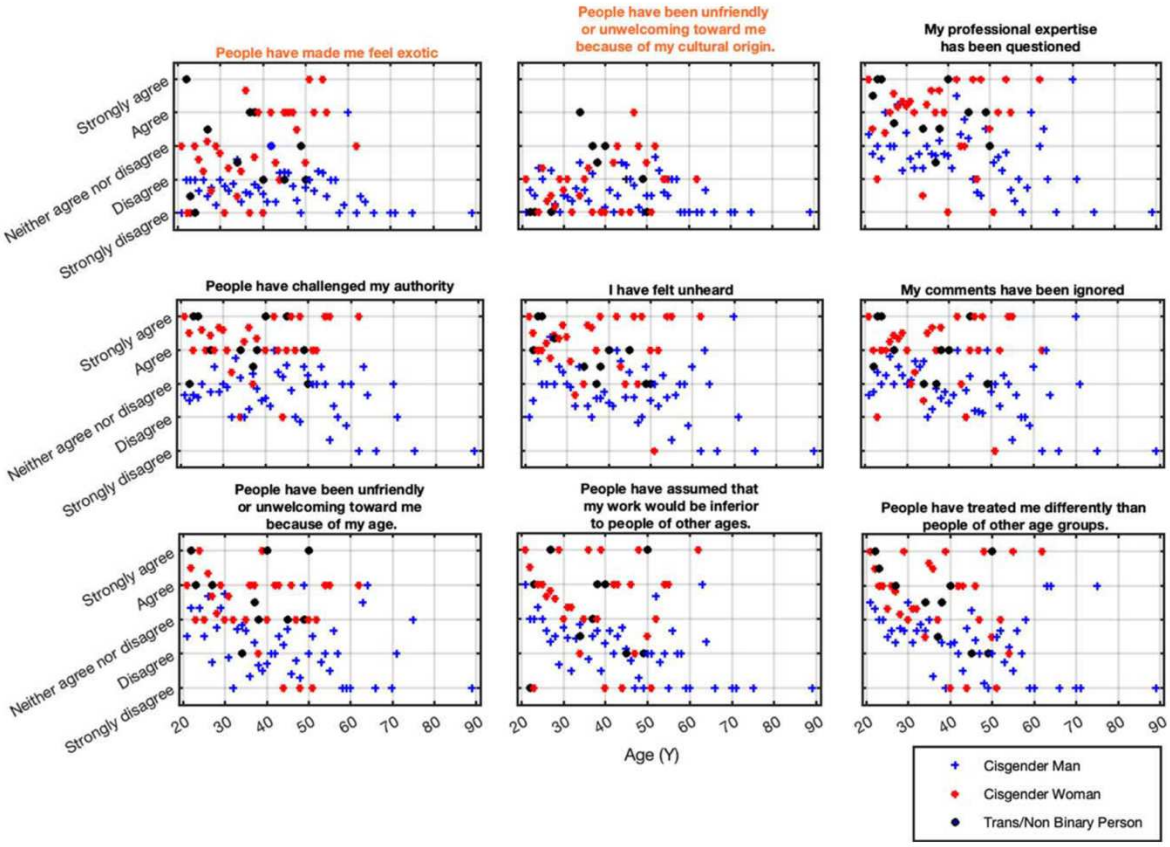


Fig. A6. Microaggressions with a simultaneous effect of GEN/AGE (black titles) or a GEN∗AGE intersection term (gray/orange titles). No microaggression had both a simultaneous effect and an intersection term for AGE. Markers represent the mean response for a given gender at a given age, e.g., at age 50, a single cross represents the mean score for cisgender men of age 50, a star for cisgender women of age 50, and a dot for trans/non-binary people of age 50.

THE AUTHORS


Grace Brooks


Amandine Pras


Monica Lockett

Grace Brooks is an experimental musician, live sound engineer, and PhD candidate in the School of Information Studies at McGill University. They are conducting an interdisciplinary research project linking tacit knowledge and gender performativity in professional practice.

•

In addition to this project about Gender in the Studio, Amandine Pras is leading The West African Audio Network funded by SSHRC, in partnership with AFRINUM directed by Emmanuelle Olivier and funded by ANR. Her research explores, from a global perspective, how the democratization of digital audio technology that disrupted large-format analog studios and the Western business model of the recording industry has generated extended music performance techniques and innovative audio practices. She completed her PhD thesis in Information Sciences at McGill on best practices for musical recording in the digital era. Since her graduation from the Paris Conservatoire and her participation in the Audio Recording Engineer Practicum at the Banff Centre, she has pursued a career as a freelance music producer and audio engineer. She has released albums with musicians as diverse as the ARC Ensemble, Jim Black, Quatuor Bozzini, Luciane Cardassi, Daniel Carter, Benoit Delbecq, Mary Halvorson, Tony Malaby, the Metropolis Ensemble, Andy Milne, Satoshi Takeishi, and William Parker.

•

Dr. Athena Elafros is a qualitative cultural sociologist. She is Assistant Professor of Sociology at the University of Lethbridge.

•

Monica Lockett is an undergraduate student in Sociology at the University of Lethbridge. A journalist by trade, she received a diploma in Communication Arts from Lethbridge College and has worked in northern Alberta as a radio news reporter and anchor. Her research experience and interests focus on the intersections of protest, journalism, and political duty; how journalists conceive of their professional role and identity; and analyzing qualitative experiences of microaggression and discrimination in audio recording studios.

Interstitium IV

This manuscript relates gender-as-knowledge (Chapter 1) to strategies for survival in the context of hegemonic masculinity, relating how audio engineers strategically leverage performing masculinity to gain power and control in work settings defined by the highly stratified gender relations described in Chapter 2. I explore how a normative conception of masculinity in audio- in this case constructed in terms of emotional labor and performances of being adept with respect to certain technologies, aesthetics, and techniques- relates to the lived experiences of actual audio engineers on an individual level. I also highlight *what kinds* of masculinities emerge from the sociotechnical spaces of audio engineering. Returning to Watson and Ward's (2013) work on emotional engineering, I describe how the forms of emotional labor which are preferred within audio engineering are already masculinized, delineating a form of *nurturing technical masculinity* that is preferred within the industry. This is not to say that nurturing technical masculinity is a feminized masculinity: indeed, this article highlights how difficulty enacting nurturing technical masculinity poses a major issue for women working in audio.

I conducted a series of semi-structured interviews with audio professionals in Canada, the USA and Germany, exploring how they talk about their own relationships to gender, masculinity, and learning. In a context of hegemonic masculinity within the audio industry, performing masculinity is a necessary skill for success (Annetts, 2015). Engineers are keenly aware of the expectation that they will orient themselves with respect to this hegemonic configuration, as well as of changing masculinities within the field. I identify discursive methods by which audio professionals alternately cleave to and differentiate themselves from hegemonic masculinity, as well as the pitfalls and potentials afforded by doing so. For women, working in audio typically

involves deliberately, intentionally performing masculinity with variable results. All the women I interviewed discursively positioned themselves as 'scientific' and 'technical' in order to access insider status as an audio engineer. While they strive to perform masculinity in the ways that are culturally encouraged within the industry ('that's just what you have to do to do the job'), the women I interviewed expressed feeling they would never quite be fully accepted, illustrating the frustrating perlocutive limits to their gender performance: 'In the end I'm still just a girl in boots holding a multi-tool'. On the other hand, the men explicitly expressed not wanting to be seen as 'macho' or part of the 'boys club', describing themselves as artists and in some cases discursively distancing themselves from science/technology.

The interviewees also identified a relationship between gender hegemony and precarity within the industry. They related excessively masculine performances and 'toxic' behavior with insecurity and competition. I relate this finding to some contemporary studies of precarity within audio engineering (Brunet, 2024; Zendel, 2024) and argue that masculine hegemony in audio has been maintained to the extent that it has- despite the apparent 'democratizing' influence of technological miniaturization and affordability (Annetts, 2015) and the presence of organizations such as SoundGirls and WAM- primarily as a strategy for reducing competition by categorically excluding half of the population.

Chapter 3: 'I'm still just a girl in boots holding a multitool': brokering masculinity in audio engineering

Abstract

How audio engineers of all genders talk about their own masculinity- what it does for them, who it's for, and how it relates to their sense of themselves- presents an inside view into their strategies for survival and success in a highly masculinized profession. Audio engineers perform masculinity in order to position themselves with the authority necessary to direct and guide the creative process, to manufacture and reify power relations, and simultaneously to engender feelings of security and safety in clients. Women in audio pursue 'being one of the guys', a gender crossing that allows them to leverage power in the context of hegemonic masculinity and to avoid or minimize experiences of sexual harassment. Men discursively distance themselves from 'aggressive' or 'controlling' masculinity, which they framed as regressive. Instead, audio engineers favour a nurturing technical masculinity characterised by performances of masculinized emotional labor. While audio engineers of all genders work at learning to embody nurturing technical masculinity, women experience certain distinctive struggles in relation to it due to their difficulties being read as sufficiently masculine. Competition and precarity were identified by the participants as a key driver of sexism and gender-based exclusion in audio engineering.

Keywords: audio engineering, closure, emotional labor, female masculinity, precarity

Introduction

From the lab-coated engineers of early recording studios to the sleazy producer of the 1980s to the home-studio wunderkind of the 2000s, the culturally dominant image of the audio engineer which has emerged from the studios, venues, forums, and other socio-technical spaces in which audio engineering takes place is definitively a man (Kealy, 1979; Moorefield, 2010). Despite the supposed democratizing influence of technological miniaturization, the development of the home studio, and formal audio engineering programs; obtaining reasonable work and meaningful mentorship remains elusive for gender minority audio engineers. This is not to say that men working in audio engineering have it easy. In the current state of the industry, freelancing, erratic schedules, poor pay, and negligible benefits are the norm (Brunet, 2024; Zendel, 2024). In spite of this apparent precarity, careers in audio engineering remain highly sought after, and in an industry defined by masculine hegemony (Annetts, 2015; Zendel, 2023) how audio engineers of all genders talk about their own masculinity- what it does for them, who it's for, and how it relates to their sense of themselves as gendered subjects- presents an inside view into their strategies for survival and success.

I understand masculinity to be a socio-discursive positioning expressed and challenged in lived, material, embodied acts and experiences within social and physical spaces- that is to say, it is performed (Butler, 1990; Mulari, 2023). Consequently, masculinities are multiple. There is no one universal conception of what constitutes a successful masculine performance, and in fact these idealizations may differ widely, especially between local and global contexts (Connell, 2005). Masculinities are practised not only by men, and do not necessarily involve only relationships among men. To understand how audio engineers position themselves with respect to shared models of masculinity, I refer to the concept of *hegemonic masculinity*, understood as

the pattern of practices (actions, role expectations, identities) embodying the ‘current most honoured way of being a man’ (Connell, 2005). The presence of a hegemonic masculinity structures a gender field by organizing the hierarchies of power within that field into a patriarchal structure. Therefore, looking at how people orient themselves with respect to the hegemonic form becomes a powerful tool for understanding how power works within the social field.

To better establish the mechanisms underlying the continued masculinization of audio engineering and develop an understanding of how audio engineers' experiences at work are shaped by the gendering of the field, I conducted a qualitative study consisting of semi-structured interviews with professional audio engineers (men, women and non-binary people) addressing the following questions:

- RQ1: Given that audio engineering is a male-dominated field, how do audio engineers position themselves with respect to masculinity?
- RQ2: What is the relationship between the precarity of audio engineering labor and its continued masculinization?

Research methods

I recruited fourteen interviewees via snowball sampling, beginning with people from my own network. The interviews took place between 2019 and 2021, lasted between one and four hours, and were organised around a set of core questions relating to how the interviewees started working in audio engineering and their experiences of learning and mentorship within the field (Appendix 4). When it was not brought up by participants, I asked questions about gendered

experiences and their thoughts on the masculinization of audio engineering. In all cases, the interviews volunteered a wide variety of topics, which allowed me to gather contextual data and add detail to my picture of the practices, attitudes, discourses and affects associated with each participant's work life as an audio engineer. Interview materials were transcribed by hand and the data was coded in Taguette (Version 1.3.0) using the constant comparison method for qualitative coding. I gave the interviewees the option to review their anonymized quotations before including them in this article. This step was taken to ensure their full consent in sharing their stories in this context. Whenever practical I've included contextual information and allowed the participants to speak for themselves as much as possible.

Eight of the participants self-identified as men, two as non-binary and the remaining four as women. One of the non-binary people, one of the cisgender men, and one of the cisgender women self-identified as queer. One of the participants was African American, one was Latinx, and the rest were white. Three study participants were recent (<5 years) graduates of audio engineering degree programs, in the early stages of establishing their professional careers, while the rest had worked in audio engineering professionally for at least ten years prior to the interviews. Three worked primarily in mastering, five in live sound reinforcement, five in sound recording (two in classical music and the rest in pop or rock), and one in sound design. At the time of the interviews, I'd worked directly with five of the interviewees in a music production context and had pre-existing relationships with them. One interview was discarded for ethical reasons related to workplace privacy.

The results presented here are structured in terms of themes that emerged from the qualitative coding, which were densely interleaved with information relevant to each of the research questions, reflecting the complexity of the data itself.

Findings

I. Sciencey narratives and getting a foot in the door (RQ1)

Audio engineers engage in a wide mix of tasks, some technical and some artistic (Beer, 2014; Kealy, 1979; Neuenfeldt, 2007; Porcello, 2004). As such, the literature on audio engineering often frames the practice as 'both an art and a science' and the audio engineer as 'wearing many hats' (Beer, 2014), with equal importance placed upon scientific background/technological virtuosity and artistic temperament/aesthetic judgement. There was a strong distinction in how women and men situated themselves on this art vs. science spectrum. Men and non-binary participants typically described having been aspiring artists (typically musicians, but in one case an actor and in one case a visual artist), with audio engineering representing a natural extension of that. For example, one participant describes his early interest in recording stemming from a desire to connect with and emulate popular musicians whose work was meaningful for him:

> Q1 (he/him): I wanted to be a musician when I was younger, but I never felt like I had the chops… So I looked for other methods of working in music and I found that recording was something I really enjoyed. I was less interested in the people who made the recordings as much as I was the records themselves and the musicians. Recording was like a gateway into being the people that I wanted to be. I wasn't super interested in recording as an art form yet, or a producer in their role. It was more like, 'Well, if I just figure out this thing, then I'm going to be the next Kurt Cobain, I just got to do it'. [Laughs]

Growing up at the end of the MTV generation, his statement reflects the celebrity culture of the early 2000's, where authenticity, do-it-yourself (DIY) aesthetics and cult of personality

prevailed. For him, sound recording was a tool for self-creation, an aspirational site of becoming-in his case, becoming a performer himself. This 'next best thing' narrative was invoked in some form by several participants, although always accompanied by an expression of enjoying their work.

Another participant describes how involvement in art and performance scenes quite literally opened the door to the studio for him. He describes a serendipitous formative experience of feeling 'so at home' in a university recording studio, as well as his captivation with the technological objects contained within it.

> Q2 (he/him): A friend of mine needed a voice actor for a radio play. So I went [into the studio] when I was 19, and it was the first time I'd ever been in a recording studio. And I was just like, I felt so at home. I was like, my God, this is school? First of all, that's incredible that this is school. And second of all, like, look at all these machines.

These examples reflect how masculine subjectivities and sociabilities are often constructed in relation to, and characterised by positive feelings towards, technology. This relation has been highlighted throughout the masculinities literature and has strong historical roots (Annetts, 2015; Mellström, 2004). Nonetheless, like the other men I interviewed, this participant contextualizes his interest in audio technology strictly in terms of an underlying love of music.

On the other hand, women universally described themselves as having entered audio engineering specifically via an interest in science and mathematics or an interdisciplinary interest in both science and music, tacitly forcing themselves into proximity with masculinity by capitalizing on the cultural association between science (especially physics) and masculinity (Götschel, 2014).

> Q3 (she/her): I had to specify a major and I had no idea what recording was, but I was like, Oh - I can do that. So I went to the interview [with the director of the program] and he asked me, why do you want to study this major? I was like - 'I like music, and I like science, and I think it's a great way to put both of them together' - and he said 'Best answer I've heard all day, you're in.'

This association is echoed in another participant's statement that by virtue of 'coming into audio through the physics mindset' she was 'already interested in other things that were not normal for female expression'. She links her non-traditional career aspirations with 'subversion' and participation in masculine spaces (Assunção, 2016), which she implicates in her own gender identity.

> Q4 (she/her): I guess I came into audio through the physics mindset. When I was deciding what I wanted to study, I didn't particularly see myself as a traditional female, right? I was very interested in spending time with guys. And friendships with guys, and those interactions. So I guess at the beginning I didn't see it as something that I couldn't aspire to, because I was already interested in other things that were not normal for female expression. So I was already kind of subverting that.

Women drew attention to their scholarly excellence, often in conjunction with an expression of their 'scrappiness' or tenacity, an emphasis that appears throughout the interview material. They also described not being encouraged by their families to pursue a career in audio engineering. On the other hand, the men reported largely neutral or positive encouragement from their families. In several cases, they reported that their parents facilitated their interest in music and sound recording by allowing them the use of the family home to practise or record. One participant

expressed that while his parents were not happy with his career choice and would have preferred him to pursue a more traditional occupation, they did act in ways that were ultimately supportive:

> Q5 (he/him): I had a lot of friends who were in bands, and so I bought a 16-track half-inch machine and a few mics and asked my parents if I could record in their basement. Which was a mistake. A mistake? It didn't last very long. It lasted two sessions. They came home once, and they'd done this grocery run and they put all this food in the cupboard. And then they came home and like the band was in the den and everyone was chowing down on the food. And so they're like, I think you're gonna have to find another space.

Another non-binary participant described that while their mother is supportive of their audio career, their father initially wasn't until they emphasized the technical aspects of audio engineering:

> Q6 (they/them): My mom was on board with it, and my dad's definitely [a] big chemical engineer pencil pusher, so of course he's like, No. But then I kind of cheated the system, I was like, 'No, it's a STEM field.' [laughs] It buys me time with him… [laugh] I can basically emasculate him by talking about technical things and science things that I learned and be like 'Hey, here's all these things that you don't know'.

The statement that by 'talking about technical things and science things' they can 'emasculate' their father was made in jest, but it reveals clearly how scientific and technical knowledge can be mobilized within a context of gender. To position themselves as having the authority to make their own decisions about what they choose to study in relation to their unsupportive father, they invoke scientific and technical knowledge that he doesn't have. This technique of navigating

hierarchies of masculinity through performances of technical knowledge is widespread in engineering cultures (Annetts, 2015; Faulkner, 2009a; 2009b).

Whether or not they later took part in formal education, men typically reported having started recording in a DIY context as a first step to getting into professional audio. This usually looked like purchasing a recording device - either a 4-track recorder, or if they started out following the widespread availability of digital recording equipment, a low-cost digital interface- and 'putting themselves out there' as someone who had both audio equipment and the skills to operate it.

> Q7 (he/him): I was in bands and I liked to make records, and I got a really basic digital interface. So I then just sort of made myself available to other people in town and said 'I can dub your DATs', and if people need CDs I could make them listening copies. I wasn't mastering, I was the person you went to when you weren't getting your record mastered.

This wasn't the case for the women. While they sought out and benefited from educational opportunities outside of formal settings, their first forays into audio engineering were uniformly via universities, private colleges, and other educational institutions. Outside of this study cohort, I know women and non-binary people working in audio who had their introduction to it via DIY, so I would hesitate to generalize this finding without gathering further information[52]. However, the distinct division within this group of sound engineers does suggest that formal audio education can create opportunities for women in audio engineering and calls to mind some studies which show that DIY cultures can alternately empower, exclude or silo women and girls

[52] Anecdotally, I can say that the women and non-binary people I have in my professional network who have taken the DIY route typically have a parent or other close relative who works in professional audio.

(Dunn, 2012; Griffin, 2012; Sherrill, 2017; Wallace, 2014). Three of the four women I interviewed were in their 50's, which suggests that this effect is not simply a result of age differences between the interviewees with younger engineers having taken part in formal programs and older engineers entering the industry via informal routes, but further research with a larger sample size is merited to validate this result.

II. Authority and changing masculinities in audio engineering (RQ1)

Masculinity is a performative tool that is used by audio engineers to do their work. In particular, the participants in this study identified a certain attitude of 'professionality' and the capacity to exert authority on the job with masculine performativity. When asked if he thinks he acts more masculine or more feminine at work, one participant indicates that he'd prefer to think that he doesn't lean one way or another, but then immediately connects acting more masculine with acting calm and in control:

> Q8 (he/him): [rubbing his chin] I'd like to think that I don't, but I might, you know, like it's something I've never really been aware of. I have a pretty naturally calm demeanour when I record, so I don't think it would be too performative or like being an aggressive masculinity. But there is definitely an ethos of like really trying to look like you're in control of what you're doing, it's assertive almost, which I guess is like a trait less, less vulnerable or something, which would be some kind of weird twist on that.

Another participant, a non-binary mastering engineer, related the physical affordances they have and their embodied skill at strategically performing masculinity to their capacity to leverage authority when they need to. While masculinity might not be their most authentic self-expression, it is a useful tool at their disposal which they use to manage unruly clients. In one of

several stories of this kind which they related to me, a group of young people brought a record to the mastering house they worked at and became disorderly while in the mastering studio. Rather than call off the session and force the clients to leave, which would have resulted in a loss of income for the mastering house, the participant used a masculine vocal performance accompanied by a forceful statement of intention that positioned them as a masculine authority in control of the situation. They leveraged their embodied capacity to lower the fundamental pitch of their voice into a range stereotypically associated with patriarchal authority. This self-aware mobilization of the power of masculinity was a performative utterance in the purest sense, a speech that does something (Austin, 1955).

> Q9 (they/them): I can remember I had one session where a bunch of 17-year-olds brought this record in to be mastered. And they started getting kind of like, you know- threatening me! And I just turn around and drop my voice, a fifth, and said no- we are going to do this, this is what's going to happen. You're going to sit the hell down and I'm going to finish this record.

Authority and masculinized speech were also linked by another participant who suggested that her work in live sound is about being a gatekeeper rather than a creative facilitator. She uses a 'dry and bossy', scientific or technical explanatory style when working with musicians. This masculine verbal and vocal performance is used to keep things running smoothly and to ensure that musicians 'play by [her] rules', echoing Annetts' (2015) assertion that performances of technical knowledge are one of the key ways that belonging is asserted in audio communities (Annnetts, 2015; Marshall, 2020).

> Q10 (she/her): I tend to be direct and if I am annoyed I tend to be very dry and bossy [doing air quotes on bossy]. But I like to be very clear and as explicit as possible as to what's happening… Like for me, it's important that you understand that this is not just me telling you what I want you to do. Maybe there's a gendered thing - when you're exercising authority it can't just be because 'I said so'. It has to be because 'reasons'. I guess it would be a question for male presenting engineers whether they feel that they have to give so much contextual information.

Women in audio- especially non-heterosexual women, such as this participant- experience significantly more challenges to their authority than do men (Brooks et al., 2021). Just taking on a technically explicit verbal habitus is not enough for her to be able to avoid these challenges, suggesting a limit to the success of her masculine social performance. She experiences having to explicitly justify her decisions as gendered, and while she expresses feeling that she must have strong logical reasons for requiring things to run a certain way she's unsure if her male colleagues experience the same expectation.

Masculinity as a tool to leverage authority is characterised by both positive and negative experiences and affects. One recording engineer indicates that excessively controlling behaviour in the studio reads as 'old world' and out of date. While 'boys club' behaviour is still present in audio culture, he makes it clear that it's not very appealing to him nor, in his view, as prevalent as it used to be. He associates this behaviour with 'go[ing] for drinks', pointing to the relationship between substance use and gendered exclusions. This relationship is explored in more detail by Zendel (2024), who shows that while turning down extracurricular activities involving substance use in favour of personally accountable decisions may be seen as

professional or admirable among men, it is often not an option for women in audio for whom it could have negative career implications.

> Q11 (he/him): To me it's like this kind of old-world thought, of like the traditional roles- the man's gotta be in charge. To me in this day and age, most people don't think of it like that anymore. But it's lingering and still a problem, and it's unconscious and residual- like without a doubt I'm sure I've definitely done things that someone could point out and I'd be like, oh yes, that was definitely problematic. [And] there's definitely an old-world mindset of the old boys club and like, you know, when are we going to finish this record? Where are we going to go for drinks and you know, hang out and do whatever. You come across some people like that. They're everywhere for sure. But I definitely don't think it's as prevalent as a thought anymore in recording.

Several of the men and both non-binary people in this study described their efforts to behave in ways that were deliberately in opposition to sexism. This usually involved taking a reflexive approach to how they embodied authority when working with women, sometimes expressed in terms of exercising enough authority but not too much, expressing enough information but not too much. For example, it's not unusual for an audio engineer to want to modify the tone of a recording musician's amplifier or drum kit to get a more balanced recording. Another engineer describes getting 'super self-conscious' about how he approached that process when working with women, but also pointed out that a best practice might just be to check in with the musician regardless of their gender before making those changes. He expresses a strong desire to avoid being seen as 'mansplaining' while still needing to embody the authority and knowledgeability required to effectively do his job as record producer, describing a trade-off between 'knowing it all' and 'being a know it all', which characterizes a tension between performing masculinity in

terms of technical knowledge (as in Annetts, 2015) and acting in ways that are consistent with what (as I will show in the next section) is a preferred nurturing masculinity within the field.

> Q12 (he/him): There's a lot of explaining and I just don't want it to be conceived as mansplaining … just because I really don't want to be that guy. And it's just so easy to be that guy because like, there's two things that balance: ideally, you should know it all. If you're the record producer, any question that should be asked of you, you should know the answer to it. So you should know it all without being a know-it-all, right?... So I try to be aware of it. It's not to say that I haven't been clumsy about it either, whether it's a guy to woman thing or just like, the older guy to younger guy thing.

He identifies seniority as another important element in the power structure of audio, the 'older guy to younger guy thing'. I've previously shown seniority (expressed in terms of 'years on the job') to be a significant predictor of experiences of microaggressions in audio engineering (Brooks et al., 2021). This was reflected in the material presented here.

III. Nurturing masculinity and emotional labor (RQ1)

The 'trying to … look like you're in control of what you're doing' highlighted in the last section represents an instance of emotional labor in the studio, a subject that has been the subject of some study. Emotional labor refers to 'a process by which workers are expected to manage their feelings in accordance with organizationally defined rules and guidelines' (Hochschild, 1983). It is used to invoke certain desirable emotional states in other people and is often used to manipulate the conduct of others in the absence of a legal contract that might otherwise encourage cooperation- as, for example, in the highly unregulated field of freelance audio work which is the primary site of employment for most audio engineers (Brooks et al., 2021; Watson,

2013). Hochshild comments that jobs involving significant emotional labor are more often performed by women than by men, reflecting naturalized ideas of who is best suited to create feelings of well-being or affirmation in others (Guy & Newman, 2004; Wharton, 2009). However, as a highly masculinized profession involving emotional labor, audio contravenes this expectation.

In their 2013 article 'Creating the right 'vibe': emotional labor and musical performance in the recording studio', Watson and Ward highlight the important place that skilful performance of emotional labor in the studio takes within engineering practice. They situate emotional labor as part of effective '*performative engineering'* – understood primarily as 'engineering the performance' (Horning, 2004) rather than as engineering accomplished *through* performance. Interestingly, nowhere do they point out the apparent incongruity of this extremely masculinized profession relying so heavily on emotional labor, despite their assertion that their all-male cohort of research participants was 'representative of music production, recording and engineering remaining almost exclusively male forms of employment' (Watson & Ward, 2013; pp. 8). This indicates that the capacity to do emotional labor has become fully naturalized as masculine in audio, which makes sense when we consider the specific forms of emotional labor in question: *emotional neutrality* and *empathetic emotional labor,* which are used to create a work environment characterised by *tolerance* towards the musicians and *capacity trust* in the engineer.

Emotional neutrality is defined by Watson and Ward as 'a "technique used to suppress emotions felt whilst displaying unemotional behaviour, wherein suppression of the emotion is the performance itself" … emotional neutrality speaks of the unspoken, and often un-heard, relational-based elements of what are commonly seen as task-based or 'technical' (Horning, 2004) job roles.' Emotional neutrality is thus heavily associated with a 'scientific', objective, or

dispassionate affect and by proxy associated with masculinity. In an audio context it is typically accompanied by empathetic emotional labor geared towards eliciting positive affects in musicians: being both professional and 'pleasant and nice' (Watson & Ward, 2013). One participant describes his experience of doing emotional neutrality as performing a neutral, accepting 'composed personality' capable of instilling a sense of security in musicians by acting as an 'anchor point':

> Q13 (he/him): A good recording engineer or mixing engineer is just aware of what their client is feeling, it's really just knowing how to walk the storm - and having a composed kind of personality, to the point where [if they're not asking for help], your job is not to help them or fix them or do anything - You're just an anchor point for [the musician]. You're just a, you know, a double-blind for somebody else. You're just like a necessary presence.

The association of emotional neutrality with masculinity is manifested in how the women I interviewed suggested that to be perceived as exhibiting the same level of emotional neutrality as a man, they need to be even more emotionally even-tempered.

> Q14 (she/her) What would be perceived as being righteously pissed in a man can be perceived as being "hysterical" [air quotes]... As women, in order to be perceived as as emotionally in control as men are, we have to be more emotionally in control than men are. And that is a tough aspect of being a woman in a male-dominated field.

Tolerance involves the capacity to accept normatively unacceptable behaviour such as excessive substance use or abusive behavior from clients (Watson & Ward, 2013), and is associated with

toughness, resilience, acceptance, and strength[53]. Being present in the studio or out on tour can involve witnessing and tolerating moments of strong emotion, and skillful performances of emotional neutrality and empathetic emotional labor can work to maintain a positive working environment - at least for the musicians who are its beneficiaries.

> Q15 (he/him): It's very intense. You get to see a lot of people's inner workings- you're not an adviser, you're not brought in for anything like that. It's just a byproduct of your job being there, having to make sure the mic works essentially. You get to see some light moments. You get to see some heavy moments and you get to see everything in between.

Taken together, emotional neutrality and tolerance are somewhat conceptually analogous to stoicism, a masculinized form of emotional labor that can be understood as *emotional compression*- the deliberate limiting of strong emotions to achieve a social result (Táíwò, 2020). One recording engineer suggests that tolerance can go one of two ways: engineers can be tolerant by being 'vulnerable', 'supportive and accepting' (via an emphasis on empathetic emotional labor), or by 'put[ting] up a very protective shield' (via an emphasis on emotional neutrality). She suggests that 'putting up a protective shield' is a psychological mechanism for withstanding an emotionally charged workplace as a sensitive figure. In her own working experience, she thinks that taking the 'supportive and accepting' route works for her because it puts musicians at ease, even while in the vulnerable position of sharing their art.

> Q16 (she/her): Our sensitivities to music and art and creation makes us very sensitive and very vulnerable, and people deal with that differently. Some put up a wall and kind of

[53] It takes a great deal of tolerance to weather experiences of sexism and sexual harassment, a topic I will explore further in Section V.

> charge through - some kind of put up a very protective shield - and some are very vulnerable. I think that [vulnerability] appeals to a lot of clients because you're just very much in tune with them and very supportive and accepting of them, because they're also vulnerable.

Finally, capacity trust, or trust based on one's judgements about another's capacity for competent performance in a workplace, depends both on emotional trust- developed via empathetic emotional labor, the ability to socially situate and identify with clients- and the expectation of a skilled performance of creative and technical labor (Watson & Ward, 2013). As I have discussed, technology and technical labor are widely characterised as masculine, as is musical creative labor, especially that which involves technology (Rodgers, 2010; Wolfe, 2010). This has serious implications for how readily clients and coworkers will trust that a woman audio engineer is competent. In short, this capacity trust is also already masculinized, as reflected in the experiences of women participants who reported having their expertise questioned by clients in ways that they understood to be gendered and struggling to build capacity trust with artist clients despite their experience and evident expertise.

The participants identified that authority and power are implicated in building capacity trust. To succeed and retain the trust of clients, one participant express needing to be 'unassailably an expert', remaining 'the biggest authority in [the room]' while not intimidating the client so much that they feel unable to ask questions or give input.

> Q17 (they/them): When I'm dealing with my clients, I can't seem wobbly at all. Shit could be falling apart, but I need to perform a very high level of competence. I need to be unassailably an expert. Because I've seen other people who are very good but who did not

> ever get the hang of performing the expertise, and clients don't trust them. It makes clients very nervous. If you're dripping with sweat with a client present that goes badly.

The masculinized forms of emotional labor defined by emotional neutrality and empathetic emotional labor, in conjunction with the requirement to exercise tolerance and build capacity trust, are extremely important in audio engineering. Nurturing archetypes such as 'the midwife' or 'the psychologist' are sometimes invoked when talking about this, as is what was universally referred to by my interviewees as 'bedside manner'[54]. Bedside manner, which is developed mainly via practice or in some cases the observation of other engineers, was singled out as a key skill for success. It largely corresponds to successfully performing the forms of masculinized emotional labor noted above. Riffing on the concept of bedside manner, one participant identifies himself as a musical doctor, capable of providing expert advice to help artists make good decisions in the studio. This advice won't always be what the artist wants to hear, but because he's able to convey via good bedside manner that his commitments towards the artist are nurturing and supportive, he can help them bring their art back to wellness.

> Q18 (he/him): Musical midwife! It just feels like - OK, listen, I've delivered a lot of babies. I'm not going to name your baby… but I have this experience. I've done this before, hundreds of times. And maybe this is your first or second time to do it - so you're in good hands. Don't worry, I haven't dropped the baby yet. In addition to midwife, on the other side of the coin in medicine, the Hippocratic Oath of do no harm is also incredibly valuable in terms of record production. It's interesting because bedside manner too… sometimes the best approach is just to be like, I'm sorry, this song is sick. This is not easy

[54] https://www.gear-club.net/episodes/2019/tom-elmhirst

to hear. You're not going to like to hear this, but the song is not good. And I'll tell you why.

Hegemonic masculinities ‘are imagined positions of ontological security from which the world may be viewed as under control’ (Garlick, 2023). The skilled performances of masculinized emotional labor described here, taken in conjunction with the performative technical knowledge that Annetts (2015) identifies as defining masculine hegemony in audiophile communities, defines a *nurturing technical masculinity* that is preferred in audio engineering. It is simultaneously a performative mode (à la Butler) and a key body of knowledge that can be learned through repetition or mentorship. Nurturing technical masculinity is performed by audio engineers to exercise the authority necessary to direct and guide the creative process as well as to simultaneously engender feelings of security and safety in the performers they work with. Nurturing technical masculinity is strictly *not* a feminized masculinity; while audio engineers of all genders work at learning to embody it, women experience certain distinctive struggles in relation to it due to their difficulties being read as sufficiently masculine. This can have implications for their technical and artistic working practices. For example, the difficulties with establishing capacity trust faced by the participant from Quote 10 lead her to keep a clear justification for her decisions always available to hand. Similarly, Zendel relates how a woman he interviewed avoids creative mixing decisions even if she knows they will sound good in favour of conservative techniques that she knows won’t be questioned (Zendel, 2024).

IV. ‘Just one of the guys’: Women doing gender crossing (RQ1)

Not only did women discursively position themselves as having a scientific (ergo masculine) mindset coming into audio engineering, they also reported using deliberate performances of

masculinity to further affirm their belonging and to position themselves as having power within a field structured by masculine hegemony. Women's performances of masculinity are often framed as seeking to 'fit in with the guys' (see also Zendel, 2024) and constitute a 'gender crossing'- whereby women construct an alternative masculine identity to cross into a male-dominated space (Djupvik, 2017; Messerschmidt, 2004). This is evidenced in the participant from Quote 2's assertion that she 'didn't particularly see [herself] as a traditional female, right?' This subordinate gender-crossed identity is predicated not upon its similarity to men, but rather based in its opposition to conventional emphasized femininity – 'the notion of "one of the guys" is not fashioned by being *similar* to boys, but, rather, certain girls being *different* from other girls' (Messerschmidt 2004, p.158).

Several of the women I talked to suggested that they had sought to 'be one of the guys' since childhood (see Quote 2), and so immersion in an audio engineering milieu just expressed a continuation of that. They connected their childhood experiences of having mainly boys for friends when they were young to their current ease working in male-dominated environments.

> Q19, Participant A (she/her): I grew up with a lot of male friends and cousins. There were a lot of young men peers in my life. And I'm not a girly girl. So I probably had closer guy friends than I had girlfriends, because I relate to it more- we like the same stuff. We like football. I didn't like talking about clothes and fashion and whatever. So I would always gravitate to the guys' discussions. And so it just didn't feel awkward to me. It didn't feel weird that I was the only woman there. It was just kind of like, well, they're all like my brothers, you know, like every tour I've done, the crew, it's like a little family. So it was just it was normal to me, you know?

This participant discursively distances herself from stereotyped images of accentuated femininity, such as being a 'girly girl' and 'talking about clothes and fashion and whatever', a classic discursive strategy for gender crossing (Messerschmidt, 2004). By invoking the most extreme and unrealistic images of feminine gender expression, and then indicating that they aren't reflective of her (she 'isn't like the other girls'), she places herself instead in proximity to masculinity. By suggesting that she relates to the men on her crew as if they were her brothers, she communicates the emotional and physical intimacy of touring life, where she works for months at a time in close quarters with the same group of people. She also makes it extremely clear that for her, work relationships remain platonic. This reflects how women doing gender crossing must maintain their identity as asexual to avoid being overly sexualized while being 'one of the boys', and thus are doing a qualitatively different gender than the boys themselves (Messerschmidt, 2002). It may also be a move used to cope with repeated experiences of sexual harassment in the workplace (Zendel, 2024), which I will discuss later. She continues:

> Q20, Participant A (she/her) I never really thought of myself as 'I'm a female engineer'. I just was like, I'm a sound engineer. It was always other people saying, well, you're a woman sound engineer, or a female. So I'm like, 'No, you wouldn't say, Here's a male sound engineer. I'm just a sound engineer.'

This expression of frustration with repeated instances of being 'girled' (Mulari, 2023) by the people around her resonated throughout the interviews. The question of 'Did they act that way because I am a woman?' arose over and over, as well as frustration at being labelled a 'woman sound engineer'. This makes sense considering the relationship between being 'girled' and sexual harassment and gender discrimination: one of the functions of sexual harassment is of 'making people into their gender', and conversely, experiences of having attention drawn to their

gender may be tacitly associated with being harassed (Mulari, 2023). It also raises the spectre of affirmative action: were they hired because they're a good engineer, or because they're a woman? As succinctly stated by one interviewee:

> Q21 (she/her): I think early on when I started … if you were too pretty you obviously weren't a good engineer, you were there because you were pretty.

For the women I interviewed, 'being too pretty' is a workplace hazard. Not only does it increase the likelihood of being sexually harassed on the job, it brings up the possibility that this sexual harassment may actively impede their ability to get the job done. Another participant indicates how her style decisions at work have been influenced by the complexly interacting factors of her own desire to be perceived as practical and sensible rather than as attractive, her desire not to be sexually harassed, and her status as a gender minority, constructed in terms of being 'the unicorn'.

> Q22 (she/her): Comfort and practicality were always a bit of a priority for me. However, I do think working in the fields of audio did make me gravitate toward the less feminine. And some of that might have been the feeling -being sort of a unicorn kind of thing- you know, just not many female engineers. I really felt like I had to prove that I was just like the guys to a certain degree. I wasn't really masculine, but I certainly didn't play up my femininity. Practical is how I like to think of myself- as practical and sensible. And I wanted them to compliment me on how practical and sensible I was. [Both grinning] You can be in situations on sessions [where] if somebody notices your femininity too much, that can become uncomfortable.

Of course, there are practical and sensible reasons for practical and sensible wardrobe choices under certain circumstances, especially (but not exclusively) in live sound. For example, there may be a requirement to wear 'stage blacks' to blend into the stage while moving around in front of an audience, or a tool belt and pants with many pockets for storing tools if the work requires going up into the truss (the scaffolding above the stage). On a simpler level, the extended temporalities and constricted spatiality of tour life or the studio session can be intolerable in uncomfortable clothing. But as Zendel's interview with live sound mixer 'Janice' indicates, there's no functional requirement to wear the black t-shirt and jeans uniform all the time, 'you can still be serious about your job and wear a pink flower shirt if you want to' (Zendel, 2024). Rather, for women in audio, making 'practical and sensible' clothing choices is typically a technique for fitting in and maintaining a gender-crossed masculinity at work.

Performing masculinity is about much more than just clothes, it extends to linguistic habits, socialities, physical comportment and spatial embodiment (Conell, 2005). One linguistic technique characteristic of masculinized work environments is 'guy talk'. This performative speech involves using sexualized humour, teasing and mock aggression to create a space of masculine solidarity, also functioning to break up the monotony of work and as a 'harmless' outlet for workplace tension (Collinson, 1988). While the women I interviewed didn't indicate that they themselves took part in the more acute practices of 'locker room talk', they did express that *tolerance* of this kind of banter facilitated their integration as 'one of the guys' and allowed them to maintain access to the masculinized spaces of audio engineering. For example, one participant expressed pride not simply that she could work well with or tolerate 'the dudes', but that in this context she was considered 'one of the dudes' herself, which she associated with being able to endure 'certain jokes and certain comments'- presumably instances of 'guy talk'

that might normally be deemed unacceptable within mixed-gender company. She further identified physical comportment and spatial embodiment as important techniques she uses to be included in 'guy space':

> Q23, Participant B (she/her): Growing up, there were a lot of movements that I was kind of purposely trying to be more masculine or like was not embracing the delicate- you know, you shake hands in a way, right? You walk in a way that you didn't know it then, but yeah, [it] meant masculine. So that kind of performance, yes, I can see a little bit more the assertiveness, right, of your movements and not your delicateness or whatever.

This explicit description of embodied performance technique points to how the body itself is a site of learning and of knowledge. Participant B describes deliberately holding and moving her body in ways that are masculine coded and such that others can recognize her assertiveness and that the 'delicateness' of her movements is de-emphasized. She identifies masculinity with certain characteristics of movement which are hard to describe- 'walking in a way' and 'shaking hands in a way'[55]- except by referring to their obvious masculinity and the affects which they produce in her and in others. Lund (2013) suggests that the gendered body itself constitutes a kind of tacit knowledge. This is manifested in her description of how her body, whose movements are orchestrated in minute and tacit detail (Basumatary, 2020), is the instrument by which she accomplishes gender crossing.

Maintaining her gender-crossed identity also requires her to participate in physical acts that might cause her harm. Specifically, there is a social pressure for women associated with carrying

[55] Symbolically speaking, shaking hands as a significant act of recognition between men has been noted in the context of engineering cultures (Faulkner, 2009a).

heavy objects- usually speakers- which was raised by several participants. This pressure is an oft-cited barrier to access:

> Q24, Participant B (she/her): If you're not able to physically move things from point A to point B, then I feel there is this need to assert my strong physicality towards other stuff… It's something that comes up often in the SoundGirls forums and women in audio forums: 'I want to be a touring sound engineer, but I can't lift the boxes'.

She suggests that despite being at ease with hands-on work and audio technology, she can't ever quite hit the gender target that the industry sets up for her, drawing further attention to the facilitative role that tools and technology have in gender performativity:

> Q25, Participant B (she/her): Even though I can have more masculine expressions of my gender I've never been masculine enough to be misgendered. So I also recognize that I am very easily recognized as my gender even when I am expressing in a more masculine way. That also introduces another level of complexity or challenge. Even when I am in my mind trying to uphold the masculine standard of whatever, I'm still just a girl in boots holding a multitool**.**

Although she isn't a man, just by virtue of using tools she places herself in closer proximity to legible masculinity. Knowledge of tool and technology use is not just an accessory to her performances of masculinity, it's a constitutive element of them. She is loosely coupled to machine assemblages (Bryant, 2014): the 'expensive technologies … [which] amplify the physical powers of elite men's bodies' (Connell, 2015) are both the means by which she produces deliverable evidence of her professional capacities and the collaborators with which she performs her professionality and masculinity. Regardless of this and of her carefully

masculinized physical comportment, linguistic strategies, and practical fashion choices; at the end of the day she's only blurred the lines between her and the men she works with, not erased her gender differences altogether (Messerschmidt, 2004). When push comes to shove and power is on the line, she's 'still just a girl in boots holding a multitool'.

However ubiquitous, gender crossing is sometimes accompanied by a sense of being 'inauthentic' by its performers, especially when it becomes evident as a professional practice rather than as an 'authentic' expression of gender identity (Messerschmidt, 2005; Faulkner, 2009a; 2009b). This was related in Zendel (2024) and was the case for several participants in this study.

> Q26 (she/her): When I first started, I really tried to be one of the guys, but honestly it just kind of made me sick physically, autoimmune stuff flaring up. I don't know if it's audio engineering? Audio engineering didn't cause it, but trying to fit in and not being my authentic self made a bunch of autoimmune things flare up. It is a form of stress, if you can't be authentically who you are, [and] feel like you're equal to [people] who are supposed to be your peers. Recently I've gone the other way, embodied more feminine traits because quite honestly that to me feels a little better.

Performing inauthentically as a source of stress was also identified one of the non-binary participants, who experienced dissatisfaction at not feeling at liberty to express their queer identity on the job. They link 'that cumulative stress' with difficulty asking for help, and that as a queer person in a majority-cis heterosexual environment, there are just 'certain things they can't ask for help' with, suggesting a feeling of isolation at work. Interestingly, they don't just identify the impossibility of personally performing their own queer identity at work, but also suggest that

the things that exist in the environments in which audio engineering takes place might themselves be implicitly coded as straight and cis:

> Q27 (they/them) I think that existing as a queer person does have stress behind it, especially when you're surrounded by cis heteronormative things all around you in your workspace and not really being able to share that queerness as openly as you would like to… That cumulative stress … [where] there's certain things I can't ask for help [with], that this isn't the right group to ask for help with, that still do affect my work.

In the face of the unattainability of 'truly' living up to a masculinized ideal at work, deliberate performances of femininity may be taken up by some women audio engineers in a rebellious counter-narrative, creating technically prodigious spaces of feminine solidarity and creativity (Rodgers, 2020; Zendel, 2004). Some of the participants expressed having worked earlier in their careers to distance themselves from femininity to better 'fit in with the guys' and gain access to male-dominated social environments, but then later re-orienting their gender expression at work to align more closely with their felt gender. One live sound engineer describes how when she came to a full awareness of how she had been suppressing her femininity, she saw it as a challenge to more authentically represent herself. She has an ambivalent relationship with the success of her masculine gender expression at work. While she acknowledges that she effortfully chooses to express herself as 'more masculine' on the job, she also expresses frustration and anger at having internalized that 'the masculine performance was the performance to embrace' as opposed to a more feminine, personally resonant performance.

> Q28 (she/her): No one told me you couldn't look like this, right. It was no external message of 'You're looking the wrong way. Please look this other way at work.' But

> however the socialization within the audio community happens, you know. You develop that. So when I realized that I was like, 'ha, I'm actually unconsciously suppressing my feminine expression when showing up to work'. It was almost like a scary challenge.

Her experience points to the subtle ways in which gender expectations are communicated and enforced. While she was never directly told she '[looked] the wrong way', the message was nonetheless clear from within the audio community that the correct way to look and behave was masculine. Her statement illustrates how the gender norms of the industry are internalized via social interactions with other audio engineers and integrated into a sense of masculinized professional identity. She identifies that this process is 'unconscious', but also specifies that in her experience pressure to perform masculinity comes from other audio engineers rather than from musicians. While musicians may be surprised that there is a woman working as a sound engineer, the main pressure to conform in the masculinized workplace comes from her peers.

V. Competition, precarity and gender-based exclusion (RQ2)

Participants identified competition and precarity as important aspects of their workplace experience. While there is no single definition for precarity, it is characteristic of work within the cultural industries under neoliberalism[56] (Brunet, 2024). Zendel's typology defines three dimensions of precarity which are relevant to audio engineers: logistical precarity (the expenditure of much energy securing work, without any expectation of getting paid for speculative labor), *financial precarity* (unexpected costs, labor undertaken for exposure, uncertain timeframes for being paid), and *social divergence* (either too much or not enough time

[56] Neoliberalism refers both to globally dominant capitalist economic policies characterised by deregulation, competition, and austerity and to sociopolitical practices theorising people as individual, atomized bearers of responsibility and human capital (Garlick, 2023).

alone) (Zendel, 2024). The temporalities of audio engineering, both shortened (hustle culture, boom-and-bust work cycles) and extended or immersive (extended periods on the road or in the recording studio, being 'always on') (Brunet, 2024) define a vulnerable workforce for whom burnout is commonplace and safety nets are all but nonexistent (Zendel, 2024).

Competition is a complex topic for audio engineers. Considering the proliferation of audio engineering programs worldwide and the collapse of the recording industry, it's likely that there are more junior sound engineers exiting audio programs than there is a realistic job market for (Bielmeier, 2013; Knopper, 2009; McIlvery, 2015). It was discursively associated with insecurity as a factor in sound engineers displaying 'toxic' or otherwise negative behaviour and manifested in the expectation that audio engineers should sacrifice having a family life to focus on work. Nonetheless participants were hesitant to characterize competition as a uniformly negative influence in the industry. For example, one engineer explored at length the different forms that competition takes in the live music industry and indicated that competition can be a positive influence when everyone is understanding and respectful about it, since it drives people to maintain their own excellence.

> Q29 (she/her): There is a lot of competition because there are only a limited number of jobs. I think competition is a good thing because if I know that I'm up for a job with someone else, I'm going to improve my skills and just keep my reputation up.

She also describes situations where competition resulted in more negative outcomes for the people involved, relating incidents of 'job-stealing' (taking a job that was someone else's regular gig, often via underhanded means such as 'bad-mouthing' the other engineer to the artist). These

situations relate a scenario where the capacity trust of the client determines the course of events, and audio engineers are left to manoeuvre as best they can.

Competition was also brought up by the interviewees as a driver of sexism and discrimination. One participant suggested that the perceived uptick of women entering the audio workforce means that younger men see them as peers- and therefore also as competition- with all the good and bad that that entails. Understood this way, her perception that older, more established engineers are less discriminatory is not that surprising- after all, they're not really in competition with young men or women anyway, already having had successful careers.

> Q30 (she/her) When you're the unicorn, it's cute. There's a girl doing sound. But now that there's 100 girls doing sound, oh God! It's kind of frightening for some men, and I think more so the younger men. Oddly enough, the veterans of the industry seem to be more open to women being in the industry than the younger men.

Another associated insecurity and the uncertainty of audio work with gatekeeping and the need to present oneself as knowing best, drawing attention to how the discursive position of technical expert can be used to escape feelings of powerlessness. This is the 'know-it-all' figure run wild, whose 'toxic' behaviors and scarcity mindset are psychological effects of the precarity of the industry itself.

> Q31 (he/him): There's this need to prove yourself that can develop in some people and it can make them perpetrate some really toxic ideas. It's like, I need to one up you because I need to prove I'm worth my grade or my recognition or something…I see [this] quite a bit- trying to be kind of cocky or confident, [the] 'I know what I'm doing' gatekeeping aspect is definitely something that's not uncommon in the recording world and audio

> world. I guess some of that comes out of insecurity as well, and trying to be like, [deepens voice] 'I'm making records and I know I know better than you', even though I'm like, I don't know if I know better than you, but just please give me this. [laughing]

As highlighted by this quote, within a context of precarious labor, music production becomes a place for men to 'struggle to enact meaningful encounters with the sociotechnical assemblage of production… they try to (per)form an identity as one who understands the machine, who has a certain liberty in relation to it and to the social conditions of production… in unqualified jobs which deny the worker agency and self-respect' (Berner, 2008). It's unsurprising then that audio engineers use audio technology as a site to 'play out the drama of manliness in work settings' (Berner, 2008).

Despite acknowledging both their own intensely hard work and the competitiveness of the industry, almost all the participants suggested that 'being in the right place at the right time' was instrumental to their success. However, it was brought to my attention by one participant how the logic of 'being in the right place at the right time' obscures important structural factors such as gender, class, race, disability, and passport privilege which determine who can benefit from career advancing opportunities when they present themselves. This participant made a strong argument that this industry cliché was reflective of audio engineers' unwillingness to examine the extent to which social connections and their own positional privilege have influenced their career paths. She problematizes the extent to which the 'right place at the right time' narrative is commonplace within audio education contexts.

> Q32 (she/ her): Everyone talks about 'you have to be at the right place at the right time.' That was something I was so tired of hearing …they would just talk about these lucky

> pieces of life. And I'm like, Why? This is so discouraging! Like, it's cool that it happened to you like this, but this is not how life happens for everyone…Yes, eventually you will get opportunities, but it doesn't come out of thin air. It's because you build the network or you build certain skills, you've met people or you have your name thrown around, nothing is by luck. It's more about having the right skills to present yourself to an opportunity rather than 'you're lucky'. It's very enticing to people to fall into this narrative, and I get the appeal of it.

VI. Experiences of sexism and sexual harassment (RQ2)

In my previous research I established that gendered microaggressions and gender based discrimination is widespread in audio engineering (Brooks *et al.*, 2021). This was also reflected in this study. The women I interviewed all reported experiencing sexual harassment or overt sexism of some kind, mainly from other sound engineers but in some cases from clients. This occurred in a variety of contexts, from seeking work to while already on the job in a position of authority. I've included only a few representative examples here, but enduring extremely obvious and un-subtle sexism and sexual harassment was a shared experience across the board.

One participant, who now works mainly as a mastering engineer but has a history of working in the recording studio, describes that while she never felt she was in a position where she was 'in danger', that might be in part because the studio she used to work at was discerning about which recording sessions they put her on. For this participant, it's important to come in with a viable strategy for dealing with clients' bad behaviour, especially if you are already at a structural disadvantage due to being a member of a gender minority. She describes a strategy she

developed to gently but firmly reject sexual advances in the studio without inviting further conflict:

> Q33 (she/her): I tried to give them an out with their ego intact. You know, 'I'm really flattered, and I'd be really tempted. But it's in order for me to keep my job here at the studio, we have a very strict rule about not fraternizing with the clients. And if my boss were to ever find out, I would lose my job. And I really need this job.'And then nobody has to feel too damaged. It's just good to know going in I had the support of studio management as well. After it happened once, I mentioned it to the manager and the owner. 'Listen, this happened. Nothing was bad about it. There was no duress or anything like that.' But I said that 'My out in these situations is going to be that it's a very firm studio policy and that you will fire me if I fraternize with the clients. So should this subject come up with any clients, if they make inquiries, I would appreciate it if you would back me up on this because this is how I get out of this situation so everybody still feels good about themselves and I can continue working'.

By getting the studio management on the same page, if a client inquired after her they would receive a consistent story emphasizing her sexual unavailability. Only by making it clear to the person pursuing her that 'if she could, she would' was she able to make sure that nobody's ego gets bruised, which could easily result in a more volatile and difficult to manage situation arising. This act of tolerance is another canny example of emotional labor and affect management within the studio. She links this kind of emotional labor to tenacity and perfectionism, reflecting on the feeling that 'as a woman… [I] had to be good because women were counting on me.' This 'one woman represents all women' attitude is common in male-dominated fields, and was articulated by many of the participants.

In other instances, participants reported experiencing sexual harassment from their colleagues. One touring live sound engineer describes an incident that occurred when she was younger, which began as a verbal altercation and escalated into physical harassment in the form of unwanted touch. The harasser in this case was a local system tech. This person represents the interface between the touring engineer and the local sound system, providing her with technical resources and support on the day of show. She responded decisively, drawing attention to the inappropriateness of his behaviour.

> Q34, Participant C (she/her): I remember this one situation where I come in and I'm like, I'm the sound engineer, [this guy is] just like, whoa. Well, he kept calling me babe or sweetie or honey. I've worked with guys who are Southern and that's their upbringing, and I know it's not meant to be demeaning or condescending at all. It doesn't bother me. But this guy says, you don't mind if I call you babe, do ya? So my response was- you don't mind me calling you asshole?

She is careful to make it clear that she's not being reactive and can differentiate between a situation where someone might call her 'babe, or sweetie or honey' because of cultural norms and a situation where she is actually being harassed. This reflects existing research which shows that women tend to consider the intentions of the harasser rather than if the behaviour violates workplace norms when evaluating whether something constitutes sexual harassment (Russell, 2004). She continues:

> Q35, Participant C (she/her): So that didn't stop him. Throughout the day he's just trying to flirt with me and I just kept being very professional and putting up boundaries. Well, after soundcheck, he disappears, goes to take a shower, comes back, doused in cologne.

> [laughing] And I was just - I couldn't. I'm very sensitive to smells. So I'm at the Front of House and I'm trying to mix the show and I'm like, my throat is shutting down because there's just so much cologne pouring out this guy. And then he comes up behind me and starts giving me a shoulder massage. I was like, 'Dude, what are you doing? We're not dating, sorry.'

She treats this incident with levity, emphasizing the ridiculousness of the harasser's behaviour and lingering on the addition of 'so much cologne' to his on-the-job wardrobe. She also emphasizes her capacity to safely handle the situation. Nonetheless, the local system tech's behaviour represents a clear violation of her physical personal boundaries, and the participant's use of humour in this context may represent an example of the discursive strategy whereby 'downplaying experiences of harassment allows women to escape the position of helpless victim' (Aaltonen, 2017). Indeed, the participants often used humour to minimize the psychological impact of harassment and emphasize their agency and independence.

Discussion and Limitations

There are a few important limitations to the results presented here. I began this interview series during the year before the COVID-19 pandemic began and continued through 2021. My initial conceptualization of the project involved conducting interviews as supplementary to participant observation in the workplaces of my participants, but this became impossible because they (and I) ended up out of work due to COVID precautions and lockdowns. As such, I re-oriented the study focus towards discursive analysis. Ultimately I've taken a credible attitude towards what the participants told me, but it's possible that if I had been able to conduct the ethnography as I had planned it I might have observed some divergence between their words and their on-the-job

actions. However, before I began the interviews I had already worked with some of them as professional colleagues, and in the intervening years, I've worked with a few more. To the extent that it's meaningful to report anecdotal data, I've seen their actions and words match up insofar as I could observe it.

I recruited participants up to the point where I reached saturation on the themes emerging from the interviews. While there was of course individual variation between participants, there was overall a remarkable congruence between the narratives brought forward by the interviewees- for example the archetype of the unicorn, stories about buying a 4-track as a youth, and so on. This gestures to the dominance of normative professional narratives within the field, but also to the homogeneity of the group that I interviewed. In analysing these interviews as a single dataset, I assume that all of the participants take part in a shared culture of audio engineering. However, there are several analytic categories that remain unexamined.

Race is one of these. It was not a very racially diverse group of people, and deeper research involving a more racially diverse group is merited considering that power and the construction of masculinity are intersectional with respect to race, class, and gender, categories which always act as backgrounds for one another and find their most powerful articulations through one another (Connell, 1993; Crenshaw, 2013; Matlon, 2016). How race operates to structure power within audio engineering cultures is of great interest given the international nature of the recording industry and the role of music in mediating culture (Meintjes, 2003). What genre someone works in also remains mostly unexamined, as does (to a lesser extent) whether they work in sound recording, live sound, mastering, or sound design. The actual tasks and roles of audio engineers vary from genre to genre and application to application, and this variation in tasks and genre-specific musical norms has implications for specific audio subcultures. For example, in classical

production, there is a strong emphasis on tradition, reproducing a clean sound and ascertaining what constitutes an acceptable deviation from the score. This means that the relation between performances of technical prowess and professional skill are rather different for engineers working in classical production than they are for a rock recordist, for whom creative use of studio technology represents a meaningful practice of performative excellence. Consequently, the ways in which masculinities and femininities are produced and realised through professional practices will vary depending on context.

Conclusion

The purpose of this study was to clarify the mechanisms underlying the masculine gendering of audio engineering and to develop an understanding of how audio engineers' experiences at work are shaped by this masculinization. I've approached this by describing certain dominant discourses related to masculinity in audio engineering, relating masculinity to the key tacit skills of emotional labor and performative engineering, and describing some strategies used by audio engineers to embody power and agency in a context of gender hegemony. Ultimately, I describe a profession in flux, relating the ongoing reproduction of the profession's masculine gendering to power struggles under conditions of economic uncertainty. This is consistent with other work describing social closure, the situation/process where under conditions of precarity a threatened social group may deliberately exclude certain identities to maintain cohesion and preserve resources (Patitsas, 2019).

Within audio engineering, masculinity is hegemonic: that is, there exists a 'current most honored way of being a man' (Connell, 2005) within the industry, which structures the gender field by organizing hierarchies of power within that field into a patriarchal structure (Annetts, 2015;

Bates, 2022). I argue that the hegemonic form within audio engineering is a *nurturing technical masculinity* defined by performative technical knowledge (Annetts, 2015) and the skilled performance of masculinized emotional labor (*emotional neutrality* and *empathetic emotional labor*; Watson & Ward, 2013a). The pattern of practices (actions, role expectations, and identities) defining nurturing technical masculinity is achieved through 'socialization within the audio community' (Participant 5). This hegemonic configuration is both a masculine performative mode and a key body of knowledge that must be learned by audio engineers if they want to succeed. It is often framed in terms of 'bedside manner', identified by the participants as a tacit skill that can only be developed by watching a mentor or through personal practice and experience. People of all genders learn to perform nurturing technical masculinity to facilitate creative processes and exercise authority, but women in audio face specific challenges which reflect their struggle to be seen as masculine enough to belong in the industry.

In the context of patriarchal norms that associate masculinity and science/technology, I observed a distinctive gendered divide in how participants described establishing themselves within the field. Women sought to legitimise their participation by positioning themselves from the get-go as scientific and specifically as interested in physics. This discursive technique affirms their 'technical mindset' and places them in proximity to masculinity, further affirming their belonging in a male-dominated industry. They were not encouraged by their families to go into audio engineering, and all got their start via participation in formal educational programs. On the other hand, the men were already identifiably masculine and therefore prima facie assumed to be technically capable enough to be audio engineers just by virtue of being men. Their narratives reflected a desire to communicate the origins of their aesthetic sense or reflect their underlying artistic interests and personal professional aspirations. They framed their interest in audio as part

of an existing artistic practice and their career advancement in terms of musical aesthetics and developing certain key social skills. They did not need to describe themselves as 'coming from a physics mindset', because it was already assumed that they can engage in a scientific subjectivity based on their gender- they are 'at home' with audio technology. Whether or not they eventually took part in educational programs for audio they usually got their start in audio via DIY and reported neutral or positive support from their families in the early stages of their career.

One of the distinctive ways that women in audio handle gender/power hierarchies within the workplace is by establishing a masculine 'gender crossed' identity that allows them to avoid experiences of sexual harassment and gender-based discrimination as well as to wield the authority necessary to do the job. This is accomplished by discursively distancing themselves from other girls and stereotypical 'girl things', as well as deliberate aesthetic choices, the demonstration of technical prowess, gender-performative acts such as tolerating 'guy talk', emphasizing a practical, assertive communication style, and acts of physicality both subtle (as in the case of masculine bodily comportment) and overt (such as carrying heavy objects - loudspeakers being the classic example). The learned and practiced nature of these habits further points to the close relationship between professional knowledge and gender performativities in audio engineering. These gender crossed masculinities derive benefit from hegemony by way of access to (if not true inclusion in) masculinized spaces (Djupvik, 2017), coercively incentivizing their support of the hegemonic form. Their use represents an example of doing *usurpationary closure*, which is when a subordinate group uses power to grab 'upwards', making inroads into a boundaried space (Patitsas, 2019). However, 'gender crossed' identity is sometimes associated with stress and negative outcomes when it is perceived to be inauthentic or at odds with the performer's felt gender, as was the case for the women in this study.

While actual research on the topic is inconclusive or points to at most an extremely modest improvement in the number of women working in production (Bridges, 2020; Brooks *et al.*, 2021; Smith, 2023), many of the participants suggested that more women are working within music and audio production now than ever before. This is probably informed by the relatively lively cultural conversation around women in music during the last decade. In this context, masculinity is also a source of both tension and agency for men. Like women, within a context of hegemonic masculinity they benefit from the power afforded by performing certain masculinities, but they may also act in opposition to their own dominance in solidarity with clients and coworkers. While retaining agency and control under potentially volatile work conditions is one of the signature affordances of 'good bedside manner', the participants identified overly-controlling behaviour as undesirable and reflective of insecurity. This reflects the internal conflict implicit in a defining hegemonic masculinity characterised both by performances of power and control in terms of technical expertise and empathetic emotional labor.

The overarching narrative presented by the participants connected 'toxic' behaviour within the workforce to jockeying for power under limiting, competitive, and stressful work conditions, a reality that was both accepted and derided. On an individual level, this makes sense considering that audio engineers are precariously employed, the labor market is highly informal and based on an economy of affect and aspiration (Brunet, 2024), and there is much competition for very few jobs. Within this uncertainty and precarity, audio technology is used as a site for the re-production of masculine agency. On a structural level, sexism and gender discrimination are profitable for the music industry at large: they 'serve a material purpose' (Kim Deal, quoted by Zendel, 2024). Women are siloed into gendered support positions, and when they do work in

audio and music production their careers are often cut short or limited via glass ceilings- therefore also limiting their earning potential (Zendel, 2024). Narratives of 'being in the right place at the right time' are commonplace and may be used to elide considering the role of structural privilege and social advantage in career success. Taken in tandem, these findings suggest that the precarity of audio engineering is at least partially responsible for its continued gendering, with sexism and other forms of identity-based discrimination functioning as mechanisms for achieving *social closure* to reduce competition. I understand both the excessively controlling behaviour that the participants in this study associated with 'toxic' masculinity and the deliberate exclusions that surfaced in this research to be techniques for maintaining (on an individual level) a sense of control and importance within precarious circumstances and (on a structural level) an audio industry closed with respect to gender, such that what little stable work does remain in the industry is available for men to take.

Bibliography

Aaltonen, S. (2017). Grin and bear it! Downplaying sexual harassment as part of Nordic girlhood. *Nordic girlhoods: New perspectives and outlooks*, 83-102.

Annetts, A. (2015). *Masculinity and gear fetishism in audio technology community discourse*. (Doctoral dissertation, Anglia Ruskin Research Online (ARRO)).

Assunção, C. (2016). "No girls on the internet": The experience of female gamers in the masculine space of violent gaming. Press Start, 3(1), 46-65.

Austin, J. L. (1955). *How to do things with words*. Harvard university press.

Basumatary, J. (2020). Michel Foucault on Regenerative Relatedness of Power/Knowledge and Truth. *Journal of Indian Council of Philosophical Research*, *37*(3), 323-341.

Beer, D. (2014). The precarious double life of the recording engineer. *Journal for Cultural Research*, *18*(3), 189-202.

Berner, B. (2008). Working knowledge as performance: On the practical understanding of machines. *Work, employment and society*, *22*(2), 319-336.

Bielmeier, D. (2013, July). Why Didn't You Learn This at Recording School? Critical Comments by Employers. In *Audio Engineering Society Conference: 50th International Conference: Audio Education*. Audio Engineering Society.

Bridges, C., Strong, H., Overton, A., & Berish, J. (2020, August). Women in Music Industry Roles: A Twenty-Year Analysis. In *Audio Engineering Society Conference: 2020 AES International Conference on Audio for Virtual and Augmented Reality*. Audio Engineering Society.

Brooks, G., Pras, A., Elafros, A., & Lockett, M. (2021). Do we really want to keep the gate threshold that high?.

Butler, J. (1990). Gender trouble : feminism and the subversion of identity. Routledge.

Collinson, D. L. (1988). 'Engineering humour': masculinity, joking and conflict in shop-floor relations. *Organization Studies*, *9*(2), 181-199.

Connell, R. W., & Messerschmidt, J. W. (2005). Hegemonic masculinity: Rethinking the concept. Gender & society, 19(6), 829-859.

Djupvik, M. B. (2017). 'Working It': Female Masculinity and Missy Elliott. In *The Routledge Research Companion to Popular Music and Gender* (pp. 117-131). Routledge.

Dunn, K., & Farnsworth, M. S. (2012). "We ARE the Revolution": Riot Grrrl Press, Girl Empowerment, and DIY Self-Publishing. *Women's Studies*, *41*(2), 136-157.

Faulkner, W. (2009a). Doing gender in engineering workplace cultures. I. Observations from the field. Engineering studies, 1(1), 3-18.

Faulkner, W. (2009b). Doing gender in engineering workplace cultures. II. Gender in/authenticity and the in/visibility paradox. Engineering Studies, 1(3), 169–189. https://doi.org/10.1080/1937862090322505

Garlick, S. (2023). Technologies of (in) security: Masculinity and the complexity of neoliberalism. *Feminist theory*, *24*(2), 170-187.

Götschel, H. (2014). No space for girliness in physics: Understanding and overcoming the masculinity of physics. *Cultural Studies of Science Education*, *9*, 531-537.

Griffin, N. (2012). Gendered performance performing gender in the DIY punk and hardcore music scene. *Journal of International Women's Studies*, *13*(2), 66-81.

Guy, M. E., & Newman, M. A. (2004). Women's jobs, men's jobs: Sex segregation and emotional labor. *Public administration review*, *64*(3), 289-298.

Hochschild, A. R. (1983). The managed heart. Routledge.

Horning S S, 2004, "Engineering the performance: recording engineers, tacit knowledge and the art of controlling sound" Social Studies of Science 34 (5) 703-731

Kealy, E. R. (1979). From craft to art: The case of sound mixers and popular music. *Sociology of Work and Occupations*, *6*(1), 3-29.

Knopper, S. (2009). *Appetite for self-destruction: The spectacular crash of the record industry in the digital age*. Catapult.

Landström, C. (2007). Queering feminist technology studies. *Feminist Theory*, *8*(1), 7-26.

Lund, A. (2013). Staging gender: the articulation of tacit gender dimensions in drama classes in a Swedish context. *Gender and education*, *25*(7), 907-922.

Marshall, O. (2020). Shibboleths in the studio: Informal demarcation practices among audio engineers. Social studies of science, 50(6), 881-900.

Matlon, J. (2016). Racial capitalism and the crisis of black masculinity. *American Sociological Review*, *81*(5), 1014-1038.

McIlvery, R. J. (2015, August). Audio Recording Education: Do we really need another program?. In *Audio Engineering Society Conference: UK 26th Conference: Audio Education*. Audio Engineering Society.

Mellström, U. (2004). Machines and masculine subjectivity: Technology as an integral part of men's life experiences. *Men and masculinities*, *6*(4), 368-382.

Messerschmidt, J. W. (2004). Flesh and blood: adolescent gender diversity and violence. Rowman & Littlefield

Moorefield, V. (2010). The producer as composer: Shaping the sounds of popular music. MIT Press.

Mulari, H. (2023). Negotiating sexual harassment and young urban femininities in Helsinki. In *Re-Imagining Sexual Harassment* (pp. 72-91). Policy Press.

Neuenfeldt, K. (2007). Learning to Listen when there is too much to hear: music producing and audio engineering as 'engaged hearing'. *Media International Australia*, *123*(1), 150-160.

Patitsas, E. (2019, May). The social closure of undergraduate computing: Lessons for the contemporary enrolment boom. In *2019 IEEE/ACM 2nd International Workshop on Gender Equality in Software Engineering (GE)* (pp. 33-36). IEEE.

Porcello, T. (2004). Speaking of sound: language and the professionalization of sound-recording engineers. Social Studies of Science, 34(5), 733-758.

Rodgers, T. (2020). *Pink noises: Women on electronic music and sound*. Duke University Press.

Russell, B. L., & Trigg, K. Y. (2004). Tolerance of sexual harassment: An examination of gender differences, ambivalent sexism, social dominance, and gender roles. *Sex Roles*, *50*, 565-573.

Sherrill, J. T. (2017, August). Gender, technology, and narratives in DIY instructions. In *Proceedings of the 35th ACM International Conference on the Design of Communication* (pp. 1-8)

Smith, P., Pieper, K., Hernandez, C., & Wheeler, S. (2023). Inclusion in the Recording Studio? Gender & Race/Ethnicity of Artists, Songwriters & Producers across 1,100 Popular Songs from 2012 to 2022. *USC Annenberg Inclusion Initiative*.

Wallace, J. (2014). *Handmade 2.0: women, DIY networks and the cultural economy of craft* (Doctoral dissertation, Concordia University).

Watson, A. (2013A). 'Running a studio's a silly business': work and employment in the contemporary recording studio sector. Area, 45(3), 330-336.

Watson, A., & Ward, J. (2013B). Creating the right 'vibe': emotional labor and musical performance in the recording studio. Environment and Planning A, 45(12), 2904-2918.

Wharton, A. S. (2009). The sociology of emotional labor. *Annual review of sociology*, *35*(1), 147-165.

Wolfe, P. (2012). A Studio Of One's Own: Music Production, Technology And Gender. *Journal on the Art of Record Production*, *7*.

Discussion

The purpose of this thesis project was to develop a structural understanding of how the ongoing masculinization of the audio industry relates to the knowledge required for success within the field. In doing so, I developed an understanding of gender as itself a kind of personal embodied knowledge (Lund, 2013). I related how masculine performativity in the form of technological mastery and masculinized emotional labor are crucial skills for audio engineering, and explored how the masculinities that emerge from within the industry are shaped by these social techniques. The inverse move- showing how audio technologies and techniques are coded masculine via the naturalized masculinity of the men who create and use them- is perhaps more obvious, but it lacks the explanatory power to account for the ongoing masculinization of the industry despite usurpationary educational interventions made by organizations such as SoundGirls or WAM (Annetts, 2015).

Annetts (2015) argued that technical knowledge is used as a masculine performance in the context of audio engineering. In my research, I add that masculine performances are themselves a kind of tacit knowledge that are learned via socialization within the audio community. I use as an example the forms of masculinized emotional labor identified in Watson & Ward (2013), which were associated by my research subjects with performances of masculinity but are also necessary skills which are learned via processes of meaning-making including mentorship and 'trial and error'. Taken together, technical knowledge as masculine performance and masculinized emotional labor as performative gender knowledge define a masculinity that is hegemonic in the field and which I denote *nurturing technical masculinity*. Audio engineers of all genders learn to do *nurturing technical masculinity* as part of their professional formation, a

situation which poses unique challenges for women and some non-binary people who may struggle to be seen as masculine enough to be read as professional and for whom performing masculinity can involve a level of cognitive dissonance and stress.

Understanding gender performativity as knowledge and knowledge as performative allows us to better understand how masculinity is baked into the knowledge economy of audio. It also does some theoretical work. Just as gender-as-performance denaturalizes the association between the 'sexed' body (itself an unstable form subject to enormous natural variation) and the phenomenon of gender; gender-as-knowledge highlights the meaning-making that underlies practices of doing gender (Chapter 1). Gender-as-knowledge re-places the emphasis on power-to, and reifies how practices of coming to know things constitute the subject. It foregrounds how gender knowledge is tacit and shared through embodied practices in space (Kraus, 2017; Lund, 2013). While the *tacit* nature of gender knowledge has been noted within the performance studies literature, I think it is more illustrative to think of gender knowledge as *personal* in the sense of Michael Polanyi's PK project. This is because not only are there elements of gender knowledge that are *not* tacit but also because framing gender knowledge as *personal* spotlights more strongly the mechanism by which gender knowledge constitutes gendered subjectivity.

In Chapter 2, my co-authors and I related toxic behavior at work to the adverse emotional effects of sustained performances of emotional labor, which are associated with predictors of workplace incivility including emotional exhaustion, decreased organizational attachment, and burnout (Bartlett et al., 2008; Blau & Andersson, 2005; Jaarsveld et al., 2010; Koon & Pun, 2018). We suggest that harassment and discrimination may be behaviors related to the perceived precarity and invisibility of audio engineering labor, a thesis which was echoed by many of the audio engineers I later interviewed for Chapter 3. They associated competitiveness and excessively

controlling behavior with insecure, 'toxic' masculinity, and identified a tension between the necessity of being able to use masculine performativity to be 'in control' - to guide the course of the soundcheck or recording session- and being 'too controlling' (sometimes expressed as 'old school'). The necessity of control is held in precarious balance with having 'good bedside manner', which corresponds to performing the emotional neutrality and empathetic emotional labor (Watson & Ward, 2013) that are the other hallmarks of masculinity in audio. Ultimately, I describe a profession in flux, relating the ongoing reproduction of the profession's masculine gendering to power struggles under conditions of economic uncertainty. This is consistent with other work describing social closure, or the situation/process whereby under conditions of precarity a threatened social group may deliberately exclude certain identities to maintain cohesion and preserve resources (Patitsas, 2019).

Additional findings

There were a few key insights that I mention briefly in Chapter 3 that merit further discussion but which I had to cut for reasons related to the length of the paper. One of these was the extent to which learning experiences with more experienced engineers were a shared influence defining the success of all the participants. This finding is implicated in how gender-performative knowledge is shared and reproduced in audio engineering. Mentorship was sometimes presented in terms of more well-defined mentor-mentee relationships facilitated by work at studios or programs within educational institutions- most of the women had experienced some sort of formal internship opportunity, and several participants (both men and women) have since taken part in such programs as mentors. In other cases, it was defined primarily by informal knowledge-sharing experiences, wherein the younger engineer sought out more experienced mentors to whom they asked questions and built their knowledge-base. The kinds of knowledge

shared within these contexts varied from the purely technical- for example how to work with a tape machine- to the interpersonal. One woman described how her female studio mentor not only provided her with valuable technical and artistic training but also advised her that in order to navigate the sometimes-brutal experience of being a gender minority in the workplace she should develop a 'thick skin'. Another described how his mentor helped him learn to manage the workflow of a studio session and provide the right kind of feedback to encourage excellent performances- that is, developing the correct bedside manner. Many participants described feeling grateful to other engineers for being generous with their time and knowledge, and some of them have gone on to participate as mentors in formalized mentorship programs.

Another item emergent from the interviews was certain stereotyped cultural concerns related to women in the workforce - most notably the topic of children. One of the women and one of the men indicated that they have children. All of the women brought up the topic of parenthood in the interviews, indicating that they had been discouraged from having kids. Overall the attitude that they expressed was that it was easier for men working in audio to have kids and still maintain a career, because the cultural expectation is for women to arrange their schedule in terms of children's needs. Yet, having a family also represented a real challenge for men in audio engineering- especially if they expected to get to spend quality time with their children.

Women doing masculinity to survive in a male-dominated workplace can be understood as doing a 'gender crossing' by constructing a subordinate masculine identity in order to leverage power within the context of masculine hegemony. One of the tools used by women in audio for gender crossing is discursively distancing themselves from other women, being 'one of the guys' via 'not being like other girls'. In its most negative forms this can lapse into 'queen bee behaviors' (Derks et al., 2016), where competition to remain 'the unicorn' results in women

behaving badly towards other women while simultaneously emphasizing their own masculinity and commitment to their career (Derks et al., 2011). While I didn't discuss this in detail in Chapter 3, some of the women I interviewed expressed dismay at their own internalized misogyny, echoing Buckingham & Ronan's finding that showed that women working in audio were less likely than men to believe that women were well-suited for technical and managerial roles (Buckingham & Ronan, 2019). Simultaneously, they expressed their surprise and pleasure at encountering woman-led audio workplaces.

Masculine hegemony can also be a source of stress or anxiety for men working within audio engineering. Not only are men who are disabled, queer, migrants, or BIPOC placed at a disadvantage with respect to the hegemonic norm, but so are younger men across the board. All of these groups experience microaggressions and discrimination within their work environment (although to a significantly lesser extent than do women and trans/non-binary people). For example, BIPOC cisgender men who participated in the JAES survey and indicated that they are members of a racial minority at work experienced the microaggression 'I have been told I was too independent' more than cisgender men who were white and not a racial minority at work, while the opposite was true for BIPOC cisgender women who were a racial minority at work. This can be understood as reflective of racist tropes which figure Black men as unruly or out of control while simultaneously denying Black women agency and self-determination (Flowe, 2020; Saddik, 2003), and illustrates how patriarchy figures along intersectional lines. Beyond these cursory findings, this thesis has largely neglected an analysis of racial dynamics within the music industry, focusing instead on gender and how gender can be classed via processes of closure. Considering the intersectional nature of power (Crenshaw, 2013) and the ongoing reverberations and impacts of settler colonialism and capitalism on masculinities within the

global music industry (Connell, 1998; Matlon, 2016; Meintjes, 2003), further research examining the complexity of how models of masculinity are formed through race and class within audio engineering are highly merited.

Influence of my positionality on the body of work

My insider positioning played out in several ways throughout this PhD. In terms of recruitment, it was largely a plus: audio engineers like to talk to other audio engineers about audio engineering, and the participants I worked with in this research were enthusiastic about sharing their personal career stories and talking to me about their experiences in the industry. In some cases, access to research participants was via my own professional network. In other cases it was facilitated by my supervisor Martha de Francisco, who is extremely established within the international audio engineering community; or via contacts generated through my research with Dr. Amandine Pras. In all these cases my own position as an audio engineer was conducive to getting my foot in the door. In an interview setting, an insider stance with respect to technique and technology facilitated going deep on topics that might otherwise have been waylaid in technical explanations. Throughout this research, our shared experiences allowed me to relate to the research participants genuinely; my curiosity about their experiences was not based on a detached stance but rather on a desire to understand a discipline and culture which we have in common and reproduce together in our interactions as colleagues.

At the same time, there were certain things that were taken for granted in the interviews and survey project, and relevant detail which I might be missing due to this insider positioning. Simply, I've worked hard to develop my own professional subjectivity as an audio engineer, learning through trial, error and mentorship to behave in ways that allow me to develop capacity

trust with musicians and identify me as an insider to other audio engineers; and this position carries with it strongly naturalized professional narratives of how things work in the industry. As an audio engineer talking to other audio engineers, my interactions with the participants involved an element of social reproduction- by talking about audio engineering together, on one level we are doing that culture ourselves.

Another way that my insider positioning worked against me in this research was in a certain amount of anxiety I feel about criticizing audio engineering culture at large and specifically a fear of saying things in my research which might be received poorly by my friends and colleagues. This materialized in a hesitation to engage with some of the more 'problematic' topics raised and statements made by the research participants I worked with, and an overall attitude of protectiveness and appreciation that characterizes my feelings about these people. While I've tried to emphasize how masculinity works in nuanced and ambivalent ways in the lives of audio engineers, as well as its structural nature, I am aware that even the most sympathetic exploration of masculinity has the potential to be understood as an attack within the context of patriarchy and masculine hegemony. This is because drawing attention to the performed nature of masculinity denaturalizes it and exposes the constructed nature of masculine ascendancy within systems of gender hierarchy, thereby representing an implicit challenge to masculine power. That said, in the context of a working landscape where reputation is key (and despite the anonymization of the interview data), some participants - especially women with extensive career experience, who have weathered protracted discrimination within the industry - expressed their own significant anxieties about how they were represented in the interview material. On a personal emotional level and with respect to my own ethics as a researcher, it's obligatory that I present them in ways that are consistent with their (largely) sympathetic and

generous bearings towards me and such that I avoid reputational damage of any kind. It is also a limiting factor on what interview material I presented in this thesis.

At the same time, my experiences differ from those of most audio engineers in specific ways that position me as an outsider within the field. My ongoing engagement with academia is one of these ways, my work as a professional musician is another. Both of these outsider identities trouble and inform my research project. As a PhD student- an identity that is itself aspirational - my association with the University system means that I have certain motivations and covert investments which have informed my research praxis. These include the requirement of publication, the necessity of generating 'usable content' from my research activities, and other concerns associated with participation within the extractive research economies of neoliberal academia. By performing the researcher I place my participants in a situation where they are tacitly encouraged to perform the research subject, ultimately defining a situation where we create knowledge together via discursive relational practices (Connor et al., 2018). However, my identity as researcher and author distances me from my research participants in a multiplicity of ontological and epistemological ways which define a power imbalance between us. This occurs in terms of my own power to define what constitutes an interesting question, to engage in the formalized activities of 'collecting data', to *discard* data (for example because it is deemed anecdotal), to decide what parts of their experiences are communicated in text, and to define the discourses contextualizing these experiences. With this in mind I've tried in Chapter 3 to present my research findings such that my research participants 'speak for themselves' as much as possible, but the format of an academic article with an abbreviated word limit is not conducive to including the extended quotes and rich textual evidence that would have made this possible to the fullest extent.

Mediation and action research

The issue of mediation is even more aggravated for Chapter 2; we used the most brute-force statistical tools available to us to make our point as clearly as possible. In doing so, we by necessity obscured much intersectional complexity (Brooks *et al.*, 2021). We knowingly engaged with the power differential implied by our stance as a cross-disciplinary research team 'studying' audio engineers as a population and with the ontological/definitional power implied by statistical tools in order to intervene in the field. This intervention took the form of a published article in the JAES, a journal which publishes mainly technical articles catering to audio engineers, as well as a series of talks drawing attention to structural equity issues in the audio industry. Our use of statistical tools as opposed to the 'soft' (sic) tools of qualitative discourse analysis was primarily performative: while we were mainly saying things with that article that would undoubtedly be communicated in more nuanced ways via a qualitative paper, there is an emphasis within the JAES upon publications featuring some kind of mathematical model or statistical treatment. In this context, my own background in applied mathematics was useful; by speaking the privileged language of statistical analysis we presented our results in such a way that they might be heard by audio engineers who valorize performative technical knowledge (Annetts, 2015).

The collaboration between myself and Dr. Pras (both of whom have backgrounds in physics and audio engineering) with Dr. Elafros and Monica Lockett (who are sociologists) was extremely generative, although not without difficult conversations. As a team, we ran aground on the methodological-linguistic difficulty of trying to speak about intersectional identity when applying such a necessarily reductive tool to collect data – what words should we be using to describe identity 'categories' when identity is so personal, contextual, and complex? We found ourselves frustrated by our own limited perspectives and struggled to find consensus on how to

interpret data coming from an international survey of this scale, when the politics of race and gender are so globally heterogeneous. In a dataset as large as the one we collected, it's important to be careful with the statistical questions one asks. We did our best to engage responsibly our statistical instrument, but our analysis is heavily skewed towards contrasting the experiences of women- especially cisgender white women- with 'everyone else', a 'difference' approach that (as mentioned in the literature review) serves to naturalize binary gender as well as flattening intersectional power differentials. For just one example, lumping the diverse genders of the participants in the survey into the three categories of 'cisgender man', 'cisgender woman' and 'transgender/non-binary' felt acutely awkward, and we know we lost valuable nuance in making that choice. Just looking at 'the pay gap' and considering that transgender women are typically even more underpaid than cisgender women while transgender men tend to earn on par with their cisgender counterparts, our choice of categories clearly passes over something important (Leppel, 2016). However, the conversations around equity within pro audio are so underdeveloped that we chose to sacrifice nuance in our data in favor of statistical significance and simple argumentation in the quantitative paper. Regardless of these methodological-ideological issues, I think that in terms of the overall goal of providing an advocacy tool the project was successful in a way it wouldn't have been had we used only qualitative methods more appropriate to capturing nuance and depth.

That said, some of our findings were both unexpected and most concisely represented via statistical methods (Olsen & Morgan, 2004). The demographic portion of the survey provided key descriptive statistics for the group of participants who filled it out, which can to a limited extent be extrapolated to represent audio engineers generally. For example, nearly a quarter (17%) of the men and half (44%) of the women we surveyed self-identified as non-heterosexual.

While the difficulties in accounting for queer populations are well-established (Cameron & Stinson, 2019; Treharne et al., 2011), this is definitely a significantly higher percentage than is found in the general population, especially of non-heterosexual women. Although the experiences of lesbians and bisexual women working in male-dominated industries remain understudied, there is some small evidence to show that non-heterosexual women may be more likely than heterosexual women to take on non-traditional gender roles and therefore choose non-traditional careers (Wright, 2011; 2016). Beyond the intersectional statistical findings related to gender and sexuality that I described in Chapter 2 and a few notable challenges which I noted faced by queer interviewees who participated in the study presented in Chapter 3, I have largely neglected exploring the complex intersection between gender and sexuality in this research. Further research is merited on this topic.

We failed completely to capture the experiences of Indigenous audio engineers in the survey. While we included a question asking about Indigenous status, we discarded the results because the question was misinterpreted by a large number of participants, sometimes in ways that appeared to be deliberate or even inflammatory. This is too bad, considering that there is a small but burgeoning body of literature on the use of recording in Indigenous communities as a Site for empowerment (Barney, 2007; Scales, 2003; 2013). These inflammatory or deliberately hostile survey responses were the source of much conversation within our research team: how to handle participants who fill out the survey, but make it clear that their participation amounts at least partially to 'trolling'? Ultimately, except for the question on Indigenous status, we opted to include the survey results from these participants.

COVID-19 and the changing audio industry

The interviews presented in Chapter 3 took place during the early COVID-19 pandemic, and even at that time participants expressed concern that venue closures during the pandemic would further intensify competitiveness between audio engineers. It is not an overstatement to say that the (ongoing) COVID-19 pandemic has been traumatizing to the music industry worldwide, precipitating an enormous loss of income and infrastructure for musicians and industry professionals (Brunet, 2024; Fischlin et al., 2021; Messick, 2021; Taylor, 2020) and paving the way for predatory venue takeovers by multinational conglomerates such as Live Nation at the expense of local music scenes (Hunt, 2022). In my immediate community of freelancers and small venue employees in Montreal, I witnessed enormous changes in the socio-geographical landscape of the industry. Indeed, given the predominance of low job security and no benefits within the arts, cultural workers- especially cultural workers who were part of racial or gender minorities- were disproportionately affected by COVID-19 (Arditi, 2021). One UK study noted a 44% reduction in the number of Black and racial minority women working within arts and culture between the end of 2019 and mid-2020 (Edgar-Jones, 2021). Indeed, several of the participants I interviewed during my data collection either did not return to working full time in audio engineering or did not return to it at all following the easing of COVID restrictions despite having had successful careers in the field before the pandemic. This may have been for a variety of reasons: anecdotally, I can speak to a loss of momentum, having attended coding bootcamps or other skilling programs and found other (less precarious) employment outside of the music industry, not being offered their previous gigs following reopening, disability due to COVID-19, and 'COVID cautiousness'. Speaking to this last item, since mask-wearing has ceased to be commonplace, people working in customer service and the live music industry remain at high

risk of repeatedly contracting COVID-19, which contributes to the risk of permanently disabling long-COVID (Velasquez-Manhoff, 2021; Subramanian et al., 2022). Unlike music consumers who might only attend a live concert once or twice a month, venue employees are in public space surrounded by hundreds or thousands of breathing, unmasked people several nights a week, typically without paid time off or any negotiating power to leave work should they experience COVID symptoms.

Following the reopening of music venues and recommencement of international tours I also witnessed an influx of young (typically in their late teens or early 20s), 'green' live sound engineers with very little real-world experience to the live sound industry. I also work as a recording engineer, but I have not noted the same dynamic in sound recording, perhaps because of the typically higher financial barriers to entry or the fact that I mainly work on my own in that context. Taken in conjunction with the significant number of seasoned live engineers who I've seen take their leave of the industry for voluntary or involuntary reasons and/or pivot to studio recording, as well as the lack of accountability of venue owners towards their staff, I'd suggestion that this is often because the bottom line is lower if you employ cheaper, less experienced venue staff. In any case, regardless of why exactly this has taken place, the live industry has experienced a huge staff turnover during the last four years with complex outcomes for audio culture broadly.

Recommendations for Knowledge Management

Departing from the claim that not only can knowledge be (gender) performative (Koltun, 2015) but also that (gender) performativities are a kind of personal knowledge (Albarracin & Poirer, 2022; Kraus, 2017), relating gender performativity to knowledge via Polanyi not only contributes

to currents in enactive cognition but adds further voice to the call for a theoretically rigorous performative turn in Knowledge Management made by Gond et al. (2015; 2016).

Nonaka develops a link between social processes of knowledge sharing and building organizational knowledge via *knowledge conversion* which transforms tacit knowledge into mixed tacit/explicit knowledge. Fifteen years after the original paper describing this process, he clarified that his model only pertains to institutional knowledge (not to individual knowledge), and that knowledge conversion should not be understood as the complete transformation of an individual's tacit knowledge into explicit knowledge- rather it describes the creation of additional explicit knowledge that elucidates, complements, or places the tacit knowledge into context (Nonaka, 2009; Straw, 2016). Nonetheless, perhaps because of the fifteen-year gap, Nonaka's model has been widely (mis)understood to mean that all knowledge falls into one of two neat categories: tacit knowledge which cannot be articulated semantically, and explicit knowledge which can be articulated using words, writing, diagrams, instructions, and so on. This is a conceptual departure from Polanyi's actual contribution, as has been pointed out by several KM researchers (Grant, 2007; Oğuz & Elif Şengün, 2011; Straw, 2016): Polanyi's concept emphasized the tacit foundations of all knowledge, whereas Nonaka's model nominally conceived of the possibility of explicit knowledge without such foundations.

Similarly, performativity theory has been largely misapplied or under-utilized by organizational scholars; see Gond et al. (2015) for a detailed review. While J. L. Austin has had some meaningful influence on the field, even among those scholars within management studies who cite Butler few rarely engage meaningfully with their work, and none explicate the relation between knowledge and gender performativity. Rather, they focus on how gender is materialized through spatial practices (eg. Tyler & Cohen, 2010) and through social practices and relations

(Rumens, 2010) in the workplace, on how performativity constitutes organizational identities (Hodgson, 2005) or on the ontological work that performativity does. Because performativity theory presents a challenge to the power of words to define what is (as per Barad, 2003), it also represents a challenge to the definitional power of the managerial, techno-rational view of the world which dominates organizational and management studies and which marginalizes other interests and ways of participating in the politics of everyday life (Mumby, 1995). Garrick & Chan (2017) explicitly interrogate the relationship between personal or tacit knowledge and performativity, challenging the pursuit of the bottom line as the primary objective of KM, which emerges in terms of an (allegedly counterproductive) emphasis on performative, instrumentalized knowledge. In this article, knowledge is identified as something that one can perform for specific ends within an organization, but performativities as *themselves* a kind of knowledge are neglected. Further, *performativity* as a concept is defined ambiguously, appearing to refer both to *that which is performed* and to a *culture of performativity* wherein organizational performance as defined in terms of profit and productivity is paramount (Peters, 2004).

In short, Knowledge Management has appropriated superficial understandings of both Polanyi's concept of tacit knowledge and performativity theory as articulated by Butler while neglecting the epistemological underpinnings of these theories (Gond et al., 2015; Straw, 2016). This neglect both limits the insights which a deeper engagement might facilitate and their challenge to business-as-usual practices within KM. This is pragmatic; current practices allow knowledge managers to get on with the business of providing advice to organizations looking for solutions to their knowledge-related problems while using stylish buzzwords which recall feminism (Gond et al., 2015). Questions from within masculinized and profit-motivated neoliberal corporate cultures inform and motivate much KM research and disrupting the positivist status quo may be

counter to the interests of the field (Berdahl, 2018; McDonald, 2010; Styhre, 2001). Naturalized concepts within the discipline carry with them the cumulative weight and power of capitalist corporate history and technocratic conceptions of objectivity, and so tend to dominate discourse. On the other hand, the effectiveness of current approaches to KM are controversial, with some authors arguing that the discipline is too ill-defined to be optimally effective or suggesting that KM practices have minimal measurable impact on organizational effectiveness (Abbas, 2020; Mårtensson, 2000; Wilson, 2002). While it is beyond the scope of this thesis to articulate exactly *how* this might take place, I suggest that a more epistemologically rigorous approach to the construction of knowledge itself may be just what is required to reinvigorate KM, especially with respect to understanding the impact of identity and power on professional performance. This is brought into sharp focus by the results of my research, which directly relates performativity theory and the personal nature of knowledge - both theories with significant but neglected epistemological consequences for KM – with how professional knowledge in audio engineering is developed and played out.

Conclusion

When I started this project nearly seven years ago, it was with the conviction that there was more to answering the question ‘why are there no women working in audio?’ than simply ‘the boys club rules in the music industry’. Perhaps negative early education experiences decrease opportunities for building technological self-efficacy among young girls, there aren’t enough role models, or there is a lack of opportunities for mentorship or hands-on learning? While I still think these factors do contribute to the gender gap, my current conviction is that while they may factor in during the early career stages that tend to be of interest to educators, they are not the whole story. Instead, attention should be paid to the attrition of women at around the 10-year mark in their careers that my colleagues and I identified in Chapter 2. This attrition is reflective of the distinctive gendered challenges faced by women seeking to establish long-term careers in audio engineering, obstacles which extend more deeply into the working lives of women engineers than do the oft-cited lack of role models or early encouragement. They face and tolerate ubiquitous experiences of sexism and sexual harassment (Chapter, 2), developing sophisticated techniques for managing their emotions and the emotions of the people around them to avoid experiencing danger or escalating conflict (Chapter 3). They also experience glass ceilings, boy’s clubs, being left out of collaborations, and being ghettoized into specific and less-desirable ‘positions, career streams, industry sub-sectors, genres of music, scenes, and subcultures’ (Zendel, 2024). In this context, is the ongoing underrepresentation of women and other gender minorities working in music production and audio engineering (Gaston-Bird, 2019) really any surprise?

While asking ‘why no women in audio’ might superficially seem like a rather different thing to ask than ‘how are masculinities produced in audio, and what are those masculinities like’, as my research shows, the two are closely related via hegemonic masculinity. There is a most honored way of being an audio engineer(ing man), which both shapes what kinds of masculinities are practiced by men working in audio and structures power such that women and non-binary people are coerced into performing masculinity in order to succeed within the industry (Chapter 3). The learned, practiced nature of these performances of masculinity illustrates how closely coupled masculinity is to other kinds of audio engineering knowledge and how masculinities are produced via the socio-technical practices of audio engineering itself, ultimately contributing to understanding the reproduction of audio engineering as a masculinized field. It also suggests a theoretical perspective on gender performativity as a kind of embodied knowledge, which I establish via a diffractive reading of Judith Butler’s gender performativity theory through Michael Polanyi and Marjorie Grene’s theory of personal knowledge (Chapter 1).

This research doesn’t account for the male-dominated managerial class of venue owners, agents, and other employers who determine where the money goes within the music industry. There is a commonly held cultural idea of who should be a sound engineer that is just as heavily emphasized by other stakeholders as by audio professionals themselves. These individuals not only dictate in large part who gets hired and promoted, but they also perpetuate an environment of competition and intensifying financial precarity for audio engineers. In turn, responsibility can be extended to the whole system of neoliberal capitalism, which produces masculinities defined by ruthlessness, instrumentalization, and jockeying for power (Eversberg & Schmelzer, 2023; Martinez- Guzmán, 2022). Everyone loves to complain about a macho sound guy, or by extension a hegemonically masculine culture of audio professionals, but it’s not just the audio

engineers who are at fault here. It will require more than DEI committees and audio education for young women to make meaningful change. Audio engineering exists in context, and that context is profoundly disenfranchising for the majority of people, including men. There is nothing intrinsically problematic about performing masculinity in order to get a job done- as I emphasized in Chapter 1, gender performativities can have a liberatory quality. The issue is that when there is so little self-determination given to audio engineers in the first place - they are underpaid, made invisible, and coerced into exploiting their own labor (Zendel, 2024)- maintaining a sense of stability and control becomes a matter of acute importance. This becomes doubly an issue for women, non-binary people and men embodying subordinate masculinities when *who* can wield power is determined mainly in relation to a hegemonic masculinity. Until the underlying issue of workers exploitation within the music industry is addressed, gender segmentation is likely to remain the status quo.

I will end with a final quote, in which one of the audio engineers I interviewed describes how young audio engineers are socialized to accept unreasonable working conditions. She relates her own decision to have a child and the chilling effect that it has had on her career, and finishes by pointing out how the boom-and-bust cycle of work within audio engineering is not actually conducive to creativity at all, a seeming contradiction in the creative industries. In this context of ever-intensifying precarity, it seems unlikely that there will be a major change in the culture of audio engineering in the immediate future. However, my genuine hope is that in their own nearest communities audio engineers will - like some of my interviewees - begin to recognize the limiting nature of hegemonic discourses within the industry, and rather than doubling down on social closure will challenge each other to act in solidarity in order to improve working conditions for everyone.

Back in the nineties, there was an interview [with this studio manager]. She was talking about hiring an assistant and how she had qualms about hiring a particular assistant because he was in his mid-twenties, maybe he was approaching 30. And she's like, 'I really had to explain to him that if you're going to do this you're not going to have time for your wife. You better not be thinking about having children. If you're going to do this, you have to dedicate yourself entirely to this. You're not going to have any other kind of life for the foreseeable future'. I have a lot of respect for her. I think she's a great person and a great studio manager and when she was coming up in the industry, women weren't in these important roles, authoritative roles. But on the other hand, I thought, why is that? [I have a relative] who is studying to be a neurosurgeon… but I don't think anybody has told him, if you're going to be a neurosurgeon, don't think of having a relationship. Don't think of having a family, don't think you're going to see your friends anymore. I mean, okay, maybe if you're going to be working undercover for the FBI on a long term assignment. But nobody is saying to somebody who wants to be a firefighter, you're never going to have a family. And they are dedicated to their jobs and they work 12 hour shifts, sometimes for days straight when they're on call. This expectation that we are willing to sacrifice all aspects of our lives for the privilege of minimum wage… that's something that I really don't appreciate in this industry.

I did have a child quite late in life. It's hard to say if my career is responsible for that because you also have to meet the right person? But if I had wanted to have a child earlier in life, it would have been very difficult to do some of the work that I've done and end up with the reputation that I have now. My career is not moving forward at the same trajectory as it was prior to parenthood, but I have a child and I love him, and I wouldn't change that… I want to at least be able to say that there was some other point in my life, that I have done something other than just [audio engineering]. And if that one thing is raising what I hope will be a decent human being and enjoying the relationship with my husband and that kind of stuff, it might be that simple.

But the novelty of being in the studio til 4 a.m. and posting on Facebook about how long I've worked is long past. I'm highly motivated to finish my projects on time because I have something to go home to. And that something to go home to doesn't have to be a spouse and a child or anything, something to go home to can be whatever your passion is outside of work. Or just relaxing and time off. I've read somewhere that to be truly creative you need to have like a 30% buffer. We can only be functioning at about 70% to have enough free resources to be creative, because creativity needs some room to develop. You were saying that you're in this period where you're sort of going right flat out. These periods might be productive in a certain way and they might be financially worthwhile in certain ways. But these tend not to be our most creative. You put your head down and you get through it and you learn from it, but that's not going to be what charges your creative battery. That's not going to be the time when you come up with your best ideas, if you are somebody who writes music, probably this isn't the period when you write your best music, and that's something we must think about. If you're going to work in a creative industry, leaving enough resources for joy is one thing, but also for creativity is another important thing.

Bibliography

Abbas, J. (2020). Impact of total quality management on corporate sustainability through the mediating effect of knowledge management. *Journal of cleaner production*, *244*, 118806.

Acker, J. (1990). Hierarchies, jobs, bodies: A theory of gendered organizations. *Gender & society*, *4*(2), 139-158.

Albarracin, M., & Poirier, P. (2022). Enacting gender: an enactive-ecological account of gender and its fluidity. *Frontiers in Psychology*, *13*, 772287.

Alcoff, L. M. (2009). The problem of speaking for others. *Voice in qualitative inquiry: Challenging conventional, interpretive, and critical conceptions in qualitative research*, 117-135.

Allix, N. M. (2003). Epistemology and knowledge management concepts and practices. *Journal of knowledge Management practice*, *4*(1), 1-24.

Annetts, A. (2015). *Masculinity and gear fetishism in audio technology community discourse* (Doctoral dissertation, Anglia Ruskin Research Online (ARRO)).

Anthony, B. (2022). *Music Production Cultures: Perspectives on Popular Music Pedagogy in Higher Education*. CRC Press.

Arditi, D. M. (2021). Precarious labour in COVID times: the case of musicians. *Fast Capitalism*, *18*(1).

Arksey, H., & O'Malley, L. (2005). Scoping studies: towards a methodological framework. *International journal of social research methodology*, *8*(1), 19-32.

Ashcraft, K., & Mumby, D. K. (2003). *Reworking gender: A feminist communicology of organization*. Sage Publications.

Austin, J. L. (1955). *How to do things with words*. Harvard university press.

Barad, K. (2003). Posthumanist performativity: toward an understanding of how matter comes to matter. *Signs*, *28*(3), 801–831.

Barad, K. (2007). *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Duke University Press.

Barley, W. C., Treem, J. W., & Kuhn, T. (2018). Valuing multiple trajectories of knowledge: A critical review and agenda for knowledge management research. *Academy of management annals*, *12*(1), 278-317.

Barney, K. (2007). Sending a message: How indigenous Australian women use contemporary music recording technologies to provide a space for agency, viewpoints and agendas. *the world of music*, 105-124.

Bartlett, J. E., Bartlett, M. E., & Reio Jr, T. G. (2008). Workplace Incivility: Worker and Organizational Antecedents and Outcomes. *Online Submission*.

Basumatary, J. (2020). Michel Foucault on regenerative relatedness of power/knowledge and truth. *Journal of Indian Council of Philosophical Research*, *37*(3), 323–341. https://doi.org/10.1007/s40961-020-00224-4

Bates, E. (2009). Ron's right arm: Tactility, visualization, and the synesthesia of audio engineering.

Bates, E., & Bennett, S. (2022). Look at all those big knobs! Online audio technology discourse and sexy gear fetishes. *Convergence*, *28*(5), 1241-1259.

Beer, D. (2014). The precarious double life of the recording engineer. *Journal for Cultural Research*, *18*(3), 189-202.

Bell, A. P. (2015). DAW democracy? The dearth of diversity in 'Playing the Studio'. *Journal of Music, Technology & Education*, *8*(2), 129-146.

Bennett, S. (2017). Songs about fucking: John Loder's southern studios and the construction of a subversive sonic signature. *Journal of Popular Music Studies*, *29*(2), e12209.

Berdahl, J. L., Cooper, M., Glick, P., Livingston, R. W., & Williams, J. C. (2018). Work as a masculinity contest. *Journal of Social Issues*, *74*(3), 422-448.

Bielefeldt, C. (2015). Produzenten und Studios in der populären Musik. *Musik & Ästhetik*, *19*(76), 20-42.

Bielmeier, D. (2016). Audio recording and production education: Skills new hires have and where they reported. *Journal of the Audio Engineering Society*, *64*(4), 218-228.

Bielmeier, D. (2017, October). Audio education: Audio recording production students report skills learned or focused on in their programs. In *Audio Engineering Society Convention 143*. Audio Engineering Society.

Blake, A. (2009). Recording Practices and the Role of the Producer. The Cambridge Companion to Recorded Music, 36-53.

Blau, G., Andersson, L. "Testing a measure of instigated workplace incivility." *Journal of occupational and organizational psychology* 78.4 (2005): 595-614.

Botha, L. (2011). Mixing methods as a process towards indigenous methodologies. *International Journal of Social Research Methodology*, *14*(4), 313-325.

Brooks, G., Pras, A., Elafros, A., & Lockett, M. (2021). Do we really want to keep the gate threshold that high?.

Brunet, M. (2024) *Precarious Sounds: Labor in the Live Music Industry.* [Master's thesis, Concordia University]

Bryant, Levi. (2014) *Onto-Cartography: An Ontology of Machines and Media.* Edinburgh University Press.

Buckingham, S., & Ronan, M. (2019, March). Factors contributing to gender imbalance in the audio industry. In *Audio Engineering Society Convention 146*. Audio Engineering Society.

Butler, J. (1990). *Gender trouble: Feminism and the subversion of identity*. Routledge.

Butler, J. (2010). Performative agency. *Journal of cultural economy*, *3*(2), 147-161.

Butnor, A., & MacKenzie, M. (2022). Enactivism and gender performativity. *Feminist philosophy of mind*, 190-206.

Buzzanell, P. M., Arendt, C., Dohrman, R. L., Zoltowski, C. B., & Rajan, P. (2023). Engineering Emotion Sustainably: Affective Gendered Organizing of Engineering Identities and Third Space. *Sustainability*, *15*(6), 5051.

Cameron, J. J., & Stinson, D. A. (2019). Gender (mis) measurement: Guidelines for respecting gender diversity in psychological research. *Social and personality psychology compass*, *13*(11), e12506.

Caruth, G. D. (2013). Demystifying mixed methods research design: A review of the literature. *Online Submission*, *3*(2), 112-122.

Castillo, C. (2020). Mixing Tracks: Notes toward the analysis and design of vocal manipulation in Hip Hop music. *Computers and Composition*, *58*, 102608.

Cole, S. J. (2011). The prosumer and the project studio: The battle for distinction in the field of music recording. *Sociology*, *45*(3), 447-463.

Congdon, L. (1997). Between brothers: Karl and Michael Polanyi on fascism and communism. *Társadalom és gazdaság Közép-és Kelet-Európában/Society and Economy in Central and Eastern Europe*, 114-123.

Connell, R. (1987). *Gender and power: Society, the person and sexual politics*. John Wiley & Sons.

Connell, R. W. (1998). Masculinities and globalization. *Men and masculinities*, *1*(1), 3-23.

Connell, R. W. (2005). *Masculinities*. Polity.

Connell, R. W., & Messerschmidt, J. W. (2005). Hegemonic masculinity: Rethinking the concept. Gender & society, 19(6), 829-859.

Connor, J., Copland, S., & Owen, J. (2018). The infantilized researcher and research subject: Ethics, consent and risk. *Qualitative Research*, *18*(4), 400-415.

Corey, J. (2016). *Audio production and critical listening: Technical ear training*. Focal Press.

Cornwall, A., & Lindisfarne, N. (2003). *Dislocating masculinity: Comparative ethnographies*. Routledge.

Cornwall, A., Karioris, F. G., & Lindisfarne, N. (Eds.). (2016). *Masculinities under neoliberalism*. Zed Books Ltd.

Crenshaw, K. (2013). Demarginalizing the intersection of race and sex: A black feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics. In *Feminist legal theories*(pp. 23-51). Routledge.

Croghan, N. B., Arehart, K. H., & Kates, J. M. (2012). Quality and loudness judgments for music subjected to compression limiting. *The Journal of the Acoustical Society of America*, *132*(2), 1177-1188.

Crowdy, D. (2022). *Code Musicology: From Hardwired to Software*. Rowman & Littlefield.

De Jaegher, H. (2021). Loving and knowing: Reflections for an engaged epistemology. *Phenomenology and the Cognitive Sciences*, *20*(5), 847-870.

De Jaegher, H., & Di Paolo, E. (2007). Participatory sense-making: An enactive approach to social cognition. *Phenomenology and the cognitive sciences*, *6*, 485-507.

De Man, B., Boerum, M., Leonard, B., King, R., Massenburg, G., & Reiss, J. D. (2015, May). Perceptual evaluation of music mixing practices. In *Audio Engineering Society Convention 138*. Audio Engineering Society.

De Man, B., Leonard, B., King, R., & Reiss, J. D. (2014). An analysis and evaluation of audio features for multitrack music mixtures.

Derks, B., Ellemers, N., Van Laar, C., & De Groot, K. (2011). Do sexist organizational cultures create the Queen Bee?. *British Journal of Social Psychology*, *50*(3), 519-535.

Derks, B., Van Laar, C., & Ellemers, N. (2016). The queen bee phenomenon: Why women leaders distance themselves from junior women. *The Leadership Quarterly*, *27*(3), 456-469.

Di Paolo, E., & Thompson, E. (2014). The enactive approach. In *The Routledge handbook of embodied cognition* (pp. 68-78). Routledge.

Djupvik, M. B. (2017). 'Working It': Female Masculinity and Missy Elliott. In *The Routledge Research Companion to Popular Music and Gender* (pp. 117-131). Routledge.

Dochtermann, J. (2010). *Big studio secrets for home recording and production*. Nelson Education.

Draz, M. (2022). Realness as Resistance: Queer Feminism, Neoliberalism, and Early Trans Critiques of Butler. *Hypatia*, *37*(2), 364-383.

Eagly, A. H. (2009). The his and hers of prosocial behavior: an examination of the social psychology of gender. *American psychologist*, *64*(8), 644.

Edgar-Jones, P. "We Are in Danger of Losing an Entire Generation of Talent in the Arts—But It Is Not Too Late." *Independent,* 31 Jan. 2021, www.independent.co.uk/voices/sky-arts- covid-lockdown-theatre-b1795394.html.

El Dib, R. P., Silva, E. M., Morais, J. F., & Trevisani, V. F. (2008). Prevalence of high frequency hearing loss consistent with noise exposure among people working with sound systems and general population in Brazil: a cross-sectional study. *BMC Public Health*, *8*(1), 151.

Elden, M., & Chisholm, R. F. (1993). Emerging varieties of action research: Introduction to the special issue. *Human relations*, *46*(2), 121-142.

Espineira, K., & Bourcier, M. H. S. (2016). Transfeminism: Something else, somewhere else. *Transgender Studies Quarterly*, *3*(1-2), 84-94.

Evers, C. W. (2019). The gendered emotional labor of male professional 'freesurfers' digital media work. *Sport in Society*, *22*(10), 1691–1706. https://doi.org/10.1080/17430437.2018.1441009

Eversberg, D., & Schmelzer, M. (2023). Degrowth and Masculinities: Towards a gendered understanding of degrowth subjectivities. *Degrowth Journal, May*, *3*, 2023.

Festré, A. (2018) Michael Polanyi's economics: a strange rapprochement. hal-01931732

Fischlin, D., Risk, L., & Stewart, J. (2021). The poetics of engagement: Improvisation, musical communities, and the COVID-19 pandemic. *Critical Studies in Improvisation*, *14*(1), 1-25.

Flowe, D. J. (2020). *Uncontrollable Blackness: African American Men and Criminality in Jim Crow New York*. UNC Press Books.

Floyd, J. (2015). *Sun records: an oral history* (2nd ed.). Devault-Graves Digital Editions.

Foucault, M. (1975). Discipline and punish: the birth of the prison. *A. Sheridan, Tr., Paris, FR, Gallimard*.

Foucault, M. (1976). The history of sexuality vol. 1. The will to knowledge.

Foucault, M. (1980). *Power/knowledge: Selected interviews and other writings, 1972-1977*. Vintage.

Fox, J. H. (2009). *King of the queen city: the story of king records* (Ser. Music in american life). University of Illinois Press.

Fox, N. J. (2008). Post-positivism. *The SAGE encyclopedia of qualitative research methods*, *2*, 659-664.

Fox, N. J., & Alldred, P. (2023). Applied research, diffractive methodology, and the research-assemblage: Challenges and opportunities. *Sociological Research Online*, *28*(1), 93-109.

Gabbay, J., & Le May, A. (2004). Evidence based guidelines or collectively constructed "mindlines?" Ethnographic study of knowledge management in primary care. *Bmj*, *329*(7473), 1013.

Gander, J. M. (2015). Situating creative production: recording studios and the making of a pop song. *Management Decision*, *53*(4), 843-856.

Garrick, J., & Chan, A. (2017). Knowledge management and professional experience: the uneasy dynamics between tacit knowledge and performativity in organizations. *Journal of knowledge management*, *21*(4), 872-884

Gartner, R. E., Sterzing, P. R., Fisher, C. M., Woodford, M. R., Kinney, M. K., & Victor, B. G. (2020). A scoping review of measures assessing gender microaggressions against women. *Psychology of Women Quarterly*, *44*(3), 283–306.

Gaston-Bird, L. (2019). *Women in Audio*. Focal Press.

Gibson, C. (2005). Recording studios: relational spaces of creativity in the city. *Built Environment*, *31*(3), 192-207.

Gill-Peterson, J. (2023). Trans Auto-Antonym Theory (The Masc–Femme Dialectic). *Paragraph*, *46*(1), 108-123.

Gond, J. P., & Cabantous, L. (2016). Performativity: Towards a performative turn in organizational studies. In *The Routledge companion to philosophy in organization studies* (pp. 508-516). Routledge.

Gond, J. P., Cabantous, L., Hardy, N., & Learmonth, M. (2015). What do we mean by performativity in organization studies? The uses and abuses of performativity. *International Journal of Management Reviews*.

Grandey, A. A., & Gabriel, A. S. (2015). Emotional labor at a crossroads: Where do we go from here?. *Annu. Rev. Organ. Psychol. Organ. Behav.*, *2*(1), 323-349.

Grant, K. A. (2007). Tacit Knowledge Revisited: We Can Still Learn from Polanyi. *Electronic Journal of Knowledge Management*, *5*(2), pp173-180.

Greig, A. (2011). Chapter Seventeen: Anxious States and Directions for Masculinities Work with Men. *Men and Development*, 219.

Grene, M. G. (1995). A philosophical testament. Open Court.

Halberstam, J. (1998). *Female Masculinity*. Duke University Press. https://doi.org/10.2307/j.ctv11cwb00

Hansen, K. A. (2022). Staging a 'real'masculinity in a 'fake'world: creativity, (in) authenticity, and the gendering of musical labour. *Cultural Studies*, *36*(5), 713-731.

Haraway, D. (1988). Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective. *Feminist Studies*, *14*(3), 575–599. https://doi.org/10.2307/3178066

Harkness, G. (2014). Get on the Mic: Recording Studios as Symbolic Spaces in Rap Music. *Journal of Popular Music Studies*, *26*(1), 82-100.

Harrison, A. K. (2014). "What Happens in the Cabin...": An Arts-Based Autoethnography of Underground Hip Hop Song Making. *Journal of the Society for American Music*, *8*(1), 1-27.

Hecker, T. (2008). Glenn Gould, the vanishing performer and the ambivalence of the studio. *Leonardo Music Journal*, 77-83.

Hénaff, G. L. (2015, October). From Studio to Stage. In *Audio Engineering Society Convention 139*. Audio Engineering Society.

Hennion, A. (1989). An intermediary between production and consumption: The producer of popular music. *Science, Technology, & Human Values*, *14*(4), 400-424.

Henriques, J. (2007). Situating sound: the space and time of the dancehall session. *THAMYRIS INTERSECTING PLACE SEX AND RACE*, *18*, 287.

Hepler, S., Cannon, S., Hartnett, C., & Peitso-Holbrook, T. (2019). Undoing and doing-with: Practices of diffractive reading and writing in higher education. *Posthumanism and higher education: Reimagining pedagogy, practice and research*, 141-151.

Hepworth-Sawyer, R., & Hodgson, J. (Eds.). (2016). *Mixing Music*. Taylor & Francis.

Hesmondhalgh, D., & Baker, S. (2010). 'A very complicated version of freedom': Conditions and experiences of creative labour in three cultural industries. *Poetics*, *38*(1), 4-20.

Heung, S., Phutane, M., Azenkot, S., Marathe, M., & Vashistha, A. (2022, October). Nothing micro about it: Examining ableist microaggressions on social media. In *Proceedings of the 24th International ACM SIGACCESS Conference on Computers and Accessibility* (pp. 1-14).

Hochschild, A. R. (1983). The managed heart. Routledge.

Hodgson, D. (2005). 'Putting on a professional performance': performativity, subversion and project management. *Organization*, *12*(1), 51-68.

Homer, M. (2009). Beyond the studio: the impact of home recording technologies on music creation and consumption. *Nebula*, *6*(3), 85-99.

Horning, S. S. (2004). Engineering the performance: Recording engineers, tacit knowledge and the art of controlling sound. *Social Studies of Science*, *34*(5), 703-731.

Horning, S. S. (2013). *Chasing sound: technology, culture, and the art of studio recording from Edison to the LP*. JHU Press.

Huffermann, J. D. (2023). The primacy of Knowing-how: cognition, know-how and an enactive action first epistemology.

Hunt, T. J. (2022). Increasing Competition in Live Music: The Case for Better Enforcement of the Live Nation Entertainment Consent Decree. *Clev. St. L. Rev.*, *71*, 269.

Intersex Human Rights Australia. (2019) Intersex Population Numbers. Retrieved 06/12/2024 from https://ihra.org.au/16601/intersex-numbers/

Jago, M. (2019). What is a jazz record anyway?: Lennie Tristano and the use of extended studio techniques in jazz. In *The Art of Record Production* (pp. 142-154). Routledge.

Jennex, M. E. (Ed.). (2005). *Case studies in knowledge management*. IGI Global.

Jorgensen, J. Engineering selves: Negotiating gender and identity in technical work. *Manag. Commun. Q.* **2002**, *15*, 350–381.

Kardos, L. (2015, May). The sonic vernacular: considering communicative timbral gestures in modern music production. In *Audio Engineering Society Convention 138*. Audio Engineering Society.

Karhu, S. (2022). Gender skepticism, trans livability, and feminist critique. *Signs: Journal of Women in Culture and Society*, *47*(2), 295-317.

Katz, B. F., & Majdak, P. (Eds.). (2022). *Advances in Fundamental and Applied Research on Spatial Audio*. BoD–Books on Demand.

Kealy, E. R. (1979). From craft to art: The case of sound mixers and popular music. *Sociology of Work and Occupations*, *6*(1), 3-29.

Kennedy, R., & Gioia, T. (2013). Jelly roll, bix, and hoagy: Gennett records and the rise of America's musical grassroots (Revised and expanded). Indiana University Press.

Kidder, W. C. (2004). The bar examination and the dream deferred: A critical analysis of the MBE, social closure, and racial and ethnic stratification. *Law & Social Inquiry*, *29*(3), 547-589.

Knowles, J. D., & Hewitt, D. (2012). Performance recordivity: Studio music in a live context.

Koon, V. Y., & Pun, P. Y. (2018). The mediating role of emotional exhaustion and job satisfaction on the relationship between job demands and instigated workplace incivility. *The Journal of Applied Behavioral Science*, *54*(2), 187-207.

Kraus, A. (2017). Gender as a Form of Tacit Knowing in the Fields of Pedagogy. *Culture, Biography & Lifelong Learning*, *3*(1), 12-19.

Lame, G. (2019, July). Systematic literature reviews: An introduction. In *Proceedings of the design society: international conference on engineering design* (Vol. 1, No. 1, pp. 1633-1642). Cambridge University Press.

Landström, C. (2007). Queering feminist technology studies. *Feminist Theory*, *8*(1), 7-26.

Leonard, M. (2016). Girls at work: gendered identities, sex segregation, and employment experiences in the music industries. *Voicing girlhood in popular music: Performance, authority, authenticity*, 37-55.

Leppel, K. (2016). The labor force status of transgender men and women. *International Journal of Transgenderism*, *17*(3-4), 155–164. https://doi.org/10.1080/15532739.2016.1236312

Levac, D., Colquhoun, H., and O'Brien, K. "Scoping studies: advancing the methodology." *Implementation science* 5.1 (2010): 69.

Lewin, K. (1946). Action research and minority problems. *Journal of social issues*, *2*(4), 34-46.

Lewis, J. A., & Neville, H. A. (2015). Construction and initial validation of the Gendered Racial Microaggressions Scale for Black women. *Journal of counseling psychology*, *62*(2), 289.

Leyshon, A. (2009). The Software Slump?: digital music, the democratisation of technology, and the decline of the recording studio sector within the musical economy. *Environment and Planning A*, *41*(6), 1309-1331.

Lund, A. (2013). Staging gender: the articulation of tacit gender dimensions in drama classes in a Swedish context. *Gender and education*, *25*(7), 907-922.

Marshall, O. (2020). Shibboleths in the studio: Informal demarcation practices among audio engineers. *Social studies of science*, *50*(6), 881-900.

Mårtensson, M. (2000). A critical review of knowledge management as a management tool. *Journal of knowledge management*, *4*(3), 204-216.

Martínez-Guzmán, A. (2022). Masculine Subjectivities and Necropolitics: Precarization and Violence at the Mexican Margins. In: Walkerdine, V. (eds) Neoliberalism and Subjectivity in Latin America. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-031-17855-9_3

Mathew, M., Grossman, J., & Andreopoulou, A. (2016, September). Women in audio: Contributions and challenges in music technology and production. In *Audio Engineering Society Convention 141*. Audio Engineering Society.

Matlon, J. (2016). Racial capitalism and the crisis of black masculinity. *American Sociological Review*, *81*(5), 1014-1038.

Mazzei, L. A. (2014). Beyond an Easy Sense: A Diffractive Analysis. Qualitative Inquiry, 20(6), 742-746. https://doi.org/10.1177/1077800414530257

McCartney, A. (2003). In and out of the sound studio. *Organised Sound*, *8*(1), 89-96.

McGarry, G., Tolmie, P., Benford, S., Greenhalgh, C., & Chamberlain, A. (2017). "They're all going out to something weird": workflow, legacy and metadata in the music production process

McIntyre, P. (2012). Rethinking creativity: record production and the systems model. *The art of record production: An introductory reader for a new academic field*, 149-61.

Meintjes, L. (2003). *Sound of Africa!: making music Zulu in a South African studio*. Duke University Press.

Messick, K. J. (2021). Music industry in crisis: The impact of a novel coronavirus on touring metal bands, promoters, and venues. *The societal impacts of COVID-19: A transnational perspective*, 83-98.

Miller, R. A., & Smith, A. C. (2021). Microaggressions experienced by LGBTQ students with disabilities. Journal of Student Affairs Research and Practice, 58(5), 491–506.

Morris, B. (2015). Olivia Records: The Production of a Movement. *Journal of lesbian studies*, *19*(3), 290-304.

Mulder, J. (2015, June). Amplified music and sound level management; A multi stakeholder perspective. In *Audio Engineering Society Conference: 58th International Conference: Music Induced Hearing Disorders*. Audio Engineering Society.

Mumby, D. K. (1996). Feminism, postmodernism, and organizational communication studies: A critical reading. *Management Communication Quarterly*, *9*(3), 259-295.

Mumby, D. K. (2004). Discourse, power and ideology: Unpacking the critical approach. *The Sage handbook of organizational discourse*, 237-258.

Mumby, D. K. (2004). Discourse, power and ideology: Unpacking the critical approach. *The Sage handbook of organizational discourse*, 237-258.

Murris, K., & Bozalek, V. (2019). Diffracting diffractive readings of texts as methodology: Some propositions. *Educational Philosophy and Theory*, *51*(14), 1504-1517.

Nadal, K. L., Skolnik, A., & Wong, Y. (2012). Interpersonal and systemic microaggressions toward transgender people: implications for counseling. *Journal of Lgbt Issues in Counseling*, *6*(1), 55–82. https://doi.org/10.1080/15538605.2012.648583

Namaste, K. (1996). 'Tragic Misreadings': Queer Theory's Erasure of Transgender Subjectivity. *Queer studies: A lesbian, gay, bisexual, and transgender anthology*, 183-203.

Neuenfeldt, K. (2007). Learning to Listen when there is too much to hear: music producing and audio engineering as 'engaged hearing'. *Media International Australia*, *123*(1), 150-160.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization science*, *5*(1), 14-37.

Nonaka, Ikujiro, and Georg Von Krogh. "Perspective—Tacit knowledge and knowledge conversion: Controversy and advancement in organizational knowledge creation theory." *Organization science* 20.3 (2009): 635-652.

Oğuz, F., & Elif Şengün, A. (2011). Mystery of the unknown: revisiting tacit knowledge in the organizational literature. *Journal of knowledge management*, *15*(3), 445-461.

Ohanmamooreni, A. (2013). *There's nothing "micro" about it: The effect of sexist humor on the expression of micro-aggressions*. Western Carolina University.

Olsen, W., & Morgan, J. (2004). A critical epistemology of analytical statistics: addressing the sceptical realist.

Owen, D. (2002). Nietzsche's Event: Genealogy and the Death of God. *Theory & Event*, *6*(3).

Parkin, F. (1974). Strategies of social closure in class formation. *The social analysis of class structure*, *1*, 1-18.

Patitsas, E. (2019, May). The social closure of undergraduate computing: Lessons for the contemporary enrolment boom. In *2019 IEEE/ACM 2nd International Workshop on Gender Equality in Software Engineering (GE)* (pp. 33-36). IEEE.

Paucar-Caceres, A., & Pagano, R. (2009). Systems thinking and the use of systemic methodologies in knowledge management. *Systems Research and Behavioral Science: The Official Journal of the International Federation for Systems Research*, *26*(3), 343-355.

Peters, M. A. (2004). Performative, 'performativity' and the culture of performance: Knowledge management in the new economy1 (Part 1). *Management in Education*, *18*(1), 35-38.

Pi, X., & Yang, Z. (2022, October). Convention Express Paper 43. In *Presented at the 153rd AES Convention*.

Pierce, C. M., Carew, J. V., Pierce-Gonzalez, D., & Wills, D. (1977). An experiment in racism: TV commercials. *Education and Urban Society*, *10*(1), 61-87.

Polanyi, M. (1958). *Personal knowledge : towards a post-critical philosophy*. Routledge.

Polanyi, M. (1969). Knowing and being: essays by Michael Polanyi.

Porcello, T. (2004). Speaking of sound: language and the professionalization of sound-recording engineers. *Social Studies of Science*, *34*(5), 733-758.

Pras, A., & Guastavino, C. (2011). The role of music producers and sound engineers in the current recording context, as perceived by young professionals. *Musicae Scientiae*, *15*(1), 73-95.

Pras, A., Cance, C., & Guastavino, C. (2013). Record producers' best practices for artistic direction—from light coaching to deeper collaboration with musicians. *Journal of New Music Research*, *42*(4), 381-395.

Pras, A., Guastavino, C., & Lavoie, M. (2013). The impact of technological advances on recording studio practices. *Journal of the American society for Information Science and Technology*, *64*(3), 612-626. (Bielefeldt, 2015)

Prince, S., & Shankar, K. R. (2012, December). Survey on Effective Audio Mastering. In *International Conference on Future Generation Communication and Networking* (pp. 293-301). Berlin, Heidelberg: Springer Berlin, Heidelberg.

Putnam, M. T. (1980, May). A Thirty-five Year History and Evolution of the Recording Studio. In *Audio Engineering Society Convention 66*. Audio Engineering Society.

Ramone, P. (2007). *Making records: the scenes behind the music*. Hachette Books.

Reyes, I. (2010). To know beyond listening: Monitoring digital music. *The Senses and Society*, *5*(3), 322-338.

Ridgeway, C. L., & Smith-Lovin, L. (1999). The gender system and interaction. *Annual review of sociology*, *25*(1), 191-216.

Rodgers, T. (2010). *Pink noises: Women on electronic music and sound*. Duke University Press.

Ronan, D., De Man, B., Gunes, H., & Reiss, J. D. (2015, October). The impact of subgrouping practices on the perception of multitrack music mixes. In *Audio Engineering Society Convention 139*. Audio Engineering Society.

Rother, E. T. (2007). Systematic literature review X narrative review. *Acta paulista de enfermagem*, *20*, v-vi.

Rumens, N. (2010). Firm friends: exploring the supportive components in gay men's workplace friendships. *The Sociological Review*, *58*(1), 135-155.

Rumsey, F., & McCormick, T. (2012). *Sound and recording: an introduction*. Focal Press.

Sacha, J. O. (2017). Fighting feelings: The emotional labor of "old heads" in an amateur boxing gym. *Sociological Perspectives*, *60*(1), 77-94.

Saddik, A. J. (2003). Rap's Unruly Body The Postmodern Performance of Black Male Identity on the American Stage. *TDR/The Drama Review*, *47*(4), 110-127.

Salehi, K., & Golafshani, N. (2010). Commentary: Using mixed methods in research studies: An opportunity with its challenges. *International journal of multiple research approaches*, *4*(3), 186-191.

Sanchez, R., & Mahoney, J. T. (1996). Modularity, flexibility, and knowledge management in product and organization design. *Strategic management journal*, *17*(S2), 63-76.

Scales, C. A. (2002). The politics and aesthetics of recording: a comparative Canadian case study of Powwow and contemporary Native American music. *The world of music*, 41-59.

Scales, C. A. (2013). The North American Aboriginal Recording Industry. *The Journal of American Folklore*, *126*(499), 81-91.

Seay, T. (2012). Capturing That Philadelphia Sound: A Technical Exploration of Sigma Sound Studios. *Journal on the Art of Record Production*, *6*.

Shepherd, R. (2011). The collaborative recordist. *Musicology Australia*, *33*(2), 255-264.

Shortall, S., McKee, A., & Sutherland, L. A. (2020). The performance of occupational closure: The case of agriculture and gender. *Sociologia Ruralis*, *60*(1), 40-57.

Skea, D. (2002). Rudy Van Gelder in Hackensack: Defining the jazz sound in the 1950s.

Slater, M. (2015). Nests, arcs and cycles in the lifespan of a studio project. *Popular Music*, *34*(1), 67-93.

Smith, P., Pieper, K., Hernandez, C., & Wheeler, S. (2023). Inclusion in the Recording Studio? Gender & Race/Ethnicity of Artists, Songwriters & Producers across 1,100 Popular Songs from 2012 to 2022. *USC Annenberg Inclusion Initiative*.

Spivak, G. C. (2023). Can the subaltern speak? In *Imperialism* (pp. 171-219). Routledge.

St-Pierre, I., & Holmes, R. N. (2010). Mimetic desire and professional closure: toward a theory of intra/inter-professional aggression. *Research and Theory for Nursing Practice*, *24*(2), 128.

Straw, E. M. (2016). Knowledge management and Polanyi. *Unpublished Paper*, *20*.

Stryker, S. (2008). Transgender history. New York: Seal Press.

Subramanian, A., Nirantharakumar, K., Hughes, S., Myles, P., Williams, T., Gokhale, K. M., ... & Haroon, S. (2022). Symptoms and risk factors for long COVID in non-hospitalized adults. *Nature medicine*, *28*(8), 1706-1714.

Sue, D.W. (2010). *Microaggressions in Everyday Life: Race, Gender, and Sexual Orientation*. Wiley & Sons, Hoboken, NJ.

Swann, G., Minshew, R., Newcomb, M. E., & Mustanski, B. (2016). Validation of the sexual orientation microaggression inventory in two diverse samples of lgbtq youth. Archives of Sexual Behavior : The Official Publication of the International Academy of Sex Research, 45(6), 1289–1298. https://doi.org/10.1007/s10508-016-0718-2

Sweet, P. L. (2019). The sociology of gaslighting. *American Sociological Review*, *84*(5), 851-875.

Tadman, B. (2020). Diffractive Co-conspiracy in Queer, Crip Live Art Production. *Performance Research*, *25*(5), 92-100.

Táíwò, O. O. (2020). Stoicism (as emotional compression) is emotional labor. *Feminist Philosophy Quarterly*, *6*(2).

Takaki, K. (2011). Enactive Realism. *Tradition & Discovery*, *38*(2).

Taylor, I. A., Raine, S., & Hamilton, C. (2020). COVID-19 and the UK live music industry: a crisis of spatial materiality. *The Journal of Media Art Study and Theory*, *1*(2), 219-241.

Taylor, K. (2021). When the Music's Over: COVID-19 Decimated the Arts in Canada, and the worst May be Yet to Come. *The Globe and Mail*, *11*.

Thaler, A., & Zorn, I. (2010). Issues of doing gender and doing technology–Music as an innovative theme for technology education. *European Journal of Engineering Education*, *35*(4), 445-454.

Théberge, P. (2004). The network studio: Historical and technological paths to a new ideal in music making. *Social Studies of Science*, *34*(5), 759-781.

Thompson, P., & Lashua, B. (2014). Getting it on record: Issues and strategies for ethnographic practice in recording studios. *Journal of Contemporary Ethnography*, *43*(6), 746-769.

Treharne, G. J., Brickell, C., & Chinn, A. (2011). Surveying "Non-Heterosexual Orientation": The problems of unstratified sampling, non-Inclusive categorizations, and implied causality: Commentary on Wells, McGee, and Beautrais (2011). *Archives of sexual behavior*, *4*

Tripp, D. (2005). Action research: a methodological introduction. *Educacao e pesquisa*, *31*, 443-466.

Tyler, M., & Cohen, L. (2010). Spaces that matter: Gender performativity and organizational space. *Organization studies*, *31*(2), 175-198.

Van Jaarsveld, D. D., Walker, D. D., & Skarlicki, D. P. (2010). The role of job demands and emotional exhaustion in the relationship between customer and employee incivility. *Journal of management*, *36*(6), 1486-1504.

Velasquez-Manoff, M. (2021). What If You Never Get Better from Covid-19?. *New York Times Sunday Magazine*.

Wajcman, J. (2004). *Technofeminism*. Polity.

Walzer, D. (2016). Digital storytelling in music and audio education: Inspiring modern reflective practice with relevant technology. *TOPICS for Music Education Praxis*, *3*, 46-76.

Walzer, D. A. (2017). The Curricular Soundtrack: Designing Interdisciplinary Music Technology Degrees Through Cognitive Apprenticeship and Situated Learning. In *New Directions for Computing Education* (pp. 143-160). Springer, Cham.

Watson, A. (2013). 'Running a studio's a silly business': work and employment in the contemporary recording studio sector. Area, 45(3), 330-336.

Watson, A., & Ward, J. (2013). Creating the right 'vibe': emotional labour and musical performance in the recording studio. *Environment and Planning A*, *45*(12), 2904-2918.

Watson, A., M. Hoyler and C. Mager (2009) 'Spaces and networks of musical creativity in the city', Geography Compass, 3 (2), 856–78.

Williams, A. (2010). "Pay Some Attention to the Man Behind the Curtain"—Unsung Heroes and the Canonization of Process in the Classic Albums Documentary Series. *Journal of Popular Music Studies*, *22*(2), 166-179.

Wilson, L. T., & Asay, D. (1999). Putting quality in knowledge management. *Quality Progress*, *32*(1), 25.

Wilson, T. D. (2002). The nonsense of knowledge management. *Information research*, *8*(1), 8-1.

Wolfe, P. (2012). A Studio Of One's Own: Music Production, Technology And Gender. *Journal on the Art of Record Production*, *7*.

Wolfe, P. (2019). *Women in the studio: Creativity, control and gender in popular music sound production*. Routledge.

Wood, N., Duffy, M., & Smith, S. J. (2007). The art of doing (geographies of) music. *Environment and Planning D: Society and Space*, *25*(5), 867-889.

Wright, T. (2011). A “lesbian advantage”? Analysing the intersections of gender, sexuality and class in male-dominated work. *Equality, Diversity and Inclusion: An International Journal*, *30*(8), 686-701.

Wright, T. (2016). Women's experience of workplace interactions in male-dominated work: The intersections of gender, sexuality and occupational group. *Gender, work & organization*, *23*(3), 348-362.

Yonemura, R., & Wilson, D. (2016, June). Exploring barriers in the engineering workplace: Hostile, unsupportive, and otherwise chilly conditions. In *2016 ASEE Annual Conference & Exposition*.

Young, K., Lovedee-Turner, M., Brereton, J., & Daffern, H. (2018). The impact of gender on conference authorship in audio engineering: Analysis using a new data collection method. *IEEE Transactions on Education*, *61*(4), 328-335.

Zagorski-Thomas, S. (2014). *The musicology of record production*. Cambridge University Press.

Zendel, A. (2024) *On The Road: Precarious Work and Life in The Touring Music Industry.* [Doctoral dissertation, University of Toronto]

Appendix A: Scoping review search strategy

Boolean query used in both Scopus and Google Scholar systematic searches

(“music” OR “popular music” OR “music * related disciplines”)
AND
sound engineer* OR “sound engineer*” OR sound technician OR “sound technician” OR mixing engineer OR “mixing engineer” OR sound mixer OR recordist OR studio engineer OR “studio engineer” OR recording engineer OR “recording engineer” OR live sound tech* OR “Sound recording executives * producers” OR producers engineers OR “music producer” OR record produc* OR “studio environment” OR engineering sound recording OR “recording studios” OR live mix*
AND NOT
“Machine learning” OR Algorithm OR Transcription OR “Streaming Service*” OR “Speech Recognition” OR “Mobile Phone” OR EEG OR “Cloud Music” OR “automatic identification” OR “3d audio” OR medicine

Appendix B: Scoping review exclusion and inclusion criteria

Exclusion criteria:
-Is the study population described as musicians or music students without reference to sound engineers?
-Is the topic described as acoustics, musicology, film, computer music, file-sharing/piracy, music pedagogy, psychoacoustics without reference to sound engineering practice specifically?
-Is the topic a specific technology, recording technique or sound analysis technique without reference to sound engineering practice specifically?
-Is the topic a specific musical work, feature, composer, scene or genre without reference to engineering practice specifically?
-Is the topic unrelated to music?
-Is it a studio or lab report without direct reference to social aspects of the studio/lab?
Inclusion criteria:
-Is the study population described as sound engineers?

Appendix C: Letter from MP to MG, 09/04/1960 (Polanyi Papers [Box 16, Folder 1] Hanna Holborn Gray Special Collections Research Center, University of Chicago)

Dear Marjorie,

I am getting increasingly clear about the question to which I should like to find an answer with your help. If there are two kinds of knowing ('by reliance on' and 'by attending to') where have they been hidden for 2500 years? To this I have found and given so far only some fragmentary replies. Here is a list of the two kinds of knowing in past writings:

1) Religious faith as explained by St. Augustine and contrasted by him to explicit forms of reasoning.
2) Einfuhlung as discovered by Lipps, Worringer etc. for esthetics; by Winelband, Dilthey etc. for history and contrasted by them as nomothetic vs. ideographic knowledge, etc.,
3) Buber's division of all knowledge into I-It and I-thou kinds.
4) Mysticism (negative theology) vs. explicit theology
5) Thomism vs. science, ignoring being
6) Phenomenology which developed a high sensibility to states of affairs not accessible to specification, and a brilliant technique (see e.g. Hannah Arendt) for handling them (without acknowledging their distinction)

Well, then there is Kant and German idealism plus historicism where the two kinds of knowing stick out, but are actually built into systems which try to avoid acknowledging them.
But this leaves out a great deal of the history of philosophy; Descartes, Locke, Spinosa, Berkeley, Leibniz, Bradley, etc. etc. Where were the two kinds of knowledge hiding in the writings of all these thinkers? Where? This question leads on to another, which I have tried to look at recently. What exactly does the dual theory of knowledge tell us with respect to the great 'traditional problems' of philosophy? Universals? Mind and body? Primary and secondary qualities, which is an extension of the mind-body problem? Perception and externality, which is another extension of it? …I think Langer's Philosophy in a New Key is an actual attempt to acknowledge two kinds of knowing… it says a lot about 'symbols' in the major sense of the term, which I have not been able to comprise. Likewise Eliade's analysis of ritual and myth as 'existential knowing' richly exceeds my presentations.

All this goes to say: You (Marjorie) are a philosopher, intent on figuring out how things stand and you accept the framework of dual knowing; you have all the knowledge of philosophy, past and present that I lack- what is your reason for leaving this enormous body of thought unleavened by the new insights which you share with me? I have just read the opening of Langer's Feeling and Form. She says: "Is it peculiarly in the vague un-systemtic realms of thought that a single problem, doggedly pursued to its solution, may elicit a new logical vocabulary, i.e. a new set of ideas, reaching beyond the problem itself and forcing a more negotiable conception of the whole field". This is true, and here I stand at the edge of this enormous field, which precisely the kind of new ideas Langer speaks of, prevented by rapidly diminishing prospects from entering it. And you do nothing about it! Clash and Rathdrum!! Well, I shall be safely gone by the time this violent appeal evokes your reaction. But I do wish I could talk to you about these aches and frenzies. In any case, let me try to use this epistle as

notes for further thought. Do send it back therefore, please, with any comments that may cross your mind. Mail addressed to 22 Upland Park Road will be faithfully collected here to await my return.

All the best to you meanwhile, on all your ways,
Michael

Appendix D: Interview guide

Interview 1 (Entrance Interview)

Q 1.1 Although I know some of this stuff already, for the record I'd like you to introduce yourself. What are your name, age, and preferred pronouns?
Q 1.2 What is your involvement in audio engineering?
Q 1.3 Can you tell me a bit about your current job?
Q 2.1 Have you participated in any formal or informal educational programs related to audio? (Eg. workshops, degree programs, internships, high school keystone projects)
Q 2.2 Have you participated in any postsecondary formal education outside of audio engineering?
Q 3.1 Have you had any mentors or teachers who you feel have helped you or contributed to your learning in audio engineering?
Q 3.2 Are there any peers or friends who you have worked with who you feel have helped you learn or who you have learned alongside?
Returning to your current position(s), I'd like to ask you some more specific questions about what your work life looks like.
Q 4.1 On a scale of one to ten, how much do you enjoy your current job?
Q 4.2 Who do you interact with most usually at your current job, and how often? (For example, 'I interact with the venue owner about once a week, when he comes in to chat with the bar staff'.)
Q 4.3 Overall, do you feel respected at your current job?
Q 4.4 Are there any individuals at your workplace who you have difficulty working with, or do not feel respected by?
Q. 4.5 Do you feel that your gender influences how you interact with people at your job, or how people at your job interact with you?
Q 5.1 What are the main tasks you engage with at work? If possible, I'd like to hear about them in order of when you would do them in a typical work day, but it's not super critical that you tell them to me in order of occurrence. (Eg. helping with load in, setting up microphones, balacing pan pot levels, etc.)
Q 5.2 Do you have any other responsibilities at work? (For example, keeping gear in good repair, bookkeeping, answering phone calls.)
Q 5.3 What are the main pieces of gear that you work with at work? I'd love to hear a little about what you think of them, and how you use them. If you can show them to me that would also be great.
Thank you. Are there any aspects of the questions I've asked so far that you'd like to return to or elaborate on?

(Concluding comments)

Interview 2 (Follow up interview)

Q. 1 I'd like to continue talking about gender in audio, if you are ok with that. And these questions may sound kind of preposterous, but please feel free to riff on them or see where they take you- they're intended only as prompts.

The first thing I'd like to ask is: when you got interested in audio, did you think of it as a masculine type of work?
Q. 2 One podcast I listened to last. Year was an interview with tom elmhirst called 'the midwife of audio'. This brings forward the figure of the audio engineer or producer as someone who can take on many roles. As an audio engineer, how do you picture yourself with respect to musicians- as a father figure, or as a psychologist, or as an employee?

Q. 3 And how did you feel about that?

Q. 4 Have you ever specifically felt like you acted more or less masculine just because you were at work? Or in order to get work done?
Q. 5 Have you ever felt like you acted more or less feminine just because you were at work?
Q. 6 Under what circumstances did these things happen?