University of Southampton

Faculty of Engineering and Physical Sciences

School of Electronics and Computer Science

Web Science Institute

The Creation and Life of 'Artificial Intelligence and Music': How Practices of Design and Use Shape the Direction of AI and Work in a Creative Industry.

by

Kieron Rhys Owen

ORCID ID: 0009-0002-0593-7655

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Abstract

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This thesis examines the construction and impact of 'Artificial Intelligence and Music' (AIM), an emergent practice of AI development for the automation and augmentation of music creation. Drawing upon findings gathered through ethnographic observations and interviews, it questions how and why the emergence of AIM is meaningful for music workers through the directions and influences of its innovation and the meaning making of its use. It argues that power in the music industry is shifting to AI technologies, developers, and controllers. These agents are shaped by an inflated value placed on association with AI in the wider AI market, and by internal competition for technical dominance within this market. AIM is therefore argued as a practice of technical, not musical innovation, limiting the practical implementation of responsible and interdisciplinary development called for in AI discourse. Regardless of music workers' (invested; neutral; reluctant; avoidant) positions on emergent AIM, these power shifts necessitate new strategies for maintaining their own agency in and beyond existing frameworks of sociotechnical music careers. These findings demonstrate a distinction between perspectives of music as incidental in AIM and vital in music work that is seldom acknowledged in AIM development. The integration of music work perspectives is therefore argued for through an expanded view of users to include the complexities of use in musical labour, and expanded objectives in AIM practice to include music as a key consideration of AIM labour. This would ensure that the responsibility for beneficial AIM does not fall to individual workers, who have seen declining conditions of work through past struggles to maintain careers through technological change.

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Author's Declaration

Print name	Kieron Rhys Owen
Date	03/10/2025
Title of thesis	The Creation and Life of 'Artificial Intelligence and Music': How Practices of Design and Use Shape the Direction of AI and Work in a Creative Industry.

I declare that this thesis and the work presented in it is my own and has been generated by me as the result of my own original research.

I confirm that:

1) This work was done wholly or mainly while in candidature for a research degree at this University;
2) Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3) Where I have consulted the published work of others, this is always clearly attributed;
4) Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
5) I have acknowledged all main sources of help;
6) Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7) None of this work has been published before submission.

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Chapter 1 Introduction

This research began in a 'pre-ChatGPT' era of AI in public discourse. AI was already visible, whether conceptually through the plotlines of novels and films, or through its practical uses announced in news headlines such as the breakthrough in solving the protein folding problem with DeepMind's AlphaFold (Geddes, 2022). Uses of AI in public-facing projects also included audio tasks before the hype brought by ChatGPT. Peter Jackson's Beatles documentary 'Get Back' used machine learning to isolate The Beatles' members' voices during studio recording, providing unheard footage of the group (Disney, 2021). This technology was then used to isolate and enhance a recording of John Lennon's unreleased vocals and create a new Beatles song 43 years after Lennon's death (Watercutter, 2023).

Beyond these isolated audio editing tasks, the development of AI that can automate and augment music creation has seen an uptick in pace and volume over the past decade. Although computer-generated music is not new – 'Illiac Suite' (1957) for instance, saw researchers code musical information like pitch and rhythm into a key of integers that could then be processed and reorganised by a computer (Hiller & Isaacson, 1959) – examples have been exacerbated by the current AI boom of the 2010-20s. Bostrom (2016: 10, 322) observes how this period was catalysed by advancements in machine learning and data availability that enabled 'practically useful' applications of AI. He claims that once models have passed this 'threshold of usefulness' any small improvement on them represents huge financial value, thereby drawing interest and investment into the field. Innovations in 'Artificial Intelligence and Music' (AIM) have for this reason continued at pace throughout the past decade, with recent notable examples in text-to-music generation, pioneered by the ChatGPT creator OpenAI through their 'Jukebox' model (Dhariwal *et al.*, 2020), and further examples from transnational technology corporations like Google (Agostinelli *et al.,* 2023) and Meta (Copet *et al.,* 2023).

Throughout this period AIM start-ups have also gained significant interest and investment. Amper (2014) and Jukedeck (2015) were early examples that offered copyright-free AI-generated music for use by online content creators; both raised millions of dollars in

investment before acquisition by larger companies (Dredge, 2018; 2019; 2020). And these start-ups are still emerging. Soundful, an 'AI-powered music creation platform' that aims to 'democratize music production' (more on this later) raised investment of $3.8 million in 2022 (Stassen, 2022). Bown (2024: 16-8) argues, however, that there is no clear user need for these 'generative music engines', which often replicate existing products and services like 'elevator music' (e.g., Musak) or digital audio workstations (e.g., Garageband). In contrast, when ChatGPT was released during the data collection for this thesis, its user-friendly interface, versatile applicability, and media attention provided conditions for widespread public engagement with generative AI. Through simple text prompts lay users could instruct an AI model trained on vast datasets to create original text in the form of conversation, stories, information, poems, and pertinent to this thesis: original songwriting contributions like lyrics and chord progressions. It gained a million users in its first week of release (Vallance, 2022) and grew to over 300 million weekly users by 2024 (Roth, 2024).

Therefore, at a small gig in Stoke-on-Trent in March 2023 I was not left wanting for opinions on AI when I spoke to people in both the band and audience. When talking to the bandleader about the impact of AI on musicians, he claimed that AI was purposefully designed to extract and exploit his and others' music for corporations' profits (he also casually refenced writers like Marshal McLuhan, Jacques Ellul, and the Unabomber with similar views on technology). He therefore claimed to not see the point in the technology because he believed art is more than the use of technology for efficiency. Later in the night, however, despite these negative opinions and the similar views of his peers, audience, friends, and family, he (drunkenly) revealed that he had in fact used AI to write chords for his songs recently. He says that as long as these algorithmic generations have been bounced around the heads of his band – the 'organic computer' – he still views the music as their own.

This pattern can be seen in past technological innovations in music. Pinch & Trocco (1998: 21) observe how the synthesiser was seen as a threat to artists' jobs because synth 'operators' were not seen as musicians, and Marshall (2015) observes how the accessibility of publication and consumption in streaming services was seen to de-value music, nevertheless both are now widely accepted tools within music careers. For this reason, despite recent

public remarks by artists like Nick Cave who claim that the musical output of AI is ‘a grotesque mockery of what it is to be human’ (Cave, 2023), my experience one night in Stoke suggests that music workers are already adapting their careers to the emergence of AI in the way they have adapted to past technological change. This can’t be taken as given, however; Boyd & Holton (2018: 334) argue that humans are not passive experiencers of deterministic technological change, they are agents in its sociotechnical construction and practice. This thesis therefore examines how and why AI is meaningful for music work through its ongoing construction in the practices of its development and adoption.

The remainder of this opening chapter is used to explain why this research was needed in the context of existing discourse, and the research questions that were that were formulated to explore its research problem. I also introduce and define the parameters of central concepts of the thesis before finally detailing the thesis structure to inform the reader where and how each of my questions are answered, and their contribution to my wider aim of demonstrating why and how practices of AIM’s development and adoption are shaping professional sociotechnical music creation in the western recording industry.

1.1 Research Problem

AI has long been prophesied as a source of radical sociotechnical change in the workplace and the aforementioned increases in development and adoption are increasing interest in the emergence of these changes. Although the above suggests that AI is already permeating music work practices, this thesis responds to a disassociation of music from many of the questions that AI raises in workplace contexts that limits understanding of how AIM development is influencing and influenced by the adoption of AI in music work. This disassociation results from two conditions surrounding AI and music that I introduce in this section: firstly, that the novelty of machine capabilities in this previously distinctly human area draws attention to the technology and its musical output as opposed to their impact on music workers, and secondly, that creative industries like music are seen as comparatively 'safe' through technological change when compared to other sectors.

On the former, the capabilities of AIM technology and their consequent musical output have led to a concentration on high-level questions like the meaning and aesthetics of machine creativity (e.g., Coeckelberg, 2017; Kalonaris *et al*., 2019), and where influences on music workers is engaged focus is often directed towards the financial and legal implications of AI training and authorship (e.g., Ramalho, 2017; Drott, 2021; Clancy 2022). AI *for/and/in* music in these cases is approached as *AI music:* the questions raised by *music* written by AI overshadow questions of how and why that technology is developed and used in existing music work practices. This continues through internal reflections and external critiques of AIM practice that argue AIM development deprioritises its musical context, reproducing biases towards culturally dominant musical output and practices (e.g., Born, 2020; Morreale, 2021; Sturm *et al.,* 2021a; 2021b; 2024; Huang *et al*., 2023: 47; Bown, 2024). Although these questions of music as a creative, artistic, and cultural thing/practice are important and unique to the challenges of AI in a musical context, they overshadow (perhaps more mundane) questions of how AIM influences the day-to-day practices within music careers. This is summarised through the following distinction between AI for work and ML for music:

> ‘Recent scholarship on AI has focused on its implications for labor, privacy, bias, and governance (Campolo, Sanfilippo, Whittaker, & Crawford, 2017). But increasingly, ML will become an integral part of the processing of sounds and images, shaping the way our culture sounds, looks, and feels.’ (Sterne & Razlogova, 2019: 2)

Unlike this distinction that prompts the discussion of cultural sounds apart from questions of labour, I argue that the same questions of workplace implications stem from the AI processing of sound as from the processing of financial transactions, logistics, calls, etc., because they are the subject of music workers’ careers. However, there is a second barrier for the investigation of AIM in the context of music *labour*. Creative work like music is often seen to be ‘safe’ through technological changes like the development and adoption of AI, resulting from a fetishism of ‘human’ creativity that machines are claimed not to be able to supplant regardless of generative capabilities (Gandini, 2016; Silverstein, 2019; Vermeulen *et al.,* 2020; Ashton, 2022). However, these predictions of work security are unreliable as they do not account for technological changes in capacity or social changes in attitude to technology (Kim *et al*., 2017: 3). Further, these arguments label workers who are not replaced outright by AI as ‘safe’, assuming technology that does not replace workers endlessly enhances them rather than questioning the nuance of how and why technological change can both positively and negatively impact working conditions and practices (Ashton, 2022: 104-6). Consequently, the technological and musical novelty of AIM output and pre-existing assumptions about creative music work limit understanding of its meaning for music work.

1.1.1 Questions and Aims

To engage with the meaning of AIM for music work, I do not examine individual technologies or their musical output in this study. The breadth of technologies under the definition of AIM in this thesis is broad so isolated outputs and use-cases are unlikely to be representative of the range of AIM innovation where developers often have ‘no clear roadmap for what designs, technologies and use cases, if any, will be successful’ (Bown, 2024: 1). I therefore move beyond the focus on technological and musical outputs of AIM

and their place in musical culture towards a focus on the construction of technological change through ongoing practices of AIM development and adoption. In doing so, I aim to demonstrate why and how the conditions of AIM development and adoption are crucial in constructing the meaning of AIM for sociotechnical music careers moving forwards. These aims are engaged through the following exploratory primary research question and two secondary guiding questions:

Why is the emergence of AIM meaningful for music creation as a sector of work in the western recording industry?

I. How has AIM developed as an emerging practice of technological and musical innovation?
II. How does the emergence of AIM relate to the existing relationships between workers and technology in music creation careers?

Because the above research problem is catalysed by the isolation of AIM and its output from music labour, these questions engage with both the development of AIM practice and the use of its output in music work as subjects of the thesis. But this approach also takes inspiration from the theoretical framework developed in the literature review of this thesis, drawing on ideas from Bourdieusian practice theory and Science and Technology Studies (STS). In STS, technical constraints, social influences, and individual sense-making are all argued to shape technology in both the innovation of technology and its adoption in the workplace (Pinch & Bijker, 1987; Wacjman, 2006: 782), and a Bourdieusian approach can be used to examine technology as a socio-material practice where 'people design and use technologies to enhance or promote certain activities and discourage others' (Sterne, 2003: 376). These questions therefore probe not into the impacts of AIM output on music work – because the pace of technological change in the AI field rapidly makes answers to such questions obsolete – but how and why these impacts are shaped in the practices of its development and adoption.

1.1.2 Defining the Topic

In the hope of setting a standard for the duration of this thesis, I aim to make clear the meaning and scope of the central concepts of the study. Throughout this project I examine

AIM within the context of music work; but as an emerging practice the term 'AIM' and its boundaries are unstable. Several terms are used by writers in the development and discussion of AI and music creation, including 'AI for Music' (Miranda, 2021), 'AI and Music' (Sturm *et al*., 2019b; Clancy, 2022), 'AI Music' (Morreale, 2021), and 'Music AI' (Ben-Tal *et al*., 2020; Knotts & Collins, 2020). I use 'AI and Music' (AIM) for the neutrality of its conjunction: 'and', which helps to avoid assumptions – 'AI for Music' and 'Music for AI' have different meanings, 'AI and Music' and 'Music and AI' do not. Furthermore, I use this term: AIM*,* to refer to the *practices* of AI development creating technology that can automate or aid stages of *music creation* through machine decision-making. Finally, *music creation* refers to the processes of composition, performance and audio production that are required to create musical works for the western recording industry, and not other work in the recording industry such as distribution and marketing that takes place after the creation of a musical work. This framing of music creation delimits the parameters of both *AIM* and *music work* for the thesis as I examine the meaning of the former's emergence for the latter.

The terminology used for AIM is intentionally broad. The recent boom of AI publicity has led to a wide array of practices, products, and services operating under the same label of 'AI'. Even in the specific context of music, Holzapfel *et al.* (2022) argue that a growing network of people who train, implement, and maintain AIM is obfuscating its authorship and agency. For this reason, I follow Nick Seaver (2018) in my approach to AIM as an 'umbrella' term. Seaver argues that technologies should not be confined by the researcher's parameters or conceptualised as specific predetermined facts, but as broad processes that can instead be defined through the process of data collection and analysis with its practitioners. Dourish (2016) critiques this approach, claiming that non-technical researchers' ambiguous use of terms such as 'algorithm' (Seaver studies 'algorithms' as ongoing sociotechnical constructs like my own study of the AIM umbrella) often overextend their functions, and that more specific technical definitions can better differentiate the subtleties of engineering practices. Despite these benefits, strict technical distinctions could lead to a view of technological processes as pre-determined despite the influences of ideologies, actions, institutions, etc. For instance, Briot (2020) observes that recent advances in AIM are most prolific in deep

learning for music generation; however, the interplay between these deep learning and other approaches to practice are crucial in understanding the politics of AIM practices in section 4.2 of this thesis. To narrow this study to the specific technical definition of generative deep learning in music would have overlooked these findings. Instead, I approach all areas of AIM in my broad definition as parts of a practice.

Developers of AI-centred music technology seldom characterise themselves through an 'AIM' label. Practitioners do not exist in a homogenous group but form a 'community of interest' from other areas of research like computer science, electrical engineering, signal processing, and human-computer interaction. (Marquez-Borbon & Stapleton, 2015: 2). These are visible in academia, where publications and conferences specify the scope and background of their work within the umbrella of AIM described in this thesis. For instance, Music Information Retrieval/Research (MIR) is primarily engaged in the computational processing of 'musically relevant' data through roots in computer science and signal processing, with 'strong links to industry and the burgeoning start-up ecology of music AI' (Born, 2020: 200; see also: Serra *et al*., 2013: 6; Holzapfel *et al.,* 2018: 44). Alternately, New Interfaces for Musical Expression (NIME) examines the use of machine learning as a tool for enabling and exploring audio generation and interaction in computational music systems (Morreale *et al*., 2020: 161; Astrid Bin, 2021: 4; Jourdan & Caramiaux, 2023). These, as with my conceptualisation AIM, are not strict boundaries and the work within them can vary greatly. Examining AIM as a broad church of practice therefore enables engagement with a broad range of practitioners to understand how their actions relate to one another. By also approaching music work as practice, I take inspiration from Prior (2008: 310) who conceptualises divergent musical categories like mainstream and 'bleeding edge' music through the same lens: they can all be observed as typical Bourdieusian practices organised through general struggles for position within the cultural field. Approaching both the construction and use of AIM as practices enables the independent and comparative analysis of both in this study.

1.1.3 The Argument

Through findings gathered using interviews and ethnographic observations within these sites of AIM construction and use, I argue in this thesis that AIM shifts power in the music industry to new agents (AI technologies, developers, and owners) that are shaped in AIM development by the narratives of the wider AI market (AI meta-capital) and competition for specific technical dominance (deep learning capital) within it. The practice is not constructed through objectives and impacts in musical contexts but the accumulation of these forms of AI capital and is therefore a field of technical, rather than musical innovation

I show how this shifting power towards technical innovators necessitates that music workers develop new strategies for maintaining their own agency. These strategies both align with and move beyond the existing frameworks of sociotechnical music careers as workers make sense of their own role alongside the technology and its conditions of creation, regardless of their view of them (e.g., invested; neutral; reluctant; avoidant). The opportunities and risks of technological change are therefore not determined for work such as music creation, but responsibility is placed on individual workers to adapt while power is accumulated within the site of development. Because workers depend on music in a way that developers do not, I argue that this distinction should be acknowledged to ensure the perspective of music-as-work is incorporated into the ongoing development and research of AIM. This enables responsibility to be shared beyond individual workers in music who have borne challenging conditions for maintaining careers through past technological change.

1.2 Thesis Outline

Following this introductory chapter, I review the literature surrounding my topics in **Chapter 2** that both formulates and scrutinises the research questions introduced above, identifying unexplored areas that require primary engagement to resolve. The first part of this chapter begins with a wide view, engaging with discourses surrounding AI development and the perceived need for ethical and responsible approaches. Technical requirements and speed of engineering practices are found to conflict with the open-ended subjectivity of designing and understanding AI in its societal context. Technical research is often, therefore, separated from its context through the pursuit of 'portable' or 'interoperable' AI models, an abstraction that risks unpredictable and unintended impacts when applied to specific contexts. This is also seen in AIM despite its musical specificity; the disciplinary dominance of computer science creates non-representative views of musical context and limits outside disciplines' engagement and understanding of the practice. Approaches that attempt to integrate context through user/human-centred practice in both AI and AIM begin to address these issues but further insulate computer scientists from other disciplines by placing the engineer at the centre of technological affordances. Repeated calls for AI and AIM practices to engage with external disciplines therefore appear in the literature but I argue the reemergence of these calls over years suggests their ineffectiveness. This provides rationale for my first guiding research question: '*How has AIM developed as an emerging practice of technological and musical innovation?',* as I probe into the nature of AI development described in the literature and the gap that emerges regarding why these calls for interdisciplinarity are not answered.

Chapter 2 continues with an exploration of music work as a site of AIM use. It again begins broadly; discourses on the technological future of work at large show that AI work impact is often examined through macro-level workforce redistribution and a replacement or enhancement dichotomy. However, impact can also be examined through subtle changes in workers' experiences at the micro level where AI and other technological innovations in the workplace can bring benefits of efficiency and productivity but also dehumanised working conditions and declining skills. Focusing in on literature surrounding music work and technology, this micro-level view is given rationale as the macro view often sees creative

labour as safer than other sectors, masking specific positive and negative impacts of technological change. Early examples of AIM applications and products in the market are then examined to show how the technology could introduce these impacts for workers. Like the first part, this literature review therefore formulates my second guiding research question: '*How does the emergence of AIM relate to the existing relationships between workers and technology in music creation careers?',* while also providing contextualisation that informs the project in answering it.

Finally, because both questions raised through the literature are concerned with practices (AIM development and use), Chapter 2 investigates theories that can be used to clarify what, how, and why findings within these practices are meaningful. A theoretical framework is developed using Bourdieusian practice theory and concepts from Science and Technology Studies (STS) as both explore how actions/practices are shaped through the conditions of their internal construction and external structure. Furthermore, updated practice approaches that build on Bourdieu's work identify how technologies are integral to practice, which enables the integration of Bourdieu's social practices with STS discourses of *sociotechnical* agency, constructivism, and networks. These theories and concepts are presented as a single framework to analyse and clarify findings from sites of AIM development and use.

In **Chapter 3**, I detail my methodological design for data generation as an *ethnographic approach* to dispersed sites of emergent practices. The project cannot be conducted as a 'traditional' single-site ethnography because it engages two separate groups: AIM developers and music workers, and because the former of these exists across individual, institutional, and commercial contexts, all of which I want to engage with in the study. Qualitative ethnographic methods of participant observation and semi-structured interviews are therefore argued to enable a study of AIM practice from the habituses of its participants in dispersed and disorganised sites. Then, to engage with the speculative, experiential, and contextual data required for my second guiding research question: '*How does the emergence of AIM relate to the existing relationships between workers and technology in music creation careers?'*, research with music workers is argued to benefit from a central focus on semi-structured interviews. These ground-up foundations of practices are argued to follow Bourdieusian and

STS inquiries that the theoretical framework of this thesis is informed by, and are also backed by growing need for and uses of diverse ethnographic approaches to the study of emerging sociotechnical cultures (e.g., Kitchin, 2014: 188-90; Seaver, 2018).

Chapter 4 introduces the findings of the thesis. This chapter is built around my first guiding research question to understand how AIM practice has developed and its resulting propensities. To do this, I construct a typology that identifies the different types of practice in my sample based on the actions, experiences, and perceptions of AIM in the habitus. These 'types' are *technical*, *applied* and *user* approaches to AIM that separate practice into stages of development based on the prioritisation of foundational capacity, practical applications, and functional optimisation of AI in music. These are constructed through individual practitioners' backgrounds and actions, but also shaped by state, industry, and institutional influences on AIM that establish and reproduce forms of AI capital in and beyond the AI field. In answer to my first guiding research question, these conditions are argued to drive technical innovation while de-prioritising contextualisation of innovation in music work, and in music more widely. My findings therefore confirm and build on the reflections of AIM practice in the literature, and despite my findings of divergent 'types' that are distinct from this narrative of isolated technical development, the influences and conditions of practice discussed constrain the impact of these types in the practice through limited power (capital), collaboration, and cumulative development.

To understand how AIM impact is shaped in and beyond development practices, I examine music work as a site of AIM use in **Chapter 5**. This begins with an analysis of how the conditions of AIM practice discussed in Chapter 4 relate to the context that AIM technology is developed for. I argue that developers often consciously or unconsciously perceive music as a hobby, creating a contrast with workers' view of music as a profession that the latter believe is an important distinction that highlights their needs. The second part of Chapter 5 therefore examines sociotechnical needs, actions, and experiences of music workers to inform my second guiding question of existing practices that emergent AIM can be compared against. This investigation builds on previous studies that argue musical career decisions are strategies of maintaining autonomy alongside economic rationale (e.g., Caves, 2003; Banks,

2010; Haynes & Marshall, 2018; Hoedemaekers, 2018), but instead focuses specifically on workers' technology use – decisions that I classify as artistic, aesthetic, economic, or practical.

Chapter 6 continues to present findings for my second guiding research question, showing how AIM relates to the existing context of sociotechnical music work discussed in the findings of the previous chapter. To do this, I examine how workers in the Western recording industry make meaning of AIM both through speculation and past/ongoing experiences of the technology based on their own career needs. Using their existing lenses of technological use, I find that workers pre-emptively and adaptively assess and use AIM as a method of self-preservation in a competitive music market. I argue that workers who adopt emergent technologies early can reap the benefits of AI and its capital discussed in Chapter 4. However, this contributes to the technology's normalisation because other workers perceive a need to follow emerging AIM use to maintain their positions, but do not gain the same benefits. Through this use, most workers perceive a necessity for new negotiations of agency that balance their own agency with that of AIM functions and associations to maintain the autonomy, authorship, and fulfilment in their work – aspects of their practice that drive their participation in the first place.

As the thesis deals with AIM as a practice rather than a fixed technical artefact, in Chapter 6 I also investigate how AIM impact is shaped in development by comparing developers' intended or unintended configurations of the technology alongside their actual uses, its 'projected and actual users and uses' (Wanka & Gallistl, 2018: 5). This chapter therefore draws together data from both groups towards its central research question: *'Why is the emergence of AIM meaningful for music creation as a sector of work in the western recording industry?'*. The responsibility that workers take for AIM uptake and adaptation is argued as a by-product of AIM practice where developers are aware of potential negative consequences of their technologies but attribute these to shortcomings at the site of use, not impacts that can be addressed in technological design. Responsibility for impact is therefore shifted to the site of use where workers accept it as a method of self-preservation in the music

industry. AIM developers and stakeholders are argued to accumulate power within the music industry as a result.

Finally, **Chapter 7** summarises the findings and arguments of these chapters towards the central research question and aim for an understanding of how and why the construction and structures of AIM development and music work practices shape the meaning of emergent AIM in music work. By simultaneously examining AIM development and use through a practice approach, I contribute to theoretical understanding of AI through an expanded Bourdieusian lens, arguing that investment in AI creates new forms of technical capital that developers and users compete for in and beyond the AI field. Through this theoretical approach, I contribute to AIM practice by identifying barriers to interdisciplinary and contextualised development, while explaining the significance of these practices for the understudied context of music work. I argue therefore, that the thesis contributes to the interdisciplinary understanding of AIM in and beyond its practices, demonstrating the value of outside disciplines' views for future collaborative progress. These findings can expand the perspectives of AIM practice towards stated goals of responsible AI, while promoting mutually beneficial goals of AIM technologies for developers and music workers without placing responsibility solely on individual workers to adapt.

Chapter 2 Literature Review

In this chapter, I explore the meaning of AIM for music work through discourses of AIM development and technological work futures. The literature reviewed here contextualises and provides rationale for the research questions above while also introducing the perspective of this thesis through its theoretical framework. In section 2.1, I investigate prevailing approaches to AI design that influence its effect in society through a wide view of AI development, questioning how technological innovation is also an innovation of the actions it is used for. Focus is then narrowed to AIM to find how AI development within this specific context influences the relationship between technological and contextual (in this case, musical) innovation. In both cases I review literature on the motivations and approaches to AI development and how these conditions influence its impact.

I begin section 2.2 with a focus on technological work futures in the context of AI innovation, identifying the perspectives of macro-economic and sociological approaches to inform this project of their value in understanding AIM impact. I then examine music work, its existing sociotechnical working practices and conditions, and how they are constructed alongside technological change. Finally, early applications and perspectives on the use of AIM in this context of sociotechnical music work are explored. The gaps at the intersection of these areas demonstrate how this research project can engage with AIM to understand its meaning for music work in society. To do this, however, I explore in section 2.3 how concepts from Pierre Bourdieu and STS can be used to examine emergent technology through its relevant sociotechnical practices. This enables the study of AIM before the introduction and impact of specific technical artefacts are observable in society through a focus on developers and users, examining their influences on one another and why those impacts exist within their wider practices.

2.1 AIM Background and Practice

In this opening section, I review the literature surrounding AIM, beginning with a general view of AI development before focusing on the specific context of AIM practice. The former of these reveals that the calls for 'ethical' and 'responsible' AI resulting from its societal risks (e.g., biased decision-making) are challenging in engineering practice. The methods of computer science are seldom suitable for examining the complex subjectivities of social context, leading to checkbox objectification of high-level concepts, or the separation of foundational AI work from these contextual questions. Despite approaches that begin to address these challenges through human-centred and user-experience methods, the engineer is placed at the centre of technological design and configuration of users despite ideological differences, leading to solutions that favour their own perspectives. These conditions continue into AIM practice despite its explicit contextual focus, where music and social disciplines are subordinated by the methods of the computer sciences. Although the focus on use-cases and user-experience is increasing through these calls, an understanding of the impact of AIM functionality on existing sociotechnical contexts is argued as limited. These findings are useful in formulating and informing my first guiding research question and highlighting the need for ground-up research on the practices of AIM to answer it:

I. How has AIM developed as an emerging practice of technological and musical innovation?

2.1.1 AI Ethics

As an investigation of why and how the development of AIM is meaningful for music workers, inspiration for this project began with growing calls for 'ethical' and 'responsible' practice in wider AI development from academic (IEEE GIEAIS, 2019), industry (Holstein *et al*., 2019), and state-level (Ada Lovelace Institute *et al.,* 2021; Madiega 2023; OECD, 2023) institutions. Such calls grow from evidence that learning models can reproduce and exacerbate biases; these can result both from real-world inequalities in training datasets and from constraints that engineers introduce through their own actions and ideological approaches (Bolukbasi, 2016; Binns, 2018; Holstein *et al*., 2019; IEEE GIEAIS, 2019: 125;

Bailey & Barley, 2020). However, the efficacy and progress of calls for ethical AI practices have been contested. Top-down institutional responsible practice frameworks, for example are often used as a bureaucratic checklist rather than their intended purpose of prompting meaningful engagement with social impact considerations (Szymanski *et al*., 2020: 3). Sullivan & Reiner (2020) argue that this 'engineering' of ethics confines the complexity of contextual relationships to narrow sub-categories that can be approached as individual problems to be solved in isolation.

This focus on ethics as an engineering problem reduces high-level concepts like 'fairness' to problems that have to be solved, leading to misinterpretations of their meaning in context. Binns (2018: 9) argues that by focusing on empirically 'fair' systems, practitioners have created mathematically equal models without an understanding of why and where equality is needed in context. He argues that excessively general fairness could fail to identify or rectify where and why discrimination can be harmful and harmless in context, solving some problems that are not problematic and overlooking others that are (ibid: 2). If a music recommender model suggests young female artists to young female listeners, for example, such suggestions could be based on preferences like shared experience – increasing the gender parity of suggested artists in such a case would rectify what Binns calls a harmless discrimination between genders. This is a somewhat simplistic example, but it highlights the risks of empirical fairness. Ekstrand *et al*. (2018) summarise this view, arguing that AI can only be designed for positive impact through a *contextual* understanding of individual concepts like 'fairness' as they interact with other sociotechnical impacts and conditions in society: the pursuit of one creates the potential to both improve or impede others.

Without contextual understanding, the risks and benefits of technology can only be identified and engaged after they are experienced by users, as observed by Sullivan & Reiner (2020), who believe AI ethics are used to fix negative impacts as they arise rather than preventing them through contextual evaluation in design. This approach is also observable within the specific context of AIM practice: Spotify advertise job roles that highlight their approach to technological development as 'think it, build it, ship it, tweak it' (Spotify, 2022). Understanding of impact is therefore postponed until the benefits or disadvantages of AI are

felt by users, but there are contrasting arguments surrounding this separation of development and contextualisation.

2.1.1.1 Foundation and Context

AI engineers value abstract models that are independent of social context because they are reusable across multiple contexts: by tailoring a model to a specific social context, its inbuilt assumptions can better reflect the needs and impacts of anticipated applications, but the model surrenders some of its portability between uses (Selbst *et al*., 2019: 61). Instead, abstract models can be applied to context at a later stage where specific scrutiny of the contextual and ethical implications are required to produce trustworthy and effective technology (Aitken, 2023). By separating general development from the complexities of societal context, however, Selbst *et al*. (2019: 62-4) argue that models can become too abstract, falling into the 'portability trap' where they can theoretically be used for multiple functions but are not compatible within specific social contexts because they have unintended impacts on pre-existing behaviours and values of world systems.

The separation of abstract foundations and contextual application can be argued as an enabler of innovation because ethical and contextual factors in technical work slow development (Steen, 2021: 254; see also, e.g.: DSIT, 2023). However, the consequent speed of innovation in machine learning produces a huge volume of model output (Maslej *et al.,* 2023: 32) which itself becomes a barrier to contextual application. According to Mackenzie (2017: 75-80), foundational AI models are never specifically tailored to individual problems or generalisable enough to be 'master' algorithms, the task of identifying and applying this proliferating corpus of models to specific contexts is therefore increasingly difficult and time-consuming. Steen (2021: 258) argues instead for the merits of 'slow innovation', observing how reflexive practices can produce a lower volume of responsible and beneficial technological development. By integrating contextual and foundational work, the causal factors between technology, functions, and impact can be identified, creating more effective and creative technical output (Sekiguchi, & Hori, 2020). These barriers are difficult to overcome, however, because AI (and AIM) practice is reliant on cost-effectiveness and speed of

development to maintain commercial and academic competitiveness (Sturm *et al*., 2019a: 37; Hagendorff & Meding, 2021; Steen, 2021).

Responsibility for aligning with emergent ethical frameworks is therefore frequently placed on individual practitioners because the competitiveness of technological innovation means the bigger picture is seldom an organisation-wide priority; practitioners must therefore lead by example to change approaches from the inside (Rakova *et al.,* 2021: 18; Drage *et al.,* 2024). This problem is exacerbated within the context of music. Huang *et al*. (2023: 45) observe that there has been limited engagement with ethical AI standards in AIM practices because music is seen as an area of 'low risk'. They believe external bodies are therefore less likely to promote specific regulatory and policy frameworks for AIM and practitioners should integrate ethical and social contextualisation within their own work to improve the practice. Because of this individualisation, Drage *et al.* (2024: 8-9) argue that responsibility is passed from one developer to another, with AI models frequently abandoned after conception because there is no clear responsibility for their maintenance. The ethical and contextual scrutiny that is argued to be applied later in the value chain is therefore less likely to be resolved after initial conception by developers. These conditions create systems with no clear structure of responsibility, with Elish (2019) observing how accountability is misattributed to non-expert end-users as the 'moral crumple zone' of AI, and Hohenstein & Jung (2020) observing how users misattribute agency to AI only as a scape goat when sociotechnical actions go awry. However, there are approaches that aim to understand and establish these relationships between users and AI before their impact in society.

2.1.1.2 User Design and AI

As a solution to non-contextualised AI and undue accountability for end-users, human-computer interaction (HCI) and human-centred AI (HCAI) practices offer approaches to integrate social considerations within AI development. HCI, for instance, enables the contextualisation of AI models by anticipating and examining users' interactions with AI functions to improve users' experiences (Veale *et al.,* 2018: 3; Yang *et al.,* 2020: 7). While such user approaches have beginnings in commerce where users' needs are observed to build

more consumable products (Wilkinson & De Angeli, 2014: 616-7), HCI is often used in academic research to contextualise innovations such as the foundational AI discussed above. AI has been identified as a design material within HCI for this reason, but isolated technical models are seen as complex and unpredictable, limiting designers' abilities and necessitating handholding from AI experts to achieve results (Dove *et al.*, 2017; Holmquist *et al*., 2017). This interdisciplinary engagement is limited by AI researchers' use of complex discipline specific jargon with limited commonalities for the workflow of HCI practitioners in later stages of technological design (Nguyen & Mougenot, 2020: 1338; Yang *et al*., 2020: 2-3).

Instead, methods flow in the opposite direction. HCI is increasingly cited in AI research where practitioners borrow its methods, integrating the evaluation of use-cases and users within its development to ensure beneficial outcomes (e.g., Heer, 2019: 1844; Holstein *et al.,* 2019). Holstein *et al.,* (2019: 2) call this 'UX for ML' (user experience for machine learning), where AI developers use methods from HCI such as prototyping to introduce earlier insights of AI impact. There are issues, however, with borrowing concepts and methods from other disciplines as a method of engaging with ethical AI design. HCI methods are often used while overlooking the ideological differences between the designer and the user, creating a 'design saviour complex' where technology is designed to overcome the designer's personal perspective of societal problems (Irani & Silberman, 2016: 5; Keyes *et al*., 2019). This reflects the limitations argued above where computer scientists attempt to 'engineer' ethics in the isolation of individual problems as opposed to the complexity of users' environments.

2.1.1.2.1 Human-Centred and Human-in-the-Loop AI

Shneiderman (2022: 47) argues instead for human-centred AI where users control AI as an essential 'human-in-the-loop' through activation, operation, and overrides, making systems more reliable and trustworthy. This, he (ibid: 21) argues, comes into conflict with rationalist engineering approaches that believe technical systems should operate correctly without human oversight. If this conflict can be overcome through HCAI, the above risks of designers' ideologies overshadowing users' needs is claimed to be addressed through its identification of opportunities for self-efficacy, creativity, and responsibility in AI use (ibid: 57). However, Woolgar (1990: 61) argues that regardless of their design choices, developers

are not simply identifying uses and users for their technical artefacts, they are also 'configuring' users by defining and delimiting what actions are and are not available to them through the parameters they set. Although Shneiderman's HCAI approach is argued to place control in the users' hands, the design of the system still configures the extent and nature of that control. Hess *et al.* (2021) therefore argue that that research and innovation in computer science should integrate experts from other disciplines such as the social sciences and the humanities alongside engagement with users, to enable the mutual identification of problems and solutions.

Calls for 'ethical' and 'responsible' practice in AI have led to a multitude of approaches to technological innovation, whether through high-level ethical concepts such as fairness, transparency, and explainability, the contextual scrutiny of technical foundations, or purposeful design for user interaction and human-in-the-loop AI. What connects these approaches is the central role of AI engineers who attempt to separate the technical, present technical solutions, or borrow solutions from other disciplines to align with these calls. The 'IEEE Ethically Aligned Design' principles acknowledge however, that because some methodologies of social and ethical context are unfamiliar to engineers, research should seek collaboration with practitioners beyond STEM for responsible engineering practices (IEEE GIEAIS, 2017: 45). This project offers an opportunity to examine these identified needs and challenges for ethical AI development in an emergent practice that explicitly states its context. The following section investigates the existing literature on these approaches to development in the specific context of AIM, to understand how the technology is designed for the social context of music.

2.1.2 AIM Practices

As in wider AI development, there are calls for greater emphasis on the ethical, responsible, and contextualised of development in AIM. These calls provide insight into challenges and strengths of the practice and are useful in building a picture of AIM and its meaning for the context of music work. Made at the request of a leading AIM research community (MIR), Georgina Born's (2020) paper on disciplinary and practitioner diversity in MIR provides an

outside perspective of AIM while also demonstrating movements towards wider disciplinary engagement from within. Born argues that despite its intersection with musical subjects, the characterisation of MIR through the methodologies and epistemologies of computer science leads to non-representative views of musical context. MIR, for instance, is often derived from and reflects music in commercially dominant areas that are treated as universal, which 'de-pluralizes' the real-world complexities of music (ibid: 195). She expands that these conditions also limit the involvement of non-STEM researchers because the disciplinary landscape of AIM practice is impenetrable for those without technical skills, limiting the ability for outside expertise on the socio-musical context of AIM to be introduced. In response, Born suggests that to enhance design and practice, MIR should establish a parity of disciplinary approaches within the practice using an 'agnostic interdisciplinarity' rather than the current overemphasis on a dominant discipline to the detriment of other 'subordinate' social and cultural disciplinary ideas (ibid: 200).

Born's view of subordinated disciplines could be argued as a self-preserving polemic as she believes her own disciplines (musicology and sociology) are subordinated by the growing involvement of computer science in her musical domains. Within AIM research, however, the role of the social researcher within sociotechnical practices is indeed diminished; Morreale (2021: 109) argues that discipline epistemologies should be 'extended' by AIM researchers who should, for instance, train in the humanities to 'appoint themselves as regulators' of ethical and sociocultural impact. Placing accountability in one's own hands like this – the hands of the most invested internal stakeholders – enables the control and dominance of STEM actors that Born warns against. Agres *et al*. (2016: 26) are more specific in their calls, asserting that the integration of basic sociological methods like questionnaires to gather data from outside the practice is akin to objective external evaluation. Voices within AIM are, however, beginning to acknowledge the drawbacks of these internalised extra-technical approaches. Sociological methods and perspectives are argued to be cited as a box-ticking exercise that doesn't enable musical contextualisation, instead aligning developers with wider movements for ethical practice in AI while maintaining cost effectiveness and fast-paced publishing (Holzapfel *et al*., 2018; Astrid Bin, 2021).

These limitations of using extra-technical methods as subordinate means to the ends of the dominant computer science discipline have therefore led to the repetition of Born's argument: engagement with sociological methods and users is needed for 'a new kind of music studies' that critiques the development and use of AI in music (Sturm *et al*., 2024; see also: Porcaro *et al*., 2021; Huang *et al*., 2023: 47). These repeated calls highlight the limitation of current AIM practices where broader disciplinary engagement is continually identified as a practice-wide need that should be acted on in the future. But if this need is continually identified, is it being acted upon at all? Morreale (2021) thinks not, claiming that despite engagement with disciplinary issues in AIM, reflective commentaries are seldom connected to research and output. He expands that issues in the practice have been raised and approaches for improvement are identified but are seldom practically integrated within ongoing practices. For this reason, the first research question of this thesis can inform this debate beyond the macro-level disciplinary challenges of AIM to find how these conditions of practice that shape development are constructed at the micro level, and why increasing calls for interdisciplinary are seldom answered.

2.1.2.1 Understanding AIM Impact

Holzapfel *et al*. (2018) present a response to the above questions through their analysis of the 'value chain' of AIM. They identify that scientific researchers are often remote from the contextual location of their technologies because there is little communication between stages of the AIM value chain – a lifespan that begins with foundational technical research, development, design, and ends with end-users of technology (ibid: 49). This does highlight a limiting factor on the impact of calls for interdisciplinary and extra-technical engagement within practical settings discussed above, but the causes and implications of this value chain remain unclear. The authors argue that foundational technical researchers are remote from users because product developers do not provide them with feedback, but other AIM authors argue that researchers purposefully avoid this data from outside their own stage of the value chain. Bob Sturm, for example, is a central figure whose technological development – particularly through a folk music generator Folk-RNN – led to his own revaluation of the ethical questions raised by computer science practices that benefit from musical cultures

(Sturm *et al.,* 2019b; Huang *et al*., 2021: 306). Sturm *et al*. (2019a: 37) believe that engineers intentionally create a gap between technical innovation and contextual applications by relying on 'cleanly labelled' data in test conditions; the 'messiness' of data from real-world contexts that bring together the theoretical and the practical is avoided because it increases the cost and difficulty of engineering practice. This can be seen where developers such as Jordanous (2012: 321) claim that standardised testing of artefacts can enable technical progress 'without being too hampered by wider questions' that arise from the complexities of real-world contexts; the wider questions introduced by ethical or reflexive disciplinary ideas from social and artistic perspectives are in conflict with the need for fast turnarounds in scientific contexts (Caramiaux & Donnarumma, 2021: 93).

2.1.2.1.1 Subjective Topics, Objective Approaches, and Bias

In a second joint article, Sturm *et al.* (2019b) expand that attempts to isolate AIM from context result from the perceived need for objective empirical outputs within the engineering praxis of AIM. This separation of objective 'hard' science from 'soft' science is a common method of establishing authority that Gieryn (1999) calls 'boundary work' and can be seen to shape the disciplinary dominance of the computer sciences discussed above. One of the communities of interest that exist within the umbrella of AIM, for instance, is computational creativity: a practice that Agres *et al*. (2016) argue should pursue AIM technologies that create music through objective means because it is 'scientifically aligned'. Arguments for objective AIM outputs do extend beyond simple disciplinary allegiances, as Loughran & O'Neill (2017) argue subjective human evaluation of AIM limits machine creativity by conforming to human standards and norms. However, by pursuing ideologically neutral practice Morreale *et al*. (2020) observe that the NIME community's lack of engagement with social and political context has caused the proliferation of practitioners' own unchallenged ideologies. The authors warn that if left unspoken, this political trajectory will limit scrutiny of the practice, its technology, and its impact. They argue, for example, that a commonly stated objective of practice is for technological output to enable greater accessibility to music creation; however, by isolating development from context, researchers cannot explain how technology can overcome existing socioeconomic reasons for music inaccessibility (see also:

Harkins & Prior, 2022: 85). Even at a basic level of perception, Beck & Bishop (2018: 237-8) find that similar 20th century projects claiming to enable music creation through technology were devalued because of anti-ideological paradigms of technological research where resulting output was seen as the epitome of 'uncool', 'corporate' art.

Both theoretical (Banerji, 2018) and empirical (Gioti, 2021b) investigations of objectivity in AI creativity have therefore found that the pursuit of empirical output amplifies engineers' own interpretations, ideologies, and biases surrounding music, conforming and reproducing the human standards that Loughran & O'Neill warn against. However, it is not only ideological objectivity that exacerbates AIM practitioners' biases. Pardue and Astrid Bin (2022), for example, observe how biases are reproduced explicitly in commercial AIM because of the low value of AIM labour compared to larger AI markets like Fintech; this, they argue, means that AIM practice attracts music enthusiasts who work in the area because they have a personal interest in music. In contrast to a perception of objectivity, workers' interest also therefore limits engagement with social context and impact because the developers believe they 'know' their product and users, context is not critically examined because of the developer's envisaged expertise. This causes a proliferation of music technology based on the biases of technologists' needs, cultures, and beliefs of what music should be rather than the users' (ibid: 8-9).

2.1.2.1.2 Integrating Uses, Users, and Their Subjective Needs

AIM practices are therefore rarely engaged with work that can demonstrate what the contextual conditions for their technology's use are, and how their technology can benefit or impair them (McPherson *et al.,* 2019: 207; Morreale *et al*., 2020: 162). Sturm *et al*. (2019a: 52-3) consequently propose that context should be integrated within practice through user interaction that contextualises technology with music users' needs, arguing that failures to link technologies to their originating problem domain can trivialise the traditions of the music cultures that AIM practice benefits from. Unlike the limited impact of calls for agnostic interdisciplinarity discussed above, this integration of use-cases as a method of demonstrating the purpose of technological advancements in end-use contexts is increasing in AIM (Ianigro & Bown, 2019). However, as with movements for ethical AI practice discussed at the top of

section 2.1, this is driven from the top-down by institutions. Micchi *et al*. (2021: 265) observe how in a flagship AIM competition: the 'AI Song Contest,' the measures of success are shifting from autonomous creative computing capacity to AI use-cases that enable co-creativity with human users. The focus on use-cases therefore reflects the check-list approach to ideas from subordinate disciplines discussed in the previous section (e.g., Holzapfel *et al*., 2018; Born, 2020; Astrid Bin, 2021). The following section examines how these use-cases are employed as a method of contextualising AIM practice.

2.1.2.2 AIM Use-Cases

Despite the increasing focus on AIM uses, there is a body of research that presents technical systems capable of generating musical material with no mention of use-cases (Dong *et al*., 2018; Zhu *et al*., 2018; Bodily & Ventura, 2022; Vatolkin & McKay, 2022). However, as these examples do claim that they can generate music without mention of a user, it can be assumed that their aim is to automate music creation. This assumption does not, however, help to understand the intentions, design, or impact of this use. To build an understanding of such research, investigation is necessary into the practices behind these publications; however, the need for clearer view on design extends beyond these apparently isolated engineering research presentations.

Similar issues with understanding technological impact arise where use-cases are identified conceptually but are not integrated within research actions, providing no tangible examples of their practical use (Bown, 2021: 17). 'Jukebox' is presented as a model that generates entire multi-instrument (including vocals) musical extracts as raw audio that authors 'would like… to be a useful tool for both professional musicians and music enthusiasts' (Dhariwal *et al*., 2020: 7). Despite statements regarding the technical possibility for some model parameters to be 'optionally influenced' by users, these use-cases are not explored in the research. 'Jukebox' is therefore an example of autonomous music generation that demonstrates the potential of AI but provides no evidence for its claimed use-case as a tool within human composition (Briot, 2020; Deruty *et al*., 2022: 45). The token attribution of use-cases is observable in several projects with similar claims towards AI-as-tool (Yang *et al,* 2017;

Madaghiele *et al*., 2021). Furthermore, some use-cases obscure research objectives when methodologies conflict with the claims of authors. In 'How Music AI is Useful', Ben-Tal *et al*. (2020) research use-cases through engagement using interactive websites and co-creation between their model and professional musicians. Through these methods, the authors argue that their AIM systems can be used as composition tools through variable parameters and editing of generated excerpts towards output that is authentic to genres. However, the value and usefulness of these use-cases is unknown because when engaging a topic like: 'How music AI is Useful', conclusions like 'compositionally useful' are superficial (Ben-Tal *et al*., 2020: 10).

Direct associations with use-cases can, however, provide an understanding of functionality in context (Banerji, 2018: 62). This is most visible where AIM research has adopted approaches of user design through methods from the field of Human-Computer Interaction (HCI) (e.g., Fiebrink & Caramiaux, 2018; Scurto & Bevilacqua, 2018). Hunt *et al.* (2020) and Deruty *et al*. (2022) present user-focused projects that focus on skilled composers by designing interactive environments to integrate generative music within existing digital audio workstation formats that are in common use. The functionality of these systems provides users with access to expanded digital music tools within existing practices, demonstrating how AI could be integrated without extra skills, equipment, or adaptation from the user. Banerji (2018: 62) argues that functionality therefore improves the fit between humans and machines, however, he believes it is also essential to expand beyond this view to understand the socio-cultural impact of systems' functions on humanity, sociality and the sociotechnical network beyond technical and practical agendas. I provide this look beyond the direct impact of these individual functions in this thesis, using examples of intended use-cases instead to examine AIM practitioners' approaches to development and music workers' sense-making of AIM more broadly. To inform the latter, in section 2.2 I review literature that engages with technological work futures and the perspectives on music work that this provides.

2.2 Technology and Music Work

If the meaning of AIM for music is to be examined through the practices of its development and use, a user is needed. I focus on music creation workers – any person engaged in paid work to create musical products as a career. Although AIM is rarely described as a workplace technology in the literature of AIM development above, it does align as such. David Autor, for example, claims that 'broadly speaking, many—perhaps most—workplace technologies are designed to save labor' (Autor, 2015: 5), reflecting the beneficial impacts that AIM researchers envisage such as increased creative productivity and efficiencies for time-consuming and monotonous musical tasks (e.g., De Man *et al*., 2017; Fiebrink & Caramiaux, 2018; Ianigro & Bown, 2019). To find how AIM affects the work and workers of music, I therefore examine AIM as a workplace technology. I begin by reviewing literature on the impact of technological change on workforces, finding that although AI work impact is often examined through macro-level workforce redistribution and a replacement/enhancement dichotomy, impact can also be examined through subtle changes in workers' experiences at the micro level. I then examine existing sociotechnical relationships in music work, questioning how and why workers adapt to technologies in practice. This, in addition to the early applications and discourses surrounding AIM in music work provide rationale and contextualisation for the second guiding research question of this project:

> *II. How does the emergence of AIM relate to the existing relationships between workers and technology in music creation careers?*

2.2.1 Technological Work Futures

The impact of technological change on the future of work is a recurring topic of debate through inventions and innovations that promise to transform society. Bastani (2020: 31-7) observes that technology has driven disruptions of agriculture, industry, and information, impacting labour since the neolithic revolution and getting ever more rapid in its effects. The discourse surrounding the relationship of work and technology generally focuses on the security or insecurity of human work through innovation; arguments for and against security

are rooted in the understanding that technological applications can either compliment or substitute human workers (Gibbs, 2017; Susskind, 2020; Bearson *et al*., 2021). By complimenting and substituting work, technology theoretically increases productivity (else it would not be adopted), however, the latter does so by displacing workforces, creating potential risk for work security (Brynjolfsson & McAfee, 2014). This section highlights the downfalls of macroeconomic perspectives of technological change, and how a sociological approach can lead to a more detailed understanding of technological impact on workers' experiences.

2.2.1.1 A Macroeconomic Outlook

Autor (2015) argues that regardless of whether technology compliments or substitutes human workers, there is an observable macroeconomic case that work security will remain. He continues that that the productivity brought by 'complimenting' technology increases sectors' labour demand, and 'substituting' technology increases overall market demand. This productivity in addition to elasticity of labour (workers moving between sectors based on work availability) consequently counteracts the displacement of work caused by substitution in existing markets (Autor, 2015; Acemoglu & Restrepo, 2018; PwC, 2018; Szczepański, 2019). Acemoglu & Restrepo (2018: 6-8) contend that this 'productivity effect' does not guarantee total work security as labour demand cannot always be proportional to productivity increases. Furthermore, capital accumulation must drive labour demand alongside new work creation; an imbalance of these factors such as the singular pursuit of capital accumulation through efficiency could lead to a diminishment of productivity (Acemoglu & Restrepo, 2018; Holford, 2019).

These predictions of economic balance are based upon observations of historical change within a framework where AI and robotics are the fourth instalment of industrial revolution following steam power, electricity, and the internet (Schwab, 2016). However, Peters (2020) argues that the approach to technological innovations as a progression through previous 'revolutions' of change incorrectly treat technologies as linear, inevitable developments. He believes that this causes a passive attitude to technological development where work security

relies on education and emerging markets being stretched to fix perpetually emerging social issues (ibid: 486; see also, e.g.: Mokyr *et al.,* 2015; Ra *et al.*, 2019). Furthermore, the linear view of these revolutions leads to an aspirational view of industry 4.0, where Neumann *et al.* (2021) argue technology is deliberately driven towards industrialisation during innovation as a capitalist strategy. This leads to underexamined human factors of technology in favour of operational efficacy and extended physical possibilities in the workplace (Kadir *et al*., 2019: 29).

Although these macro frameworks present consequences of technological work scenarios, they are as unreliable as the future: even the authors of quantitative impact predictions argue that their figures 'should be interpreted with appropriate caution' (PwC, 2021: 5). Frey & Osbourne's (2017) quantitative approach to analysis predicts that 47% of jobs are at risk of automation; the same method has also led to estimations of 57% in OECD countries (Frey & Rahbari, 2016: 3). Other approaches through task subdivisions such as in Gregory & Zierahn (2016), demonstrate that only 9% of work is at risk. The pursuit of both qualitative and quantitative macroeconomic predictions consequently presents unpredictability, especially when dealing with longer-term technological change because 'the susceptibility of a given occupation is not a fixed quantity' (Kim *et al*., 2017: 3). This results from the stubborn space between the present and future, but also a focus on *if* technology replaces work rather than *how* and *why* it could *change* it. These macro-level arguments take a deterministic stance on the impact of technology on work; in treating technologies as inevitable through the lens of historic impact, the debate surrounding this explorative work is reactionary. 'Technological unemployment' in these cases is treated solely as an effect of market readjustment that happens *after* technological change (Keynes, 1930: 3; Leontief, 1983).

2.2.1.2 A Sociological Outlook

Whether positive, negative, or neutral, deterministic approaches treat technological change as inflexible in its design. For this reason, a rejection of determinism facilitates an understanding of work impact as sociotechnical. Salento (2018) describes technological impact on work as a set of decisions affecting the conception, design, policy and use of

technology in the workplace. Each stage of decision-making is affected by the others, creating a structure where the stages of decisions before integration to society can be studied to understand how they impact the choices available to workplaces and labourers. Understanding innovation as sociotechnical in this way allows analyses to move beyond macro movements, and towards an evaluation of the inequalities of impact at the micro and meso level (Salento, 2018).

The decisions that drive technological work impact are seldom apolitical. Spencer (2017) argues that political driving forces of technology require a greater focus as technological decision-making in innovation is often dependant on the interests of capital power. Therefore, the pursuit of surplus value through automation of processes could exacerbate the exploitation of workers by increasing the number of jobs while widening inequality of income, working conditions, and skills (see also: O'Neill, 2016: 603). He argues that the value of this political-economic perspective is not in its understanding of social adjustment, but the reasons for the conditions that require those adjustments beyond the technical. Kalluri (2020) similarly argues that technical-centric discussions display AI as neutral, only biased by unfair societal data. However, this indifference serves to shore up positions of the powerful as technologies are often developed and harnessed by capital, not labour (Spencer, 2017: 145; Kalluri, 2020). For this reason, Kalluri argues that we should not ask if AI is good, but how it shifts power within society.

This view is expanded by Boyd & Holton (2018), who argue that political-economic perspectives can be useful within a wider sociological examination to build a picture of sociotechnical construction through its power, motivations, design, application, use, and effect. The complexities of this environment are therefore visible through the actions and interactions of human actors who are common denominators of sociotechnical construction and practice, rather than passive experiencers of deterministic technological change (Boyd & Holton, 2018; Leonard & Tyers, 2021). The integration of economic, political, and social considerations to these early stages of sociotechnical construction can inform, prepare, and reduce what Keynes (1930) calls the 'phase of maladjustment', where negative consequences of technological change result from implementation without an understanding of or

preparation for social impacts and needs. Regardless of positive, negative, or neutral predictions of technological impact on work, the critical evaluations of these social impacts before implementation 'do not simply sit above technological innovation and diffusion but help to constitute and direct or re-direct change itself' (Boyd & Holton, 2018: 341). To understand the future of music work through technology, such a sociological perspective will therefore be developed in this project's theoretical framework and methodology.

2.2.1.3 The Creativity Fallacy

Creative labour is often argued as 'safe' through technological change (Vermeulen *et al.,* 2020; Ashton, 2022). This stems from arguments that machines are better placed to automate predictable and routine processes than unpredictable or subjectively assessed tasks (Autor, 2015; Frey & Osbourne, 2017; Gibbs, 2017; European Parliament, 2019; Vermeulen *et al*., 2020). But this belief continues despite innovations in generative capacity of AI. Large language models like ChatGPT, for instance, have expanded the applicability of AI beyond routine work, but Gymrek *et al*. (2023: 36) argue that this shifts impacts towards higher-skilled cognitive processes like legal and economic services rather than creative roles. And this distinction between creative and non-creative work is also drawn in AIM development where AI is only seen a risk to 'functional' music markets because machines cannot replace the human creativity in 'artistic' markets (Silverstein, 2019).

These discussions of creative work safety are a fallacy for a few reasons. Firstly, all these views of AI impact use historical and current capabilities of technology as their lenses for investigation and fail 'to concede that future systems may be radically more powerful than those of today' (Susskind & Susskind, 2015: 44). This can be seen where Autor (2015: 26) says machine learning can expand the ability to automate beyond routine jobs but rebuffs further investigation due to the current technology's issues of inconsistent accuracy and success – assuming these inconsistencies will never be overcome based on current capability. These assumptions of work safety based on current technological capacity are therefore flawed because technology and its contextual conditions constantly shift, meaning 'the susceptibility of a given occupation is not a fixed quantity' (Kim *et al*., 2017: 3). Creative

work safety is a fallacy in this instance because it does not account for ongoing technological change.

Secondly, because such assumptions are grounded in the current capacity of technical artefacts rather than a view of technology as dynamic and changing, it overlooks the social in the sociotechnical. I therefore also label the creative work safety the creativity fallacy because claims are made with little contextualisation of the conditions and needs of creative work beyond the technological capacity to perform its individual tasks. Gandini (2016), for example, argues that the fetishism of human creativity has led to a myth that technology will free workers to utilise skills that machines cannot possess in newly creative jobs (see also: Pasparakis *et al*., 2021). He shows, however, that this ignores the socio-economic divides in education and growth opportunities that allow workers to develop creative skills in the first place, enforcing a separation of workers with the privilege of education, training, and thus broader skill sets rather than democratising creative work. For this reason, skills gaps cannot simply close out of necessity for work because those skills may be unattainable for many (Susskind, 2020: 164-66).

The argument that creative jobs are 'safe' through technological change therefore deprioritises the consideration of music work futures, and the relative 'safety' of creative work from automation does not exempt its workers from other impacts of technological change. Ashton (2022: 104-6), for instance, argues that discourses of 'complimenting' AI in creative work are dominated by imaginaries of endless enhancements, a view that suggests if creative workers are not replaced, they can only be positively affected. However, Ashton continues that AI can also introduce repetition and boredom to practices; he believes the simplified grand narrative of safe workers who are enhanced to use their creative skills should be avoided in favour of a granular approach. He concludes that the impact of AI exists within an assemblage of processes, practices, possibilities, and precarities in music work, and should not be classified as unanimously safe or unsafe (see also: Krafft *et al*., 2020: 6).

2.2.1.3.1 Leveraging Creativity Fetishism in Music

The importance of creative workplace assemblages in understanding the complexity of technological impact can be seen through narratives of 'immersion', a social factor of creative work that impacts technological use. The fetishism of creativity is often used to control workers' actions, conflating the creative person with their work through psychological concepts like 'flow', which are used to present work as an immersive expression of a worker's intent (Banks, 2014: 242-5). This narrative of immersive creative practice fetishises long stretches of high-intensity work as a demonstration of workers' embodiment of creativity. However, these discourses surrounding creative work create unrealistic targets that impose poor working conditions outside of regular capitalist structures to deliver productivity benefits for employers and platforms (Banks, 2014: 255-6). In music, new or trending technologies are used to provide a similar controlling influence on workers as they require immersion to use and are marketed as 'an essential tool for creativity' by aligning them with existing social norms and expectations in work; the resulting 'aesthetic experience', however, establishes technology as essential while keeping workers in routine and suboptimal conditions because closeness to the technology is used as a proxy for cultural legitimacy (Siciliano, 2016: 692; 2022; O'Grady, 2023: 142-5). This demonstrates how social conditions within the assemblage of music work effect technological impact – to understand the impact that AIM has on music work it should therefore be contextualised within such assemblages.

2.2.2 Music is Work

The impact of technology on working conditions in music is often overlooked in relation to other sectors. This is observable through the lens of the gig economy – of which the music industry is a namesake (Haynes & Marshall, 2018: 461) – where non-fixed, part-time, and zero-hour work is growing across sectors. As the gig-worker model has grown, research has identified a need for new understandings and protections for gig workers (Friedman, 2014; Gandini, 2016; Bearson *et al.,* 2021) because they often face insufficient legal and moral labour standards (De Stefano, 2015; Irani & Silberman, 2016; Kirman *et al*., 2022). Beyond the relation of new *gig* work and the musical *gig*, recurring experiences of precarious, informal, and discontinuous work in the music industry are also seen to have foreshadowed

this working landscape (Hoedemaekers, 2018: 1349; Hesmondhalgh, 2019: 112). Murgia & de Heusch (2020: 212) argue, however, that there is a lack of representation for music workers in comparison to wider gig work because artists enjoy and are emotionally invested in their work and therefore maintain their positions despite poor working conditions (see also: Stahl, 2013: 93; Speers, 2016: 67; Watson, 2016: 13).

2.2.2.1 'Normal' Work?

This self-motivation distinguishes music from the gig economy and wider lenses of work. Autor (2015: 17), for example, observes that incomes must rise over time to retain workers in organisations and sectors, a rule that is broken in music through self-motivation: during the platformisation of music consumption the volume of musical creators and output has increased while incomes have reduced (Morreale, 2021). Although music practice is therefore difficult to define through these lenses of work, music workers who remain in the sector are still subject to normal everyday working conditions, as argued by Stahl in his examination of the politics of recording artists' work:

> 'despite the impossibility of assigning them, finally, to any one category, they remain subject to the superior market power of the monopsonistic league of buyers of their services and products… even at the height of their power, they remain subject to the still more powerful multinational conglomerates' (Stahl, 2013: 231).

Stahl's observation of artists' needs to compete for consumers' attention reflects the conditions where supply is increasing while incomes fall. Music work is therefore not valued by the labour hours provided by this growing supply, but by the creativity and aesthetics of musical products and artists' projection of these products in the context of their own social and cultural capital (ibid: 93; Gibson, 2003). From this perspective, the worker's status as amateur or professional is insignificant as long as their output (music creation) is externally perceived to be culturally valuable, itself contributing to inconsistency in classifying musicians or artists as workers (Gibson, 2003: 202). Cohen (2012: 150) expands that value is extracted from music work through a 'cultural struggle' where value is not concerned with how works are created, but how they can be exploited in culture after creation through

promotion. The need to exploit music work through these 'cultural struggles' hands power to both the consumer and to organisations with influence over the dissemination of cultural products as argued by Stahl. This builds on the earlier discussion of Kalluri's (2020) argument for an examination of how AI shifts power rather than how it is used. AI-powered technologies such as streaming services and social media have enabled some individual successes in the context of cultural struggles as artists can distribute and promote themselves directly to consumers; however, power has shifted from artistic management and promotion organisations to the conglomerates that own these technologies (Negus, 2019) – more on this later (section 2.2.2.2).

2.2.2.1.1 The 'Normal' Aspects of Music Work

Caves (2003: 73) calls these areas of artistic work beyond creation itself 'humdrum inputs': although motivation for professional creative work derives from personal investment in artistic input, workers must also 'respond to ordinary economic incentives'. Workers' options are not determined by these incentives but deviation from them results in reduced circulation of work to consumers and thus reduced opportunity for success in careers (ibid; Becker, 2008[1982]: 33). This creates an art-commerce relation in music work between economic (humdrum) needs and artistic action (Caves, 2003; Gibson, 2003; Banks, 2010; Hagen, 2022). Banks (2010: 255) observes how the industrialisation of cultural production that responds to economic rather than aesthetic judgement is often seen as an elimination of artistic autonomy, so workers find varied and negotiated methods of exercising their autonomy through a focus on their craft alongside these economic needs in practice, *balancing* the artistic and commercial (ibid: 259; Hoedemaekers, 2018). These socioeconomic conditions of music work can therefore provide insight into the use and impact of technology on musical labour.

2.2.2.2 Technology and Music Work

Hennion (1983: 160; 1989) observes that in the 20th century, roles between the production and consumption of music were occupied by multiple workers with specialisms in music creation, marketing, and technical production, partially separating artistic and commercial

action (see also: Becker 2008[1982]: 9). In the 21st century, however, music work has transitioned away from these networks of specialists to individuals who take on multiple roles by adapting to rapidly changing environments through general creative and mundane meta-competencies, enabling them to take advantage of emerging revenue streams (McRobbie, 2002; 2011; 2016; Lingo & Tepper, 2013: 340-1; Purves & Himonides, 2021). The previous section argued that music workers *participate* through self-motivation and emotional investment despite poor conditions. It is this division of a worker's labour between multiple roles, however, that allows them to *succeed* despite these poor conditions: although workers enter and remain in music through 'an inner desire for rewarding work', their desires are 're-translated into a set of techniques for conducting oneself in the uncertain world of creative labour' (McRobbie, 2016: 37; see also: Lingo & Tepper, 2013: 351; Haynes & Marshall, 2018). The fetishisation of creative work as secure discussed in section 2.2.1.3 is therefore shaped by this labour elasticity to remain in work rather than an imperviousness to technological change, and technological change itself shapes the need for such elasticity as argued below.

2.2.2.2.1 Technological Roles & Revenue Streams

Elasticity shapes the conditions of work but is also shaped by them. Haynes & Marshall (2018) argue that music workers don't always gladly undertake generalist positions, they are instead 'reluctant entrepreneurs' who are forced to develop generalist skills within changing markets to succeed because they receive little capital and infrastructural support or reform. It is therefore not just emergent revenue streams that workers expand towards, they also move into existing markets such as advertisement that were once eschewed as 'selling out' but are now widely accepted and utilised (Klein *et al*., 2017). Technological change accelerates these conditions. Thomson (2013) argues that technological advancements have affected creative music workers in the recording industry through cost reductions that enable greater control of music production and audience engagement for individual and independent actors. But the effects of technology are rarely isolated. The opportunities of independent production, publication and engagement described by Thomson also increases the supply of music, reducing its value within the market and reducing workers' income from the revenue stream

– continuing the trend of reduced income through higher volumes of workers discussed in the previous section (ibid; see also: Hesmondhalgh, 2019). This makes an entrepreneurial approach to multiple revenue streams a pre-requisite for music workers as technology enables them to undertake more roles, but also creates a reliance on those additional roles for financial security in an increasingly competitive market (Thomson, 2013; Haynes & Marshall, 2018).

2.2.2.2.2 Music Surplus

The influence of technology on the surplus of musical supply is a historical continuation. Menger (1999) argues that any employment gains resulting from technological change in the arts are paradoxical because *employment* and *underemployment* grow simultaneously in the industry. This is because there is longstanding oversupply in the arts where 'existing practitioners are trapped in a disintegrating market while new aspirants continue to flood in' (Menger, 1999: 567; see also: Hirsch, 1972). This oversupply issue is one of the most prolific obstacles of the digital revolution in the music industry where subscription-based digital distribution has catalysed music 'surplus', creating a 'long tail' of artists without advertisement or pre-existing popularity who are underrepresented and get lost in the mix (Coelho & Mendes, 2019; Negus, 2019; Hesmondhalgh, 2021: 3606; Morreale, 2021; Porcaro, 2021). It is for this reason that streaming services use recommendation algorithms to increase artists' visibility to relevant audiences, however, evidence against their efficacy is mounting: 20% of all music on such platforms has never been listened to once (Eriksson *et al*., 2019: 98). Drott (2020) argues that these conditions enable underhanded exploitation of the market that in turn drives surplus. A market for 'faking attention' for instance has emerged where listening bots and fake accounts synthetically generate streaming numbers to bias recommendation algorithms to favour certain songs. This both reduces the pool of rightsholder money distributed to artists and increases the difficulty of being noticed within platforms without technical support, necessitating entrepreneurial approaches to work (ibid). Technological change therefore contributes to growing surplus that shapes workers' needs in practice.

There are musical roles that have remained largely untouched by technological innovations. Orchestral and operatic musicians, for instance, often sustain their careers by prioritising the 'mastery' of instruments that are specific to traditions (Bijsterveld & Schulp: 654-5). However, markets such as these are often limited and insulated by state subsidies that are in place to preserve those cultural traditions, and therefore do not change with technology because they are institutionally expected to reflect a particular history and heritage (ibid). Beyond these traditions, music is a free market where responsibility to adapt to technological change is imposed on individual workers through the shaping influence of the creative fallacy and increasing surplus of supply: it is self-imposed through a shift to professional and entrepreneurial personas where self-exploitation has become a common method of competition within hyper-competitive markets (Menger, 1999; Born & Devine, 2015: 145; Portman-Smith & Harwood, 2015; Hracs, 2016: 42-3; Watson, 2016; Hoedemaekers, 2018: 1368; Purves & Himonides, 2021: 218). Thomson (2013: 522) argues that musical virtuosity has therefore become an outdated measure of success in the music industry where entrepreneurs who master the exploitation of multiple creative and non-creative revenue streams gain precedence over traditionally virtuosic musicians. The following section examines in greater detail how technological change shapes these conditions through a case study of the claim that the digitalisation of music has democratised the industry.

2.2.2.3 The Democratisation Fallacy

Digital innovations influence music workers' approaches to entrepreneurial and precarious work. However, AI and digital technologies are often praised for their democratising effect on access to the information and skills usually controlled by gatekeepers (Susskind & Susskind, 2015: 110; Louie *et al*., 2020). This is observable in the music industry both from the access consumers have to music, and the access creators have to music making and distribution tools (Hesmondhalgh, 2019; Hagen, 2022). However, workers' conditions and visibility in the industry reveals a contrary argument to the influence of technological innovation on power and control surrounding music work. Gandini (2016) observes an increasing focus on reputation economy through market digitalisation that has long been present in art worlds, where reputation directly affects the value of products (see also:

Becker, 2008[1982]: 23). However, the proliferation of access to art products through digitalisation has prioritised their use-value, shifting control of artistic value away from the creator (or dominant movers of creation: record companies) to curators such as streaming services and their algorithms (Negus, 2019: 371; Webster, 2019). Pratt (2016: 208) observes that these conditions are constructed purposefully because consumption technologies are designed and adapted to make use of existing copyright laws – technology is designed for and driven by the interests of capital power, not labour (Spencer, 2017: 145).

Beyond value control, the turbulence of the music industry in transition between physical, downloadable, and streamed formats presents an appearance of technology that democratises control over work. Hracs (2012) argues that the shock to the market caused by the 'mp3 crisis' led to diminished power of large record labels as production and distribution was democratised from traditional gatekeepers to a larger number of smaller and independent actors. This redistribution of power results from lower barriers of entry into the market; however, once independent actors break into the industry their power is limited and they often have to work longer hours for less income (Hracs, 2012). Furthermore, they are highly unlikely to ever match the success of larger cultural companies who dominate the industry through advertising, partnerships, and legal agreements (Prior, 2010).

Following the digitisation of musical formats and access-based models of music streaming, data has become a valuable tool for music workers. Hagen (2022) argues that the focus on data within AI-driven marketplaces has not, however, democratised music work as the number of gatekeepers has increased rather than reduced – both data and the data controllers now hold power over data-dependant music workers, in addition to traditional music industry bodies like record labels and publishers. Despite shortcomings at the micro-level, she argues that the introduction of data-based gatekeepers has increased employment in the industry overall; these growing numbers of jobs diversifies from traditional soft skills such as A&R, marketing, and artist management, including new engineering jobs like data science and software development. However, this has served to strengthen existing hierarchies in music work, centralising the control of data access through its commodification as a tool, creating inequality for those without access including smaller actors who were able to enter the

market through 'democratising' technology (Hagen, 2022). Harkins & Prior (2022: 98) argue that technology cannot democratise for this reason: they are tied in with the social constraints of their context and cannot be reduced to the affordability and accessibility of entering the market. The democratisation fallacy that developers discuss is therefore the democratisation of technological artefacts rather than the democratisation of professional music practices.

The complexities of technological impact even after its introduction to society highlight a drawback of a deterministic approach, which Hesmondhalgh (2019) claims must be acknowledged while maintaining an understanding of the real consequences of technological developments. He argues that democratisation in media is often regarded as basic access to media products; the determinist claim that technology will democratise music is tangible through the access it provides to consumption or production. For Hesmondhalgh, optimistic arguments have had a performative role in hastening technological development and adoption as an inevitable and desirable change, while neglecting to acknowledge non-determinist views (see also: Neumann *et al*., 2021: 1). The abundance of access to products and mobility are tangible in music through surplus content and labour elasticity; however, these effects can also diminish worker conditions and control. If the definition of democratisation extends beyond access and towards the improvement of equality and control, fast-paced technological developments such as AIM may have negative consequences for individual workers and cultural decision-making (Hesmondhalgh, 2019; Kalonaris *et al.,* 2019).

The impact of digitalisation and datafication in music can inform this project of the potential impact of AIM in the industry, but the lessons of historical change are also limited. I therefore review literature that engages with the parallels of existing technology and AI, and with the impact of early AIM examples in music practices.

2.2.3 AIM and Music Work

The previous section introduced how technological change has shaped and been shaped by conditions of music work. Although the impact of AIM in this context cannot be fully understood before its widespread introduction, there are questions about its impact that can

be drawn from historical sociotechnical work, developers' communication of AIM uses, and early examples of AIM use in the music field.

Within AIM development, for example, a commonly identified benefit is productivity (e.g., De Man *et al.,* 2017; Collins, 2018; Louie *et al.,* 2020; Deruty *et al*., 2022: 46), but similarly to the knock-on impacts described in the previous section, AI-enhanced productivity could increase music output and add to the musical surplus. According to Morreale (2021), such a surge in surplus through AIM would be beneficial for powerful actors like streaming companies rather than the individual worker. He believes that an increasing surplus of music doesn't impact their income, and regardless of whether music is generated by AIM enhanced content creators or automated by their own music generation software, the AIM music listened to on their platforms is cheaper for the company and represents passive and controllable competition (ibid: 108). Furthermore, Goldschmitt (2020) argues that precedent for these approaches to business can be seen in streaming platforms' past actions. Spotify, for example, have contracted music producers to write music to specific briefs for playlists, which are released under pseudonyms and promoted by the platform. The artists themselves are not fake beyond their names, but the deceptive behaviour and propensity for platform-contracted music to outperform independent music in playlists led to its labelling as fake (ibid). This example of controllable competition could be repeated and enhanced using AIM.

Uses of technology to gain financial benefits within existing market conditions raise questions regarding the copyright status of creations with and/or from generative AI. Copyright is ordinarily attributed to human authors, meaning copyright from/with AI creations either requires human control or changes in laws to enable copyright attribution to non-humans (Deltorn & Macrez, 2021; Dornis, 2021). These frequently discussed issues of generative AI are important for music workers because their income is attained through copyright. However, laws differ between countries and few specific changes have been made to clarify or accommodate generative AI, so rights are attributed as normal when used by artists, or remuneration (through paid subscriptions or advertising data) is collected by companies or developers of that technology (Drott, 2021: 195; Clancy, 2022: 97). Ramalho (2017: 16) warns that the latter risks 'double rewarding' developers who gain financially first

from the creation of the technology and then from the technology's output. Such a 'double reward' echoes Spotify's creation and distribution of 'fake music'.

Despite these negative connotations of fake music and parallels with AI, technological capabilities and market conditions do not determine the future impacts of AIM. They do, however, provide context through which to examine AIM. For instance, there are early applications of AIM in use in the music industry that demonstrate how the technology can interact with existing sociotechnical practice in music work.

2.2.3.1 Early AIM Automation

An early example of AIM use in the marketplace is in audio mastering: the final stage of a musical product's creation where a mastering engineer ensures the quality and characteristics of a musical recording are consistent across formats, mediums, and environments. Mastering is one of the earliest examples of roles within music creation being actively advertised as automatable through AI (Sterne & Razlogova, 2019: 2). These services' machine learning methods likely only assist human curation and templates that the service provides, but the application of even marginal AI nonetheless enables a cheaper alternative to human services (ibid; 2021). This use of AI reflects Susskind & Susskind's (2015: 119, 195-7) vision of a gradual routinisation of work, they argue that where automation expands accessibility to individual tasks within a sector, the roles of workers become de-professionalised as expertise is no longer needed to carry out newly routinised actions. Through this lens the music creation process beginning with composition tasks and ending with audio mastering tasks is gradually routinised as fewer professionals are needed.

But AI in mastering has caused no job reduction thus far (Sterne & Razlogova, 2021). It has instead led to a separation of 'human' mastering that is marketed as a tailored, personal service to rationalise its additional costs – a common approach of human and machine separation that utilises nostalgia, 'retro-trust', and individualism to protect jobs (Gibbs, 2017; Tolmie, 2020; Roose, 2021). Birtchnell & Elliott (2018) observe that the virtual markets of decentralised automated services allow human workers to differentiate by providing a physical position in cultural and social music environments, again distinguishing the 'human

art' of audio engineering. Both the diversification of the 'human' and current limited capabilities of AI services protects workers' jobs by limiting automated services' uses to niche markets and lower-budget production, however, risk does exist for low-level engineers who do not have market power to charge higher prices (Birtchnell & Elliott, 2018; Sterne & Razlogova, 2019). This reflects a recurring effect of AIM, where Sturm *et al.* (2019b) argue risk is contained to early-career workers and those on lower incomes, depriving new workers of essential experience and opportunities to enter the industry. Mastering services represent – or are at the least marketed to represent – AIM as a technology that automates musical tasks without the need for human input. However, many applications in AIM development are argued not as a automation of musical tasks but an augmentation of musicians.

2.2.3.2 Augmented Workers

McCormack *et al*. (2020: 43) argue that autonomous black box systems will not lead to successful AIM; possible negative implications of autonomous AIM, they claim, reflects wider 'anxiety' about AI in popular media. They believe augmenting AI will be more successful than AI that automates and replaces people, emphasising 'the positive value of AI and how it can contribute to a richer culture' through collaborations with human creativity (ibid, 46-50). However, I follow Ashton (2022: 104-6) in questioning the 'endless enhancements' of augmenting AI (see section 2.2.1.3) through the contestations of two augmenting lenses: AIM as collaborator and as a tool for independent work.

If, as McCormack *et al.* (2020) argue, AI augmentation is a collaboration with the musician, the meaning of collaboration can provide context for AIM impact. Collaborative work is used by music workers to enhance labour value through expanded networked contacts, new avenues of public visibility for their practices and output, and even serves to guide their behaviour and actions for new social contexts (Haynes & Marshall, 2018; Hoedemaekers, 2018). In this sense, musicians' views of AIM can come into conflict with their values and needs in collaborative work. Hong *et al*. (2021) observe, for instance, that some musicians are apprehensive about AI use because of concerns that its musical output is viewed as an imitation of the music on which it is trained. The processes behind AIM and workers'

perceptions of them could therefore influence the value of augmentation-as-collaboration because this approach to work is driven by both musical and social motives. Claims about the value of collaborative augmenting AIM can therefore be contested – this thesis puts these contestations within the context of decision making in music work to understand *why* workers do or do not value AI as a collaborator.

Augmenting AIM, however, is also argued as a tool for independent music work. Gioti (2021a) argues that rather than a replacement of human collaborators, AI can improve human-computer interaction to enhance musicians' compositional ideas in musical tasks. But once again, the value of AIM within music workers' independent practice is contestable. Artists socially construct their careers in independent work, they create recognisable and visible identities that are cultivated to compete in saturated markets; these identities then guide further career-building decisions in both independent and collaborative work (Hoedemaekers, 2018; Taylor, 2024: 112-3). Therefore, any influences that alter these established identities can impact career positions by creating inconsistencies and perceptions of the worker as inauthentic, which audiences are quick to punish (Lingo & Tepper, 2013: 350; Taylor, 2024: 56-9). By integrating AIM within established individualised careers, workers can therefore be impacted by it regardless of whether the technology has a positive or negative image or function. However, Dahlstedt (2021: 909-10) argues that workers can differentiate their agency in AIM use through their own efforts to practically and theoretically understand the technology they use: he argues that users inputting high effort maintain high agency, but low effort reduces the worker's agency and increases AIM agency over them. Even where developers strive to create AIM that augments the worker, the workers' own meaning making and use of the technology can therefore shape its impact, resulting in contestable, uncertain imaginaries of how augmenting AIM will affect workers' lives. The following section argues that this meaning making is often downplayed in the development of AIM, highlighting the need for direct engagement with both AIM development and use in this project.

2.2.3.2.1 The Need for Workers' Meaning Making

Research into AIM co-creativity has exposed workers' concerns that blur the bifurcation of positive augmentation and negative automation, but these concerns are often downplayed. Savery and Weinberg (2022: 55) observe that in their own research into AI and robotics for music, their own users fear their AI systems could reduce their skills by making them obsolete in comparison to a machine. The authors argue, however, that this concern is not rooted in the technology itself, but in public perception – reflecting the anxiety of popular media argued by McCormack *et al*. above – meaning concerns surrounding the negative impact of AIM on skill can be reduced with clearer messaging from developers. But I argue this disregards the opinion of the user by assuming the negative traits of interaction are a result of the user's shortcomings rather than issues with the technology. Furthermore, the paper to which they refer (Savery & Weinberg, 2018: 12) engages with *domain experts* (film composers) by asking them to *interact* with the system *before evaluating* it. Therefore, the flawed 'public perception' to which they refer is actually constructed on both *experience with the system* and *knowledge of the industry* rather than public perception as a result of messaging from themselves as researchers.

The downplaying of workers' meaning making demonstrates a gap in understanding of how professionals on the front line of music creation make sense of these technologies and their own role in its impact. This literature is not intended as a comprehensive view of potential impacts of AIM on the user as the technological use-cases designed in AIM practice are wide-ranging and unfixed, as are their uses in music work. It instead highlights how the value of AIM in music work contexts is largely unknown. Whether AIM augments independent or collaborative work, Guzman & Lewis (2020) claim that humans evaluate and interact with technology by assigning known traditional social roles to it, and that these roles can be useful in determining the impact of that technology on individuals and groups. This is evident when examining the roles of technology in both independent and collaborative work, but the social roles of AIM are largely unknown. This thesis will therefore examine music workers' perspectives on the value and roles of AIM within their workflows. The literature on AIM development and use both show a need to look beyond the individual functionality of individual technological use-cases to understand the impact and meaning of emergent AIM

for music work. The following section therefore explores how Bourdieusian practice theory and concepts from Science and Technology Studies can provide a valuable understanding of this emergent technology from both the practices of its development and use.

2.3 A Practice Approach to Technological Change

Bonini & Gandini (2020: 6) argue that analyses of technological impact are often dependant on retrospective reception of uses in society, but that emerging technologies can be better understood through their processes of construction and reconstruction. As I approach AIM before its widespread introduction and impact in society, understanding its position is dependent on such views, e.g., how the technology is constructed by AIM developers, and reconstructed through users' meaning making. To understand these constructions, I take a practice approach to AIM that uses constructivist concepts from Bourdieu and Science and Technology Studies (STS). AIM is in the process of *construction,* and I will examine it with a mixed-*constructivist* lens of practice; this section is devoted to explaining that the rationale for this decision moves (minimally at least) beyond the similarity of these terms.

I begin by reviewing Bourdieu's structuralist constructivism, then, I conceptualise STS constructivist approaches to technology (social constructivism, technofeminism, and actor-network theory) as sociotechnical constructivism. These two forms of constructivism are then given rationale for this specific context in section 2.3.3 based on their past and potential application to social studies and argued as an effective approach when combined to analyse AIM and its impact on musical labour.

2.3.1 Pierre Bourdieu: Structuralist Construction of Practice

Pierre Bourdieu describes his approach to social practices as structuralist constructivism (Bourdieu, 1989). He argues that although actions, perceptions, identities, and social strata are socially constructed at an individual level, they are done so within a world that also has independent guiding structures; neither structures nor construction are sufficient alone as they co-exist. Despite a belief in structures of the social world, Bourdieu rejects traditional structuralist views of the world, instead attempting to understand networks of associations from within (Bourdieu & Wacquant, 1992: 113). The purpose of structuralist constructivism is therefore to study representations and experiences of practices as they happen (constructions), to explain why those practices exist that way within the context of a world-system (structure) (Halford & Savage, 2010: 943; Nicolini, 2012: 53). Bourdieu's approach

to practice is therefore valuable to this project as I utilise his concepts of *habitus, field*, and *capital* to examine AIM and music work as practices where impact is created through both the construction of practice and structures that guide them. I explain briefly here what each is, and how these concepts are relevant to this study of AIM.

2.3.1.1 Habitus

Habitus is the individual experience and embodiment of the social – the disposition to perceive, think, and act within a system (Bourdieu, 1981; Benson, 1999). It is within the habitus that practices are produced and felt. The experience in the habitus can therefore be studied as an observable social condition of the relations between individuals and structures (Bourdieu, 1984; 1989). To Bourdieu, the habitus is a linking mechanism that uses human experience as an understanding of the practices that people participate in – ethnographic data can highlight perceived boundaries between individual agency and structural constraints (Bourdieu & Waquant, 1992: 178). Research into the habitus can be used to discuss issues that exist in micro, mezzo, and macro settings, whether through experience or influence. This is achieved by using specific actions and dispositions which are non-generalisable to demonstrate a lived perspective of larger, more general routines of social organisation and behaviour that impact agency (Blommaert, 2005: 224-233).

By examining the habitus, the variety of impact caused by macro influences can affect actors' experiences and sense-making differently depending on their specific circumstances (Benson, 1999: 468). For example, Bourdieu (1981: 315) argues that the automation or de-skilling of work can affect labourers differently in the habitus: skilled workers defend their historic advantages; newly de-skilled workers would radicalise against the system; and first-generation skill-less workers would tolerate the conditions. These reactions reflect both individual actions and the systems from which those actions emanate (Schinkel, 2007: 710). Despite Bourdieu's claims about de-skilling labour being pertinent to this research, they are not introduced to my project from the top down, instead I utilise his approach to understand the impact of AIM on labour from the ground-up and question how they fit against his conclusions. The conceptualisation of the habitus allows me to focus on how practices are

constructed and perceived at the coalface of AIM, and how practitioners in music work make meaning of its emerging technologies. I can then examine these perceptions to understand the wider influences that affect the construction and eventual use of AIM through its integration to the ideas of field and capital.

2.3.1.2 Field

If the habitus is the embodiment of practice at the micro level of society, then field-theory demonstrates those experiences as a source and consequence of mezzo social constructs: fields (Bourdieu, 1989). Fields are defined by Bourdieu as the social spaces in which people are located and act. They are structured upon everyday actions: the 'locus of struggles' where actors' attempts to protect and improve their own positions within fields subjects themselves and others to the constraints of that field (Bourdieu, 1975; 1981: 307; 1990). Fields are semi-autonomous and there are no prime movers because even the powerful must struggle to maintain their positions (Bourdieu, 1981), and all agents within fields are self-governed through two conceptualisations that influence actions and reproduce their influence for others. The first, *doxa*, refers to accepted or common language, categories, oppositions, or labels within the field that inform practitioners' actions within the habitus through expectations to conform to those doxa (Everett, 2002: 69; Wanka & Gallistl, 2018). The second, *illusio*, refers to the 'rules of the game' which are unwritten but perceived in the habitus through exchange and reward, where practitioners who are invested in and play by such rules gain advantage within the field (Bourdieu, 1993: 257; Benson, 1999: 464).

Field-theory is a means to understanding how individual experience of social constructions within society operate alongside wider influences. Bourdieu & Wacquant (1992: 104-7), argue that dominant and dominated groups strive to exploit the mechanisms of fields to gain specific power within them, however, analyses should always view this action and power in the relational context of other habituses, fields, and the wider field of power. These relations can be examined through an understanding of capital in practice.

2.3.1.3 Capital

Bourdieu describes capital as the accumulation or embodiment of labour by an individual or group; it can therefore determine one's location within a social field and allow agents to appropriate social advantage within those fields (Bourdieu, 1986: Wanka & Gallistl, 2018). Unlike traditional understandings of capital, his understanding moves beyond economic theory to show how capital can embellish agency within fields and practices, accounting for the structure of the social world (Bourdieu, 1984; 1986). This is achieved through the conceptualisation of non-specific capital (economic), and specific capital (cultural and social) (Everett, 2002). Of these, economic capital holds the most power as it exists outside, between, and within all fields in a world system. It can therefore affect specific capital relationally: higher economic capital, for instance, can reduce cultural capital (mass market art), and lower economic capital can increase cultural capital in artistic fields (bohemian / avant-garde) (Hesmondhalgh, 2006).

Capital can also be transferred. Economic capital can empower agents with greater opportunities for institutionalised capital (awards, qualifications) therefore converting economic to cultural capital. There is, however, a third form. Embodied or internal capital (competencies, abilities) cannot be appropriated beyond its agent through gift or exchange because it requires personal investment of mind, body, and time within a specific practice (Bourdieu, 1986; MacIntyre, 2007: 188; Banks, 2012). Bourdieu's theory of capital can therefore be used to question what types of capital are accumulated in the development and use of AIM, and what impact that has across intersecting fields.

Couldry (2003) presents an argument for expanding Bordieusian non-specific capital. He argues that because of media's prominence across society, researchers can examine how it is significant to a field, how that significance alters its relationship with other fields, and whether this effects conditions of entry to these fields. He believes these questions demonstrate that the position of media across different fields has established it as a non-specific meta-capital as opposed to a field-specific form of capital as Bourdieu would have labelled it (ibid: 670). Lundahl (2022: 1441) expands on Couldry's proposal for meta-capital through a clearer definition: meta-capital is something that can be used to grant power, status,

and is a cultural resource across multiple fields. Through this definition he argues algorithmic recommendation is a form of meta-capital as it mediates decision-making and consumption across society. Bourdieu's conceptualisation of capital can therefore be expanded beyond the specific contexts to which he applies it, and I therefore use it to examine where value lies in AIM and whether that value exists beyond its specific practices as economic capital does. Sismondo (2011: 94) argues for this, claiming that Bourdieusian concepts are most valuable if loyalty to his strict limits is dropped in favour of examining how 'forms of capital do and do not move across' boundaries – like Couldry and Lundahl propose. Before introducing updated arguments on the specific use of Bourdieu's concepts in technology analysis in section 2.3.3, I introduce some concepts from the field of Science and Technology Studies (STS) that can enhance this lens.

2.3.2 STS: Sociotechnical Construction of Practice

By combining the approaches of Bourdieu and STS, I show here that their ideas overlap continuously through their focus on the habitus and its reproduction of wider influences.

2.3.2.1 Social Constructivism

Social constructivism is an approach to examining the meanings afforded to technologies through their relevant social groups of design and use (Pinch and Bijker, 1987). Because relevant social groups are seen to direct technology within social constructivism, Law (1987: 411) argues that the researcher can examine the impact of society on technology within its design. But constructivism can also be used to approach 'impact' from both directions as 'social groups' include the constructors, implementors, and users of technology.

Pfaffenberger argues that within social constructivism, technological impact is essentially 'the impact of one kind of social behaviour on another' (Pfaffenberger, 1988: 241). This perspective highlights the pertinence of social constructivism within a practice approach to AIM: impact can be approached as the impact of the 'social behaviour' of AIM design on the 'social behaviour' of music work and vice versa. Social constructivism therefore informs this framework by questioning what social groups exist in the design of AIM and their agency in

the process of its construction. Law (2008: 634-5) argues that the authority of social constructivism has reduced in STS because the 'social' cannot be separated from its web of heterogenous relations, and 'construction' imagery suppresses the fluid process of technology in favour of a one-way operation that cannot be undone. However, the construction of technology is not one-way according to Bruno Latour (2003: 45), who despite being a proponent of the networks that Law describes, argues that the proposition of construction also provides an opportunity for de-construction and revision of technological design. Despite this, a revision on the 'social' in technological practice is considered in the following section to clarify its meaning.

2.3.2.2 Actor-Network Theory and the Sociotechnical

ANT posits an approach to the world through agency. An object of study (a network) should be examined through anything, human or non-human, that exhibits agency (modifies or makes a difference) within that network of other agents: within ANT no object of study 'is, by itself, either reducible or irreducible to anything else' (Latour, 1993[1984]: 158; 2005: 71). ANT is therefore not specific and consistent, it is most effective not when viewed as a theory or method, but as a lens to expand research perspectives (Mol, 2010: 261-2). ANT therefore offers a starting point for research into technological impact that does not assign or determine agency, but simply holds an open view to account for anything that may act within a sociotechnical system (Sayes, 2014: 143). This ensures that technology is researched and evaluated as a potential construction of both social and technical agency where the technical both mediates, and is mediated by the social (Law, 1987; Johnson, 1988; Mackenzie & Wajcman, 1999). Technology therefore exists within a *sociotechnical* system; it is designed, used, and explained within a context of social, economic, political, and technical interrelations that influence one another (Hughes, 1983: 5-6; Johnson & Wetmore, 2009; Kitchin, 2014). I therefore refer to the STS concepts I draw from as *sociotechnical* constructivist lenses rather than social constructivist to reflect this – this is not ANT research, but my practice approach is informed by its lens.

Wajcman (2006: 774) argues that a networked sociotechnical view shows that 'rational technical imperatives' do not dictate technology that is 'intrinsically the best', instead, the social choices of design and use compliment technical reasoning in technological construction. Technological creation, Law argues is a process simultaneously influenced by social and technical context:

> Thus the social cannot, in any simple sense, be seen as lying behind and directing the technological. Neither, of course, can the technological be seen as lying behind and directing the social. Rather, it has to be asserted that the sociotechnical influences the sociotechnical. The structure of the system thus depends upon what precedes it on the one hand, and the tactics and materials used by the system-builder on the other (Law, 1987: 418).

The combination of social constructivist and sociotechnical systems approaches discussed by Law develop from the view that technology is something that is created, however the former places social interests at its centre, and the latter the system-builder (ibid: 419). Law believes that the sociotechnical systems approach is a creditable progression from social constructivism, as the perspective of system-builders allows the researcher to see social interests as they appear. However, the shortcoming here is that the incorporated social interests can be limited to one group's perception. By using a sociotechnical constructivist lens, I aim to integrate both views; neither the builders, materials, nor social interests take precedent, but are examined as stakeholders in the construction of AIM. To further develop this sociotechnical constructivism, I finally consider an important expansion of STS through feminist studies.

2.3.2.3 Technofeminism

The sociotechnical construction of technology can be understood in wider contexts through feminist theory. Beyond the identification and relation of agency that social constructivism and ANT provide, feminist orientations redirect attention towards the politics of difference between them, how boundaries are drawn to constitute separation (Suchman, 2016: 366). Suchman (1999: 263-4) argues that examining visible and invisible work in technological

design and use can identify these boundaries through individuals' locations, responsibilities, power, and politics within networks of action. This expands what and how agency is enacted within technology practices by also asking *why* there may be differences. Haraway (1988: 581) refers to the positions between these boundaries as 'situated knowledges', where the partial perspectives of practitioners define what is considered fact or truth in a particular context. Both actions of technological design and use, and the social context (boundaries and situated knowledges) in which those actions take place therefore contribute to the stabilisation and meaning of technology in society.

Feminist STS perspectives also enable engagement with the sociotechnical construction of AIM as a study of work because gendered relationships are often reproduced in the interrelations between people, capital, and technology. For example, technology as source of both economic and social power has been leveraged to lend capital to men through the early male domination of technological labour, who could then in turn lend technological tools to women for their own capital gain (Cockburn, 1999: 190-1; Wajcman, 2010). Berg (1999: 311-2) argues that for this reason, technology can change or preserve social relations such as the sexual division of labour, the intentions of which can be seen in its sociotechnical construction. If these social inequalities can be seen as socially constructed, embedded, or influential in technology practice, this view can be used to argue for the improvement of gendered, classist, disciplinary, and professional conditions in technology (Cockburn, 1999: 194). Feminist STS views issues of impact as intersecting, where technological design, work and consumption could all hold significance; the politics that affect technological impact are a negotiation of technical possibilities that reflect and shape prevailing power (Wajcman, 2006: 777, 782).

STS has been used in music to construct rich accounts of technology in society, Pinch and Trocco (1998) provide insight into the shaping of and by the early synthesiser, but they do so through a historical account with the benefit of hindsight. For this reason, I mix sociotechnical constructivism with Bourdieu's practice theory to construct a deep and wide account of AIM and the context of its surrounding practices. I explain how these relate in more detail below.

2.3.3 An STS and Bourdieusian Practice Approach

I do not subscribe to the conclusions drawn in Bourdieu's work on cultural fields but use his concepts to analyse the practices of AIM and music work relationally from the ground up. Although his analyses present clarity, they are built on outdated datasets which Hesmondhalgh (2006: 218) argues are highly selective. I also do not pursue Bourdieusian distinction between micro-genres and tastes, as it can impose rigid constructs and dilute discussion of art to small specialities and sub genres (Hennion, 1989: 405). I therefore avoid separation of music work into genres at all, instead utilising the perspective offered by concepts of structuralist constructivism in my own research data by theorising the interrelations of practices through participant experience and embodiment. Through these concepts, I analyse individual perspectives in relation to one another and wider events, as individual actions and perceptions become practices in the context of their wider fields (Nicolini, 2012: 55). Bourdieu (1984: 95) summarises these concepts as a method of understanding practices within their social context through the following conceptualisation:

$$[(\text{Habitus})(\text{Capital})] + \text{Field} = \text{Practice}$$

Here AIM can be analysed as a practice through its habitus (research actions, perceived need, interest, etc.); actions and interactions in the habitus can be expanded through capital accumulation and exchange (economic and academic investment and influences); and these constructions become practices in the context of fields that influence both habitus and capital interventions. However, because the subjects of Bourdieu's research are selective, non-contemporary, and were rarely applied to technology, I argue that a Bourdieusian approach requires a parallel understanding of the fast-paced change within contemporary sociotechnical environments. Sterne (2003: 374) has argued that such an understanding builds naturally from Bourdieu's approach because technology is unexceptional in its replication of society:

> At a basic level, a technology is a repeatable social, cultural and material process (which is to say that it is all three at once) crystalised into a mechanism or set of related mechanisms. A technology may perform labour once done by a person, which

> is to say that people design and use technologies to enhance or promote certain activities and discourage others (Sterne, 2003: 376).

Sterne's argument maintains distance from the idea that technology or its practices have a determining effect on society: technology is *promoting* and *discouraging*, rather than enforcing and invalidating. However, he reduces the impact of the material importance of technological practices in favour of the social present. Sterne (2003: 383) argues that Bourdieu's rejection of associations between specific practices and groups is translatable to technology through the debate of 'gendering', where gender, race, and class associations of technology change according to its *current* social location. Technology is always socially located, but Sterne's argument minimises the influence and effects of past material and social associations. Although technology is embodied in the habitus, the social is also embodied within technology, as Wajcman would contend: 'An STS approach would argue that these artefacts are themselves inscribed with gendered meanings that shape their design and use' (Wajcman, 2006: 779). For instance, if the social location of a technology's use changes, the technology itself does not lose or gain associations necessarily; the gendering of objects is a good measure of this and is used below to explain the need for STS approaches to the practices of technology.

Two examples. First: *the conditions of a technology's creation can remain impactful despite the gendering of its developed social location*. Early fossil fuel powered cars were marketed towards men as a fast and loud method of masculine transport (Wachs, 1998: 101). Despite the social shift to today where cars are a largely gender-neutral mode of transport, Criado-Perez (2020: 188) shows that crash safety remains stubbornly based on the male body type. The technology is more dangerous for women because of gender imbalances in its construction, despite its developed social location in use. Second: *a social group can challenge gender associations in a social location without re-gendering the object itself*. This is visible through moves to de-gender clothing; increased instances of male celebrities wearing 'female' clothes acts as a challenge to gender constructs of masculinity and femininity (Wheeler, 2020). The item of clothing is not gendered differently in design: in fact, the gendering of its construction is what gives the act of its use meaning. Wajcman

demonstrates this as a key position in the crossover of technology and feminist studies in STS, that 'users modify the meanings and values of technologies in the practices of everyday life… However, this process is firmly located in the gendered assumptions of designers about prospective users' (Wajcman, 2004: 47-8). Sterne attempts to link ideas from STS to Bourdieu's teachings. I argue that these concepts should be applied alongside one another to examine the social groups within technology, analyse their sociotechnical assemblages as a source and consequence of action, and contextualise their performances of socio-political power.

The sociotechnical approaches to technology in STS can inform and be informed by the construction of practices through Bourdieusian habitus, field, and power. This approach enables the simultaneous examination of technological design and use in the context of the power and capital of its practices. Fields of power, universal economic capital, and specific cultural, social, and political capital may influence technological change and its impact. Emerging forms of power can also be understood through individuals' struggles for dominance within new practices. This ongoing context of practice is necessary to study AIM because its capabilities are growing but they only operate on a small scale and in emerging markets, meaning their design and use cannot be studied as established or complete. The empirical focus on practices within Bourdieu's theory provides a useful lens on AIM for this reason; however, Born (2010: 179) argues that this also gives the framework a temporality that suppresses history and transformation. She therefore argues that a dialogue is required with cultural histories of change. By using STS conceptualisations of technology, I can integrate such a dialogue by approaching AIM as it relates to other sociotechnical relationships in music work.

These theoretical ideas are not worlds apart. Discussing his understanding of individual actions within practices, Bourdieu claims that 'it would be futile to distinguish in an orchestral performance what is done by the conductor and what is done by the players' (Bourdieu, 1981: 307). The roles or actions of the conductor and players are different, one is directing and the other following, however, both actions result in the same thing being done: the music. This reflects aspects of the ANT perspective of action that all acts should be

considered equal, no greater importance should be placed based on activity or consciousness. However, sociotechnical constructivism expands this view through concepts of social constructivism, materiality, and performativity: considerations such as how instruments, audiences, expectations, and associations between them also affect the music under such conditions.

Despite this, Bourdieu is claimed to have ridiculed the sociology of objects in ANT (Schinkel, 2007: 720), but this has not stopped the merging of their ideas. Wanka & Gallistl (2018: 14) argue that Bourdieu's understanding of fields as relations of power and capital can be extended through technology as it can be seen as a target and initiator of action within those fields. Furthermore, Halford & Savage (2010: 948-9) argue that both perspectives facilitate an approach to social research from the ground up by rejecting pre-defined social structures in favour of constructing abstractions of 'networks' or 'fields' based on empirical research with individual actors at the micro level. The shortcomings in both these perspectives demonstrate the value of their interplay. Bourdieu, for instance, often moves beyond the analysis of the individual, using habitus as a method of using the individual to investigate wider fields and structures (Schinkel, 2007). The understanding of technology that is targeted by STS ideas within sociotechnical constructivism consequently compliments the long view of Bourdieu, as Prior (2008: 302-4) argues the latter enables music studies to be socio-economically situated within an examination of technology as a mediator of cultural production. For these reasons, this mixed constructivist approach presents wide-ranging but connected questions for the analysis of AIM and music work conducted in chapters 4, 5, and 6 of this thesis. First, however, I set out a methodological framework that enables reliable data generation with the practices of AIM development and use.

Chapter 3 Methodology

In the previous chapter I reviewed literature surrounding Artificial Intelligence and Music within the context of music work, constructing a case for examining AIM through a theoretical framework of sociotechnical practices. In this chapter, I detail the methodological design and processes of the thesis that were used to generate data for the following secondary guiding research questions:

I. How has AIM developed as an emerging practice of technological and musical innovation?

II. How does the emergence of AIM relate to the existing relationships between workers and technology in music creation careers?

I begin by defining my field sites, constructing a collection of diverse AIM practitioners and music workers as the dispersed multi-sites of AIM construction and use. Using these sites, I explain the methods of participant selection, how I maintained reliability and validity through this selection and how saturation was measured. Despite approaches for reliable data samples, I acknowledge that challenges remain when addressing my research problem because of my own positionality within the context of the study but argue that a reflexive interpretivist-constructivist approach can aid these challenges. Through inspiration from ethnographic research, I then describe how data was collected through methods of non-participant observation and semi-structured interviews. Finally, I show how a data-centric, systematic approach to coding, and interpretive excerpting in the context of my literature, theory, and research questions enable analysis of the data to draw meaningful findings and conclusion within this research.

3.1 Methodological Design

The review and construction of my theoretical framework in the previous chapter introduced concepts for understanding technologies through engagement with the people who make up the sites of their construction and use as sociotechnical networks are perceived and experienced within the habitus of these practices. I therefore constructed the methodology of this research to examine AIM through the habituses of its stakeholders, beginning with those in closest proximity to its creation and moving outwards: AIM practitioners, music workers with experience using AIM, and music workers with no experience of AIM (more on the establishment and sampling of these sites later). To generate and analyse the experiences of these stakeholders, I engaged with them individually through a qualitative methodology to examine the meaning and sense-making within participants' perceptions (Braun & Clarke, 2013: 24).

3.1.1 Constructing the Field Site

The questions of this study are well placed to be studied with a Bourdieusian inquiry which discusses practices through empirical qualitative research with individual practitioners. To identify and conduct research with individuals, however, I use a top-down construction of research sites due to the specific nature of this thesis' engagement with AIM and music work. AIM practitioners and working groups often exist in small numbers, working on specialised areas of music creation within larger academic and commercial computer science, engineering, and product development departments. For example, there are large conference communities of music and computing in academia such as societies for 'Music Information Retrieval', 'New Interfaces of Musical Expression', and the 'International Computer Music Conference', where AIM is not the sole focus, but the topic regularly arises (these occasions provide much of the literature for this thesis). Marquez-Borbon & Stapleton (2015: 2) acknowledge that these practices are not homogenous groups of similar work, but a 'community of interest' built on practitioners from different domains. For this reason, I call the field site 'dispersed'. Coincidentally, as the parallel focus of my study on construction and use, music creation workers are also largely 'dispersed' because careers of composition,

performance, and audio production in the western recording industry often comprise of isolated independent actors publishing directly to platforms as a result of digitalisation (Lingo & Tepper, 2013: 355).

This dispersed research sample is largely characterised through isolated individuals for this reason. However, there are outliers in AIM where many practitioners work alongside one another. The first example of these are high-profile companies that research AIM 'in-house' (e.g., Google, Spotify, TikTok/Bytedance). However, the constraints within these commercial sites highlight the need for a multisited approach as they are largely inaccessible and untransparent (Bonini & Gandini, 2020). Spotify, for instance, refused to cooperate with state-backed research into the company and threatened legal action on researchers (Eriksson *et al*., 2019: 1). In past research, I had also encountered barriers to research where consent for established interviews was withdrawn by HR departments within large music technology companies. Thomas argues that such struggles are common because in these settings 'even welcome visitors face inner lines of defense' (Thomas, 1993: 82). Nevertheless, one interview was conducted with a researcher within a large commercial research group, and others in smaller companies as part of the study.

The second example of centralised AIM research is in academia, where specific projects with themes of music technology and AI have emerged. In Europe, much AIM research stems from sites like the 'Music Technology Group' at Pompeu Fabra University Barcelona, the 'AI and Music' group at Queen Mary University of London, the 'ACIDS' group at IRCAM Paris, and the 'MUSAiC' group at KTH Stockholm. All these centres are represented within the dataset through engagement with their researchers but are anonymised in the findings (more on this in the participant sampling section). These academic research centres represent rich ground for data because there are an unusual number of researchers working side by side on the specific subject of AIM, and funding comes from government, intergovernmental, and commercial sectors. A novel perspective is therefore available on academic practices and on industry involvement in AIM through these sites despite limited access to larger, more obvious commercial sites. To incorporate these larger field sites tied up in academic and

industry practice along with other smaller dispersed ones, I took an ethnographic approach to research.

3.1.2 An Ethnographic Approach

Areas of technological innovation like AIM have become a common focus of ethnographic interest, especially as digital platforms have blurred the roles of social, material, and virtual actions and interactions in our sociotechnical culture (Wajcman, 2006; Seaver, 2018). However, due to the niche, diverse, and dispersed nature of practices under the umbrella of AI and Music, there is no one field site that demonstrates the breadth of commercial and academic research. Nor is there a developed user base through which to examine the impacts of AIM use. I therefore took an ethnographic approach to research by conducting observations of AIM research in a centralised academic institution, then contextualised this study by interviewing individuals in other institutions, teams, or self-guided and self-employment settings. Findings from research within AIM practice were then utilised to discuss the development of such technologies with their stakeholders through further interviews. This was in part inspired by Kitchen's (2014: 188-90) analysis of technological assemblages, where he claims a diversity of small-scale methods is more adaptive and sensitive to the contextual and continuous processes of development. Data generation also followed the focus of Bourdieu and STS in this way, using individual experience to examine the sociotechnical construction and structures of practices (Nicolini, 2012: 53-5).

This ethnographic approach addressed all the aspects of my project through a multisited understanding of the object of study that has grown in popularity following Marcus' (1998) work on 'the field' as a world system of people, artefacts, narratives, and conflicts across multiple locations. These multi-sited locations can demonstrate the effect that individual parts of a system have on one another and the whole, which are considered of equal importance in interpretative accounts of qualitative data (Marcus, 1998; Klein & Meyers, 1999). By engaging with AIM construction and use as multisited, this ethnographic approach allowed me to engage with the variety of contexts in which AIM exists, both structured groups and individuals. The research questions could therefore be approached through the separate field

sites of AIM construction and use. This study is not a to-the-letter multi-sited ethnography but takes inspiration from it, using methods from ethnographic traditions to examine a field across multiple locations, rather than approaching research as a single ethnography in multiple places.

However, as these field sites were constructed through my readings and writings of groups within the literature, conclusions from their comparisons were at risk of emerging because of these pre-conceived associations (Atkinson, 1992: 9; Marcus, 1998; Burrell, 2009). To minimise the impact of pre-conceptions, these field sites were regarded as entry points to AIM; additional sites or 'field events' were incorporated as they appeared through action with participants and the object of study (Marcus, 1998; Ahlin & Li, 2019). For example, AIM subjects grew to include researchers not considered to work within music creation because some participants claimed to rely on the work done in these other, less applied settings of music and computer science. This approach to field sites as entry points can also help to avoid the risks previously discussed regarding access to hard-to-reach areas; Bonini & Gandini (2020) argue that their own 'failure' to carry out a multisited ethnography with inaccessible music industry representatives requires the utilisation of wider varieties of data.

Similarly, Seaver (2017: 6) argues that ethnographers should incorporate a scavenger tactic where disparate sources and perspectives are sought out rather than a traditional long-term, single site study. The scavenger technique is based on research that deals with secretive field sites, such as Gusterson's (1997: 116) use of 'polymorphous engagement' to interact with participants beyond the usual focus on participant-observation in his research of nuclear weapons practices. In response to these challenges, my research involves academic, independent commercial, and corporate backgrounds, as well as a diverse set of stakeholders active in music composition, performance, and production. In this respect, this multisited approach is akin to relational ethnography as it is built upon relationships between differently positioned stakeholders of the same field (Desmond, 2014: 554). However, this study is built upon specifically constructed relationships that theoretically intersect with the functions of AIM in society, rather than groups that actively engage with one another as studied in relational research.

The nature of software engineering and research in addition to the changing landscape of working practices in the aftermath of the COVID-19 pandemic means that much of this work was carried out across digital workspaces – the labs in which my in-person participant observations were carried out were seldom more than a third full. Reflecting multisited approaches, Hine (2000: 64-67) argues that ethnographic work in virtual environments focuses on topics not locations, making it apt for research into AIM practices and impact. However, to connect participant-controlled projections with their unmediated actions, digital interactions should be supplemented with traditional fieldwork as a method of triangulation to discover the enduring practices of the community (Hine, 2000: 21; 2016). Consequently, I used mixed methods through traditional and adapted methods for physical and digital environments. This allowed me to be situated within the differing fields of my object of study. To rely on physical sites would disregard the numerous people who operated from remote locations as was seen at the beginning of primary data collection: on the first day of participant observation, only around 10-15% of the site members were present. Furthermore, this expanded my flexibility, undertaking interviews with people around their schedules, across countries and time zones. Physical and online sites therefore make up the sociotechnical practice of AIM: it is a blended landscape in contrast to understandings of sociotechnical sites that are wholly online or only considered online against its context in the physical site (Bluteau, 2019).

Finally, towards reliable constructions in interpretative studies, Fusch and Ness (2015) explain that it is important to design research methods that achieve data saturation by uncovering the themes of the research field until no new themes appear. Participants and methods were consequently included based upon their relevance to the research questions, representation of the object of study, and ability to achieve data saturation as there is ‘no way of interpreting what is not reported in qualitative data’ (Braun and Clarke, 2013: 261). Data saturation can, however, be monitored through the relevance and meaning of data for the research questions. Klein & Myers (1999), for example, argue that an interpretivist approach should consider component parts and the whole subject separately, while contextualising and engaging with social and theoretical understanding. Therefore, this methodology was

designed to generate data that engaged with my research questions through the lenses of the theoretical framework until no new themes appeared. How sampling was carried out for this ethnographic approach to my field site is discussed below.

3.1.3 Participant Sampling

The 'dispersed' field sites of AIM that require a multisited approach first impacted participant sampling. The scope of the sample was broad, taking inspiration from Burrell (2009: 190) who advise that 'entry points' should be sought to guide and make sense of research samples. Following this and the rationale in the previous two sections, I built my participant sample by beginning with an ethnographic stage of research at a single site before moving outwards. Beginning with a field study in one of the larger centres of research enabled me to build an understanding of the types of people that existed within the construction of AIM. Using this understanding I could branch out by targeting individual researchers for interview based on my own and my interlocuters' understandings of the types of practice that exist. This ensured that recruitment included all relevant participants based upon their relevance and associations to the object of study rather than a pre-defined sample (Kristensen & Ravn, 2015: 730). How participants were recruited for the study is detailed here.

The largest single site of this study was the ethnographic stage at a European engineering department with funding from state and industry. The institute – hereafter pseudonymised as *MusicEngine* – was chosen based on its focus on music engineering and frequent output of AIM related research. To gain access, a member of my university acted as a mediator to introduce me to a senior member of the MusicEngine team to add authority to my request (Kristensen & Ravn, 2015: 724-5). Once introduced, I explained the premise of the study and faced scepticism about the value of ethnographic research at their institute; they claimed that the practitioners in MusicEngine did 'boring' work staring at computer screens. For this reason, they argued, my ethnographic approach wouldn't produce data in an efficient way. In addition to convincing my interlocuter that these concerns are part-and-parcel of ethnographic work – it is indeed a time-consuming method of data collection – I was also

questioned about the term ‘fake music’ which was included in an early working title for the project. I was asked for clarity on the meaning of ‘fake’ and whether I believed AI was being used for faking human creativity. However, by explaining my use of the term as a buzz word in response to recent media stories more than to make assumptions about the nature of AI research, an agreement was reached that I could contact individual members of the centre to conduct on-site observations. The ‘fake’ label has subsequently been dropped from this thesis because of these negative assumptions.

In this case, once consent had been gained from the head of the department, specific researchers were recruited individually through email and in-person contact to gain consent for anybody who was willing to participate in organised observations. Initially, email requests garnered few responses, but my presence in the workplace for observations and interviews allowed me to talk informally with researchers and recruit them one-by-one. Further, when on-site I joined a group meeting and utilised the opportunity to present informally – and somewhat vaguely as to not guide future data collection – my reasons for being there and my desire for participants. Through these methods, around 80 hours of organised observations that I could record data on were conducted with 12 consenting researchers during my presence at this ethnographic site (more on the details of data collection in section 3.2.1). Then, after this first stage of study at MusicEngine, I identified and contacted individual AIM practitioners to participate in interviews. I established contact by researching publicly accessible names and correspondence from published research and institutional websites. Participants in academia were selected based on their relevance to this work on AIM, most frequently this entailed researchers working specifically on music and sound generation, music interaction, or music analysis.

Commercial AIM researchers were similarly contacted through publicly available contact information on web addresses based on their roles in the development of tools for music creation. The reliance on web-based sources presented did not represent a significant narrowing of my dataset within these groups because academic and commercial technologists rely on online publications and platforms to operate. I began by targeting small companies such as AIM start-ups as these are usually less constrained by formal HR standards and

commercial sensitivity. After which, I attempted to contact artificial intelligence researchers in larger technology companies where access is less commonly achieved due to issues of commercial sensitivity (Seaver, 2017; Eriksson *et al*., 2019; Bonini & Gandini, 2020). However, of the three industry representatives that participated, one was a music generation start-up founder, one was a freelancer working for a small music technology enterprise, and the final was a permanent researcher working for a multinational technology corporation on an AIM project. Although this is a small sample, it has a diversity of perspectives that were analysed in the context of both industry influences in academia and music work.

Music workers were also largely recruited through public digital mediums such as professional websites and social media accounts because, as Amber, a composer and session musician from my sample argued: "if you're not present online even if you're the best composer that ever lived, you're not going to get any work". Nevertheless, I also recruited participants in-person at a musical performance (Lee), and through contact information on physical advertisements in a local venue (Toni). Users who publicly stated that their careers included roles such as composition, production, mixing, mastering, etc., were privately contacted to request interviews. The visibility of music workers allowed me to engage with a wider diversity of participants so 'music work' was portrayed from intersecting perspectives of gender, class, style, method, and ethnicity. I did not discriminate based upon the genre in which the music workers placed themselves, as long as they were professional or semi-professional, earning a proportion of their income from music creation in the western recording industry. Within the corpus of music work, I also diversified my sample based on their proximity to AIM including music workers who had experience with AIM systems or developers, and music workers with no experience of AI in music. This allowed me to engage with wide perspectives of how workers viewed their own and others' relationship with technology in music work.

Of the 112 people contacted for participation, 37 agreed to participate in interviews and/or observations; these are all detailed and pseudonymised in table 1 below. The project is focused on the western recording industry but is limited by a reliance on English-speaking participants owing to my own linguistic inadequacies. Despite this, data was collected with

participants who were operating in and/or nationals of 14 countries (the UK, USA, Ireland, France, Spain, Germany, Italy, Greece, Lithuania, Sweden, Australia, Argentina, China, and Japan) owing entirely to the lingual skill of my interlocuters. This reliance on bi- or multi-lingual participants in non-English-speaking countries creates a bias within my dataset, however, as their participation requires particular educational, class, and/or cultural backgrounds. Further to this point, there were a number of factors to consider in this methodological design concerning my own positionality and reflexivity.

RESEARCH PARTICIPANTS				
Music Workers				
Pseudonym	Role / Characteristics	Gender	Age	Method
Amber	Composer / Session Musician [Classical, Jazz, Pop, Choral]	Female, She/Her	50-59	Interview
Annie	Composer / Session Musician [Pop]	Female, She/Her	30-39	Interview
Cyril	Composer / Media Artist [Experimental] (AIM Use)	Male, He/Him	40-49	Interview
Dan	Producer / Beatmaker / Artist [Hip-Hop, Pop]	Male, He/Him	N/A	Interview
Dennis	Composer / Media Scoring / Sync [Orchestral] (AIM Use)	Male, He/Him	40-49	Interview
Dominic	Artist / Arranger / Transcriber [Jazz, Pop] (AIM Use)	Male, He/Him	18-29	Interview
Elaine	Artist / Producer [Experimental]	Female, She/Her	30-39	Interview
Helen	Mixing / Production [Pop]	Female, She/Her	18-29	Interview
Jeremy	Record Label: Head of Innovation [Pop] (AIM Use)	Male, He/Him	30-39	Interview
Lee	Performing Artist / Songwriter [Folk]	Male, He/Him	30-39	Interview
Melvyn	Artist / Producer [Pop] (AIM Use)	Male, He/Him	30-39	Interview
Morgan	Composer / Arranger [Orchestral] (AIM Use)	N/A	N/A	Interview
Regina	Composer / Performer / Sound Eng. [Folk] (AIM Use)	Female, She/Her	30-39	Interview
Toni	Recording / Performing Artist [Pop]	Female, She/Her	18-29	Interview
Zach	Mixing / Mastering engineer [Pop]	Male, He/Him	30-39	Interview
AIM Practitioners				
Pseudonym	Role / Characteristics	Gender	Age	Method
Adam	Doctoral Researcher	Male, He/Him	18-29	Ethnography
Ben	Doctoral Researcher	Male, He/Him	18-29	Ethnography
Christian	Research Fellow	Male, He/Him	30-39	Interview
Christine	Doctoral Researcher	Female, She/Her	18-29	Ethnography

	David	Doctoral Researcher	Male, He/Him	30-39	Ethnography
	Edward	Academic Staff	Male, He/Him	50-59	Interview
	George	Academic Staff	Male, He/Him	N/A	Interview
	Henry	Academic Staff	Male, He/Him	N/A	Ethnography
	Hugo	Academic Staff	Male, He/Him	30-39	Ethnography
	Jack	Commercial Researcher	Male, He/Him	18-29	Interview
	Joseph	Doctoral Researcher	Male, He/Him	30-39	Ethnography
	Julie	Doctoral Researcher	Female, She/Her	18-29	Ethnography
	Peter	Research Fellow	Male, He/Him	40-49	Interview
	Martha	Doctoral Researcher	Female, She/Her	18-29	Interview
	Mike	Senior Academic Staff	Male, He/Him	50-59	Ethnography
	Nathan	Academic Staff	Male, He/Him	N/A	Interview
	Oliver	Senior Academic Staff	Male, He/Him	N/A	Ethnography
	Philip	Commercial Researcher	Male, He/Him	30-39	Interview
	Ross	Research Fellow	Male, He/Him	30-39	Interview
	Samuel	Commercial Researcher	Male, He/Him	N/A	Interview
	Steven	Doctoral Researcher	Male, He/Him	30-39	Ethnography
	Tom	Academic Staff	Male, He/Him	N/A	Ethnography

Table 1: Research Participants

3.1.4 Reflexivity and Positionality

By engaging in interactive qualitative work 'in the field', this study co-created data through research actions that introduced participants' perspectives and my own interpretations without which the data would not have been generated (Mason, 2018: 21). The co-creation of data risks guiding responses and actions, necessitating reflexive design and practice to highlight my own influence on the research and prevent a blurring of the lines between data and interpretations (Mauthner & Doucet, 2003). Towards this, my methodological design separates stages of research based on a linear progression of my own mediating effect. This began minimally through participant observation with AIM developers [section 3.2.1], before increased mediation through semi-structured interviews with AIM developers [section 3.2.2]. Interviews with stakeholders in music work then represented the highest level of mediation as I used examples from my research in AIM development to question participants how AIM may impact their own experiences; for example, if a music worker could not imagine an AIM application I explained examples I had seen in AIM development (however, when it came to

it the majority of music workers were already familiar with AI applications in music). Despite this I maintained a position that all data was generated by both myself and the participants despite attempts to reduce my own influence.

Issues with reflexivity have previously been raised regarding projects that attempt to incorporate Bourdieu's methods of theorising ethnographic data. Sallaz (2018) uses Bourdieu's claims that ethnographers cannot inhabit or know the bodies of others through research to argue his methods are uncommitted to ethnography and that greater contextualisation and reflexivity are required in Bourdieusian approaches as a result. I disagree with this criticism along Bourdieu's line that 'others' can never be entirely embodied or known. Instead, I believe Bourdieu's rejection of knowing others is an example of the reflexivity that Sallaz is calling for. By acknowledging that other people are other, the researcher also must acknowledge that they cannot objectively understand their thoughts, perspectives, and experiences, and this must be accounted for within research. Hennion (1989: 421) argues that this separation of sociologist and actor is essential as it enables interaction with an 'other' that creates opportunities for new knowledge not as experience but as observation.

During data generation, it was important to maintain an awareness of my positionality, or the influence of my identity as a British, straight, white, cisgender male undertaking PhD level research that crosses the disciplines of music, sociology, and Web science. Van der Walt (2020: 64) argues that any aspects of any identity can influence research by directing assumptions and analyses based on the researcher's experiences. It was important to acknowledge firstly that I am a person in privileged social position that may have impacted participants' disclosure of feelings about their own positionality within their world. This wasn't a given, and many participants felt comfortable, for instance, talking to me about their experiences and feelings as female practitioners within male dominated disciplines. However, I achieved limited engagement with female practitioners in my sample of AIM participants (3 of 22). This is partly a result of the male domination in the field observed by Holzapfel *et al.* (2018: 50): I found and contacted 67 participants in AIM practice based solely on their subject relevance rather than considerations of gender, ethnicity, etc., and only 19 of this

sample were female. However, women who were contacted were also less likely to respond or participate in the study: only 15% of the women who were contacted participated, as opposed to 42% of the men.

Despite these considerations of my own impact on participant recruitment, the sample is broadly representative of the conditions of both general AI research where the proportion of new female PhD graduates has remained at around 20% for over a decade (Maslej *et al*., 2023: 312) and AIM specifically where only 14.1% of publications are led by women (Hu *et al*., 2016: 765). 14.1% as a proportion of the 22 AIM participants here is only decimally higher than the 3 female participants who accepted involvement in this study (13.6%). Nevertheless, my analysis includes a contextual understanding of the limitations of this sample and discusses the implications of gender imbalance in the field in its findings (see section 4.3.2).

Along with biological traits, my education and position placed me as an outsider in my participants' practices, entering the field site to ask questions about their practice as a social scientist. To ensure my own agency as the researcher and author of the study was understood throughout, I followed Skeggs' (2004: 129-30) advice by looking beyond the debate of who was speaking and who was spoken for, to include discussions of how my relations enabled the writings. On this note, I found that during the study, many conversations focused on the difference of experience between myself and the participants, some of whom had no experience of qualitative methods or research in general and questioned why I would value observing and talking to them. In efforts not to lead the participants' accounts, my responses to these conversations were of reassurance that I didn't need specific answers from them for the study to succeed, just an honest account of their experiences. Along with differences, assumed similarities were also present in data collection where participants used and expected me to understand jargon (e.g., 'autoencoders' or 'latent space' for AIM; 'transposition', 'mix automation', or 'bus channels' for music workers). Although I often had a working understanding of these terms, for better or worse there were also instances where I feigned understanding to limit interruption unless otherwise asked by the participant whether I needed an explanation. These instances highlight closeness or distance between myself and

the participants from which I contextualised my analysis by acknowledging how certain data may have been generated as a result of the relations between us.

During the ethnographic stage of research, I found that being a social scientist or outsider had the effect of drawing in a particular type of researcher and losing the interest of others. This was voiced a few times informally, where members of MusicEngine pointed me in the direction of particular people who worked with users rather than participating themselves. Then during an interview with Mike, a senior figure in the institute, I explained that as a result, many of the researchers in my sample were working on user-focused studies. Mike expressed surprise, arguing that the technically focused researchers made up much of their cohort:

> if they're focused on the technical side, they're less interested in the type of work that you do… that's really probably the larger side. You know, there's more people on that side in the department, in [MusicEngine], uhm, maybe I could prod someone to talk to you, it's not all that painful, I think you know, some people that they'll feel an insecurity of course. Being addressed by questions they've never really thought about or you know, and language they're not familiar with

This highlighted the need for reflexivity within participant sampling. As Kristensen & Ravn (2015, 731) observe, participants are more likely to engage with research that they already have a personal interest in. My sample reflected this as technically focused respondents that associated less with qualitative research were far less likely to engage with my project. Although I later added more of these practitioners on the 'technical side' to the project for interview, my sample wasn't representative of their ubiquity described by my interlocuters (5 of 20). This showed the importance of acknowledging that my sample was not representative of all views, and instead had a 'main voice' based upon the people that were more likely to participate (ibid, 734-5). This was not, however, a disadvantage as the motive of qualitative research is not to test hypotheses on scalable representations of the population but to analyse and explore how individuals make sense of their world (Biernacki & Waldorf, 1981, 145).

To circumvent some of these issues, I utilised my position as a member of the Web Science department with supervisors in music and sociology. These disciplinary labels allowed me to

choose how to describe myself to reflect the participant while remaining truthful about my own positionality. This building of rapport and a sense of shared knowledge with the participant could help to increase participation and candour in the research (Garton & Copland, 2010). When researching the second group of participants, the music workers, the biological or visible aspects of positionality and their impact remained. My background in music, specifically popular and commercial music, however, placed me in a less contrasting position than that between the engineers and social scientists in the first part of the study. This also presented potential problems for data collection, as a belief that I as the researcher was knowledgeable about the music workers' circumstances could lead to omission of information that they assumed I knew. For this reason, I stressed my position as a social scientist looking to gather information about their labour practices, rather than as a music graduate examining music creation work.

3.1.5 Ethical Considerations

The ethical considerations of this work began with the process of ethical approval, where I defined AIM developers and music industry representatives as the target groups for research using ethnographic observation and semi-structured interviews. Within this process it was agreed that data collection could take place in written and audio recorded format, where all audio data was transcribed verbatim and the recording deleted within two weeks of collection. Further, only participants who signed a consent form were included within the study through audio or written recordings. All participant data was stored on an encrypted, password-protected hard drive and contact information was destroyed after use. Redacted and non-identifiable data were printed as hard copies for data familiarisation and coding.

Regarding anonymisation, for the reasons laid out in section 3.1.1 regarding the rarity of large AIM research centres, I pseudonymised the institution in which ethnography took place as well as details that would make it identifiable such as the country in which it is based and its specific funding sources. I therefore describe this ethnographic field site (MusicEngine) as a European academic institute with multiple researchers and research outputs focused on the development of AIM with significant (multimillion) state and commercial funding. On

individual anonymisation, I used pseudonyms for participants, any identifying information was also either redacted or replaced in square brackets with non-identifiable versions (e.g., where a non-participating practitioner's name is mentioned, it would become '[colleague]'). Although some characteristics were collected such as gender and age information, participants could opt out of providing this information (marked N/A in participant table), and any information was diluted into non-specific categories (e.g., age was marked by 10-year ranges). Furthermore, descriptions of participants' job roles and institutions were important to this study, however these descriptions are explained in broad language throughout this essay (e.g., recording artist with experience collaborating with AIM developers). All of these strategies helped to prevent harm or identification within the study without diluting the meaning and context of any findings. These anonymisation strategies were important as they enabled participant candour – on multiple occasions participants asked me to reconfirm I wouldn't use their own or others' names before recounting particular experiences.

Finally, I acknowledged that the question of ethics must go beyond the practical requirements of PhD administration and towards a question of how the research generates new knowledge in an ethical way. In relation to the following sections on methods, interview question templates were submitted early in the process which served as the basic base of my questions. This ensured that the themes and content of interviews did not breach personal, institutional, and commercial confidentiality. However, questions were frequently changed through the process of tailoring interviews before and during their recording, but the themes of questions did not move beyond the scope of those included in the ethical approval process. In this respect ethical considerations are synonymous with reflexive practices, as it is the researcher's role in both data collection and analysis to not blur the boundary between the participant's narrative and their own (Mauthner & Doucet, 2003: 419). Towards these requirements, I also wrote field notes of my own actions, thoughts, and feelings during observations and interviews, and my words in interviews were transcribed verbatim alongside the participants'. I also considered my own effect on data generation in analysis, identifying

incidents where I believed responses may have been directly influenced by my own agency; where these may affect my findings they are declared in the analysis.

3.2 Research Methods

I discuss here the rationale, design, and use of the research methods used for data collection in this study.

3.2.1 Non-Participatory Observation

The dispersed and commercially sensitive nature of academic and commercial AIM practices previously discussed make engagement on an individual basis the most common method of data generation for this project. I was able to begin the project, however, in an academic institution (*MusicEngine*), where I was able to conduct ethnographic observation with multiple researchers (12) working on AI and Music projects. Here I could observe interactions, shared experiences, behaviours, and the settings of practices that are necessary for meaningful observable data in the context of this project (Mason, 2018: 139). This was the only single 'site' that multiple participants were linked to. Following Garton & Copland (2010), I conducted observations before interviews to build relationships and rapport with participants to aid discussion and candour under later questioning in interviews. This also enabled me to learn about my participants' perception of wider AIM practice, providing me both with a base knowledge of practices from which to expand interview questions and a better idea of what and where future interviewees could be found. The aforementioned linear progression of my own agency from the minimal mediation of observation to higher mediation of interviews also made it possible to observe fluctuations in participants' positions, which provided insight into how participants reacted to my own presence and questions as a social researcher. For example, there were topics or opinions that participants voiced during observations that were not repeated when questioned in recorded interviews.

Observations were undertaken in natural environments with limited mediation (the exception being the mediating effect of my presence as a researcher). This stage of research included around 80 hours of ethnographic observation through on-site visits and virtual meetings from June-September 2022, and one additional follow-up visit two months later. I was given facilities tours and observed office work, informal meetings, lunches, group meetings, 1-to-1 supervisor meetings, academic presentations, a performance, and online screen sharing of

typical work. I generated data through observation of researchers' actions and interactions, and through 'participant listening' of prompted and unprompted discussions, descriptions and explanations of AIM work. Forsey (2010) believes that listening is undervalued within observation because of the gap between what people claim to do and what they actually do. However, he argues that these claims, statements, and conversations are inherently a part of participants' action, and interest lies in the manifestation and mediation of this communication and its difference from observable action (ibid).

This observation period also facilitated the building of AIM worlds through exposure to the context in which work takes place in engineering environments. Mackenzie (2017: 22) argues that machine learning practice is inseparable from exposure to secondary research texts, papers, and events because programmes are built not only on a developer's abilities and code but a complex web of data and knowledge accumulation. Towards an understanding of this construction, Henderson (1993) observes that engineering is often observable through the less tech-heavy medium of hand-drawn diagrams, models, problems, and code which are often used by engineers to communicate problems and solutions that can be observed. For these reasons, observation was not limited to participants and events, but the environments too. I had an agreement with the head of MusicEngine to be accompanied on-site by volunteering participants, primarily because I required their access cards to gain entrance to buildings and offices. This meant that I spent time onsite with one AIM practitioner at a time; however, I would walk around the offices both to give my participants breathing space, and to make notes on the environment. In addition to gathering data on the general interactions of practitioners and attempting to recruit new participants, I observed the traces of non-present practitioners within sparsely occupied offices through the books collected on desks, the technologies used, and writing and drawing on notice boards. However, I was careful not to touch or make notes on any private work that non-consenting practitioners had done. In sections 4.1 and 5.1, I discuss in further detail how these observations impacted the study and findings of this thesis.

For reasons previously discussed, some observable work only existed in a digital, remote settings. To observe this digital work, I utilised video calling and screen-sharing software to

observe short excerpts of typical solo work. This provided participants with an option of when and what I observed, generating knowledge of how the participants wanted their work to be perceived through more overtly mediated interactions (Hine, 2000: 38; Murthy, 2008; Tummons, 2017). The data collected during digital observation therefore contrasts physical observation data because it is purposefully generated by the participant, offering limited insight to 'typical' practice. Greater insight into the culture can also be established through the connections with, and assumptions assigned to the researcher as an outsider when participants mediate and communicate their work (Burrell, 2009: 195). A fact that was seen on many occasions where participants assumed and assigned various combinations of disciplines and skills to me from computer science to music, to sociology. This was negotiated by maintaining vague descriptions in line with what the participants assumed without misrepresenting myself; for example, if participants assumed that I worked in computer science I would explain my position in the Web Science department and say I was using sociological methods within my thesis. This neither confirmed nor denied their inclinations while maintaining honesty between myself and the participants.

Data was recorded through three types of fieldnote. Firstly, through synchronous field notes in a small pocketbook to reduce blatancy of notetaking and ensure participants' comfort with my presence. Then, an asynchronous (but onsite) account of my experiences, observations, paraphrased conversations, and descriptions was hand-written in a diary format. This was done to maintain proximity to the actions I was recording without appearing to physically record everything my participants did as they did it. After leaving the ethnographic field site, I read through the first two types of notes to type out a final retrospective account of any information I recalled that was unrecorded, and any reactions and feelings I had about what I had already written. All of these accounts use basic language to create an intertextual account that Clifford (1990) argues is essential to ensure that research is an interpretation of the culture being studied, rather than an interpretation of the descriptors within my field notes. However, by changing the format and medium of data collection between my synchronous (small pocketbook), asynchronous (A5 field diary), and retrospective (digital document) accounts I ensured that each stage of description was identifiable by its spatial and temporal

distance from the field site. Mason (2018: 160) argues that methods of recording data affect researchers' ability to read and evaluate these notes in literal, interpretative, and reflexive ways. My accounts therefore integrated the distinctions between these perspectives by making data identifiable by its distance from the field.

To conduct this study, I gained written consent from all of the participants who I specifically observed, interviewed, and discussed. Access to field sites was coordinated by first acquiring consent from senior figures within institutions, who then disseminated information to the members of observable departments to ensure everyone was aware of my activity and had the opportunity to voice concerns or oppositions to my actions. This allowed me to take notes on the general environment in which my specific participants were involved while any discussion of people within field sites that had not signed consent forms are not directly discussed within the analysis of this paper, however generalisation may be noted regarding their presence in the environment.

3.2.2 Semi-Structured Interviews

Data in this thesis is largely generated through semi-structured interviews. After using the field site of MusicEngine as an entry point to AIM, I conducted interviews to engage with AIM developers in a larger diversity of environments, and with a wide variety of music workers. This included a scale of practitioners based on their relation to technical and artistic work in music: AIM developers, music creation workers with experience using AI, and music creation workers without experience using AI. There was no threshold for the number of participants; interviews were conducted until a wide range of roles, backgrounds, and identities were included, and novel themes diminished among them (Fusch & Ness, 2015). On completion, I had conducted interviews with 35 participants, including 20 with AIM practitioners conducted between June-December 2022 and 15 with music creation workers conducted between January-April 2023. These interviews ordinarily lasted between 60-90 minutes each and generated 363 pages of transcript data.

Interviews were conducted both online and in-person (usually at a neutral location such as a public workspace at the interviewee's request) to be flexible to participants' needs. Deakin &

Wakefield (2014) observe that online interviewing holds the potential to limit participation within research because of technological access. By offering either online or in-person engagement, I attempted to mitigate such issues of access; these issues were minimal, however, because AIM participants expertise in technological research and music workers' perceived need for digital presence in their careers created a field which often exists largely online. Also, similarly to Deakin & Wakefield's (2014: 607) experience, the flexibility and normalisation of video-conferencing technology was often preferred by participants (31 of 35 interviews took place online), suggesting respondents were more comfortable with the format.

Interview data was audio-recorded and transcribed verbatim. This entailed accurate documentation of all speech within interview recordings, with accentuation marked in *italics*, pauses marked as '[…]', and identifiable language replaced with non-identifiable language [in square brackets]. This transcription allowed me to immerse and familiarise myself with the data before coding and analysis began (Braun & Clarke, 2006: 87). All quotes used in this thesis derive from either these interview transcripts, or from field notes taken during observations with participants. Although all data itself is co-created or generated by the researcher, quotes from interview data is purposefully differentiated from fieldnotes in the analysis as verbatim interviews are not directly framed by the researcher's perception but the participant's actions, as argued by Clifford (1990). To ensure this participant action was captured, expressions were kept in the scripts (e.g., 'uhm', 'ah', 'you know', 'like'), including my own as the interviewer to avoid editing out representative interactions and social cues (Poland & Pederson, 1998: 302; Silverman, 2017). However, some linguistic subtleties such as perceived emotion, pronunciations, and exact pause length that are essential to discourse analysis were not included as they are not necessary or relevant to thematic analysis (Braun & Clarke, 2006: 88). Audio-recording facilitated active listening to participant responses rather than a focus on data collection, allowing me to engage with the ideas presented through expanded questioning and two-way discussion (Mason, 2018: 124-6). These methods of documentation allowed me to generate thicker descriptions from the data. Data beyond the text such as accentuation, pauses, and notes on body language,

however, must be viewed as my own interpretation of events rather than an exact account as is demonstrated in the verbatim text (Mason, 2018: 133).

A semi-structured approach to interviews was taken to tailor questions to participants, to follow unexpected questions and trajectories, and to probe detailed responses through the expansion of existing questions (Braun & Clarke, 2013). I began with two interview question templates that were designed for AIM developers and music workers respectively. These questions were written as general queries into both the issues raised in the literature and the research questions of the thesis. For example, to understand the relation between technical and musical innovation in AIM practice as is the focus of my first research question, I frame interviews around five broad areas of examination. These included general questions about the participant's practice (and the representativeness of their work during observation if I had previously observed their work) and the wider practices of AIM that they have observed/experienced. Building on issues raised in my ethnographic observations where I found a wide variety of disciplinary backgrounds (see section 4.1), I also asked about the nature of disciplines/interdisciplinarity in AI and Music and the influence of this on their own/others' views of their practices. To understand the integration of social/contextual considerations in AIM I asked questions around the growing calls for AI ethics and their relation to their own practices. Finally, I asked about the impact of AIM on society, questioning how the technology was intended to be used and its benefits and risks therein.

Interview questions for music workers were similarly structured from the broad to the specific. I began with a general inquiry about their work, experiences, and feelings in professional music practice, then moved on to discussions about their general uses and interactions with technology to establish a picture of the participants' sociotechnical experiences to inform my second research question that questions the relation between AI and existing technology practices in music work. This background allowed me to then move into specific questions about AIM, how they felt about the technology, its development, and its impact on their past and future work. Discussing AI with music workers who had little AI experience was aided by contemporary media coverage of the text generator ChatGPT which was released in autumn 2022, a few months before I conducted music worker interviews in

early 2023. The media and public interest in ChatGPT meant that even for those who had no practical experience, the concept of generative AI had become familiar. For those whom it had not, I explained in simple terms how AIM could generate and recommend for example, musical content such as melodies, chord progressions, rhythm, lyrics, and sound; it did this, I explained, by learning the conventions of music from existing data such as audio and score to varying degrees of success.

With both AIM and music worker participants the broad themes of interviews remained the same, but I rarely asked the same questions across interviews save a few introductory examples (e.g., 'how would you describe your research?'; 'what do you believe are the objectives of AIM development?'; 'what role does technology play in your interactions with music?'). These questions that did remain the same were included as entry points to topics with the intention of prompting interaction and further questions that followed the participants' responses. Before each interview, I researched each participant's background and context as Hesmondhalgh & Baker (2013: 16) argue this allows the researcher to detect candour and evasions. However, to avoid guiding the participant into pre-determined narratives I still approached interviews with what Forsey (2010: 568) calls an 'ethnographic imaginary': asking questions that probe into biography about the subject beyond the immediate concerns of research questions with the 'inductive spirit of ethnography'. This was made possible through long form interviews of 60 to 90 minutes, where participants could discuss their own character, motivations, influences, and even how they felt about talking in an interview setting. From these more informal beginnings I was able to follow the participant's narrative as they became more comfortable throughout the interview, limiting (but not preventing) my own guiding influence on the interviewees' responses. On this point, when reading my transcripts I noticed that a large proportion of my questions began with phrases such as 'you said…', 'we talked about…', these confirm that my actions frequently followed the participant's responses rather than a rigid structure, as can be seen in the examples from interview transcripts below:

> [R] You said it's something people should be thoughtful about. Do you think people in your field are, generally? (from interview with David, AIM practitioner)

> [R] Right, yeah. And you started by saying you could be in danger if AI could, could create a whole song that sounded like yours. Do you have similar feelings about other uses of AI in music? (from interview with Dan, music worker)

Interviews have become a familiar format of communication within western culture: news, pop culture, and journalism among others have created an 'interview society' where most are accustomed to their practices and norms (Silverman, 1993; cf. Holstein & Gubrium, 1997). They therefore provide a familiar format for participants to discuss ideas surrounding their own perceptions and experiences and can introduce new questions and ideas in an understandable way. However, Austin (1989: 236) argues that except for 'performative utterances' (where performance or action is embedded in speech such as: "I consent"), speech is often seen simply as an outward projection of performance, not linked to the action itself. In short: what we say we do and what we do are not mutually exclusive. This means that interview data cannot be treated as objective truth. The information derived, however, remains particularly invaluable as 'outward projection' is part and parcel of both scientific practice where rhetoric is used to establish specific constructed knowledge as objective truth (Haraway, 1988: 577), and the communication of artworks to audiences. In this way, mediated communication forms a part of technoscience and artistic practice that this project is researching.

Within qualitative research, objective truth is often not the aim. I did not undertake interviews to mine data or absolute truths from respondents, but to generate data with them, to understand their experiences and perspectives on the research questions of this project (Mason, 2018, 21). Shortly after beginning these interviews, however, participant responses – particularly in AIM development – displayed attempts to give broadly factual answers, going to lengths to highlight non-facts as was demonstrated by Julie, an AIM practitioner:

> This is *just my gut feeling*. It's *not supported by any like scientific evidence*. I feel recommendation system for producer […] this is a new topic, but just because it hasn't been introduced to the music tech research industry, it's not because it's like a new technical field. [my emphasis]

Therefore, to help participants relax, and to communicate that I did not want objective truth but their perceptions, I began interviews by paraphrasing: 'I'm going to ask you about your own experiences and feelings within the field' and ensured that questions were phrased 'what do you think' or 'why do you believe'. Austin (1989: 78-9) shows that this framing of questions limits confrontation and allows expansion: asking *why* respondents *believe* something, for instance does not challenge their beliefs, but asking *how* they *know* something challenges that knowledge as fact. This reflexive practice allowed me to actively adapt interviews towards participant insight.

Beyond the specific data collection of the interview, I also collected ethnographic notes of my encounters with participants, such as where they wanted to meet, our communications while planning interviews, and any information that was produced in the time before and after interviews were conducted. Fujii (2015: 536) argues that accidental stories and encounters such as these can be valuable in showing participants' social relations, contexts and how they react to researchers in less mediated formats, informing the way that ongoing data collection and analysis can be expanded.

3.3 Data Analysis

The data collected throughout this project was analysed thematically, by 'identifying, analysing and reporting patterns (themes) within data' (Braun & Clarke, 2006, 79). The significance of these themes could then be interpreted within the context of both their independent generation (the construction of knowledge through the research methods), relevant literature, and theoretical framework to show their meaning for my research questions (Braun & Clarke, 2013: 207). Thematic analysis is applicable to long form written accounts within field notes and interview transcriptions because excerpts and quotations can highlight the constructed experiences of participants, and themes across them can be interpreted (Aronson, 1995; Braun & Clarke, 2006).

This thematic analysis was at first approached through an interpretivist lens which Mason (2018: 3) writes is a strategy of building understanding that is informed by participants' perspectives. However, Atkinson (1992: 18-19) claims that interpreting a social world through ethnographic writing is an act of reconstructing that social world. Interpretivism can therefore not be applied without a parallel constructivist effect as one facilitates the other: data is interpreted until the researcher is able to construct a new understanding from that data (Van der Walt, 2020: 62). To ensure meaningful data and analysis was created within this project, data was interpreted to generate understanding from the ground up, before constructing findings through the guiding structures of my theoretical framework and research questions in an interpretivist-constructivist approach. Bourdieu argues that a common fallacy of social research is the projection of the researcher's own constructions into object of study without acknowledging they are only possible through their intervention (Bourdieu, 1981: 305). Consequently, my interpretivist-constructivist approach avoids this fallacy by highlighting throughout the analysis where and how my assumptions were affecting the research.

3.3.1 Transcription and Coding

Because I conducted research with two distinct groups (AIM practitioners and music workers), the following coding process was completed twice to incorporate the focus of each

group on different aspects of AIM (development and use) and therefore produced different codes. The first group was carried out in full before moving on to the second to maintain familiarisation with the transcripts and codes throughout the process. However, once coding was complete, the codes of both groups were excerpted and analysed together to find the themes that emerged between them in the context of the research questions of the study.

Analysis began with transcription, allowing me to familiarise myself with the data. Once the transcripts were written, I conducted an initial read through by listening to the audio at a faster playback speed while following the text; this allowed me to both check the document for errors and make initial notes about their content. This was completed within two weeks of each recording before the audio data was destroyed. Once all interviews had been conducted, the formal analysis process began with a second full reading of all field notes and interview transcripts before any coding took place. Any further ideas were recorded as memos during these stages based on my own reactions to the data, but were recorded separately from the data to ensure they did not impact the coding process.

Finfgeld-Connett (2014) argues that there are two methods of analysing qualitative data: data-driven inductive coding that is undertaken without pre-conceived codes, and deductive coding that utilises a template based on research questions and adapts them through action. There are risks to both as the meanings of data can be obscured through overly specific labels in the first instance and confirmation bias in the second, but inductive and deductive methods of data analysis can be combined in a systematic process of analysis. Watts (2014) claims that these two methods of engaging with data can be alternated based on the proximity of analysis to data. He argues that first-person analysis (deriving codes and themes solely from the words of the respondent) represents closeness to data as is seen in inductive approaches. This should then be combined with a third-person analysis from the perspective of literature and theory, this can be used to identify and select relevant extracts after coding to enable distance that connects the data to the world (Watts, 2014). By approaching analysis through this combination, all perspectives in the data were observed and contextualised within my research questions.

Braun and Clarke (2006) present a broader conceptualisation of the process of thematic analysis that nonetheless shows the value of this process of beginning 'close' to data before expanding beyond the individual participants. Their semantic approach to analysis argues for the use of participants' words to demonstrate the progression from organised descriptions into patterns, and an interpretation of those patterns' meanings through contextualisation: initial coding is specific, interpretation is broad (ibid: 82, 88). The use of the respondent first-person and literature/theory third person facilitated this specific analysis before introducing my own voice through interpretation.

Analysis therefore began with an initial pass of first-person data coding in which codes were generated from the participants' data beyond my own research questions or theoretical framework. In this pass, I randomly selected 3 interview transcripts and a single day of field notes from the AIM practitioner dataset, descriptively coding each in isolation based on what was being said. Once these were coded, I grouped the codes where they overlapped and narrowed down the topics discussed into broad codes that were then applied to the whole AIM practitioner dataset before repeating the whole process with the music worker dataset. Some of the codes (e.g.: 'AI Impact') existed in both groups of AIM and music work, but others (e.g.: 'AIM Design Considerations', 'Music Career Decisions') were exclusive to their group. I therefore conducted each pass of coding on the datasets separately: a second pass broke codes down into subcodes based on their subject; and a final third pass was used to interpret how the participants were talking about the subjects in the codes individually and across the dataset. These final interpretations constituted the themes of the dataset. For example, the original code 'AIM Motives' broke down into subcodes of 'artistic', 'technical', and 'economic', with themes such as 'AI Job Security' and 'Subject Allegiance' emerging. After these three passes, I had created 7 codes, 21 subcodes, and 65 themes for AIM practitioners, and 5 codes, 11 subcodes, and 46 themes for music workers.

Finally on the practicalities of coding, I conducted the first pass of interviews on paper to ensure focus and familiarity with the dataset, while also ensuring the shortcuts available on computers and in software such as word searching, counting, and classification were not used. I continued with this method for the second and third passes over field notes that were

written by hand, but for the second and third pass of interview transcripts I used NVIVO coding software to enable seamless switching between data in their original context and in the new context of their newly coded groups to find where the arguments and themes appeared in the narratives of both the individual and the group.

3.3.2 Excerpting and Interpretation

Watts argues that themes and excerpts should not be selected for analysis simply because they are prevalent in the dataset but based on their 'capacity to support, qualify, question or outright contradict some accepted aspect of the relevant literature' (Watts, 2014: 7). The prioritisation of themes based on number of occurrences is a method usually seen in content and quantitative research, where similar analysis can be achieved through more sophisticated means with larger samples (Vaismoradi *et al*., 2013; Watts, 2014; Silverman, 2017). Once coding had been conducted closely to the dataset, themes were then chosen for their relevance to the research questions of this project, and excerpts selected based upon both how well they represented their theme in the dataset and completeness of their points (e.g., where participants had described and explained their perceptions, experiences, and views). For this reason, excerpts were often more than a few lines long.

This approach aligns with Silverman's (2017: 152-4) view that grouping excerpts together as they correlate to demographic data (e.g., age and gender) is the remit of large-scale quantifiable surveys and not qualitative interview analysis. Instead, he argues that the researcher should ignore these known identifiers and focus on participants' actions and interactions in the data (ibid). Therefore, to address the first research question in Chapter 4, I select excerpts that engage with the construction of AIM conditions discussed in section 2.1.2. Rather than pre-defined identifiers, this approach exposes identifiers based on the on actions, perceptions, and experiences in the dataset. I then analyse these identifiers together through their varying degrees of exception from one another. This method of analysing and organising the field of study follows both Becker (1940: 46) and Bailey's (1994: 22-4) typological approaches where differences present in individual experiences can be built up to prevent excessively general claims being made about the whole dataset.

A similar approach is taken in Chapter 5 by building on the literature of section 2.2.2, but because music practices are already well researched in the literature, I focus on a narrower context of technological use that exists within these practices to provide context-specific foundational information for my second research question. Unlike Chapter 4, where my theoretical framework is used to interpret individual excerpts that are organised through a wider typological structure, I use Bourdieusian concepts of field and capital within my theoretical framework to both analyse individual excerpts and organise my findings. These approaches are guided by the nature of the data and my analysis of AIM and music work as sociotechnical practices in relation to my research questions. I also begin both chapters by 'setting the scene' through ethnographic accounts of the AIM field site and its relation to music work as I introduce the former and the latter in respective chapters. Finally, the findings of Chapter 6 are not organised by any theoretical or practical structure. Instead, I present a comparative analysis of both groups' perspectives on construction and impact of AIM towards the second research question of this thesis and its overall aim to understand why AIM is meaningful for music work. This chapter is unorganised in this way because of the nature of its data; I do not group together speculative and experienced perspectives but instead present them as non-exhaustive case studies to highlight their multiplicity.

On a final practical note, excerpts are presented in the text in two ways: interview extracts are indented as any other long quote would be, and extracts from field notes are indented in italics to differentiate. This is necessary not just to identify the source of data but because of the differing nature of each type of data. The former is a verbatim representation of the participant's voice, and the latter is a recording of my perceptions, observations, and experiences that construct the research site (Atkinson, 1992: 18-9).

Chapter 4 AIM Practice

In this chapter, I present findings from data generated with AIM developers. After introducing the field site in the opening section, I examine AIM practices by constructing a typology that identifies the different types of practice in my sample: technical, applied, and user approaches. Within this, I will set out how state, industry, and institutional influences shape practices through the establishment of deep learning as a form of specific cultural capital, and AI as a form of non-specific meta-capital that practitioners compete for. This typology highlights how practice is separated into stages of development comprising foundational capacity, practical applications, and functional optimisation.

The final section examines whether these stages are connected as a coherent whole. This builds upon issues identified in the literature regarding limited contextual engagement in AIM design with the social music world (e.g., Holzapfel *et al*., 2018; Born, 2020; Porcaro *et al.,* 2021; Morreale, 2021; Holzapfel *et al.,* 2022; Huang *et al.,* 2023), finding that although applied and user types attempt to address these issues, their influence on, and cumulative development of technical innovation is limited because they are alienated through the materials and paradigms of the dominant technical approach. This understanding of practice enables an in-depth examination of how AIM is impacting music work, which will constitute the focus of later chapters while referring to the findings here.

4.1 Entering the Field Site

I had imagined, entering the world of artificial intelligence practitioners, to find one of two environments: the bright, collaborative workspaces littered with interactive technologies rumoured from within Google's offices; or dark, closed rooms with brilliant programmers 'plugged in' to computers, endlessly churning out lines of code. I got neither. In both of my assumptions there was an expectation of cutting-edge technologies that enable innovative development in a world alien to my own. Instead, during my ethnographic visits to MusicEngine there were ordinary university buildings, and white-washed offices with groups of desks and office dividers. Although many people referred to the spaces as 'labs', it was hard to distinguish them from any other office. Available technology was rarely used; monitors stood dormant with posters taped to their screens, indicating their value to the practitioners. Despite this invisibility of office technology, where the monitors were used, they drew attention to other out-dated aspects of this fast-moving world, standing atop textbooks and coding-language manuals whose only usefulness was seemingly in their thickness for raising the height of an unergonomic machine. Most practitioners used their own laptops, switching between windows of their work and online examples and forums where engineers discussed more specific problems than could be solved through standardised monitor-stand textbooks that scientists often avoid (Haraway, 1988: 576).

Perhaps for this reason – that some physical locations have kept pace with the perception of AI work as cutting-edge – the offices were sparsely populated. Despite frequently being told that it was unusual for the offices to be this quiet, I saw no sign of increased numbers during my observations. The spaces that could comfortably accommodate a hundred people never had more than ten occupants. In my field notes, I observe the social effect of this environment, creating communal yet secretive talk between one of my participants, Julie, a doctoral researcher in her twenties, and her colleague:

> *4 people sit working individually, most with headphones on, the working environment appears more social in this smaller office. Some discussion takes place regarding non-specific work such as upcoming milestones, use of language in texts. Julie is*

> *approached by a colleague, and she simplifies an explanation of what she's doing with an industry-provided API to 'surfing the web'.*

Although Julie was very friendly with her colleague and they discussed several topics, there was rarely any discussion of their work. This theme continued through other discussions during my visits, where people spoke of the cross-over of interests between practitioners because of their practice topics. However, it was when specialisms became more detailed that practitioners began to perceive and draw boundaries. Although some practitioners discussed and advocated for certain approaches, methods, datasets, etc., others kept talk vague, which my interlocuters believed was to avoid ideas being stolen. Others drew the line more definitively, saying despite a generally social environment, that 'technical' people were more likely to be solitary. I experienced some examples of such incommunicativeness with practitioners during my observations at MusicEngine:

> *There is one other student in the room, I have seen them here before on a visit when Ben attempted to introduce us but they said they couldn't talk. Julie attempts to speak to them now, but they are in a meeting. Once it finishes, they immediately leave the room. On their return they leave for the day without removing their headphones, giving a silent wave as they leave. Two attempts to talk with different intermediaries on different days without success, I can't help but feel like I'm being avoided.*

The view that certain practitioners were avoiding me was possibly biased by my *need* to collect data with consenting participants. My judgement of the situation may have overinflated the actions of this practitioner from passive disinterest to active avoidance, but it was nonetheless my perception at the time. I did, however, observe and hear about a culture of both collaboration and boundary-making at MusicEngine, but with little consensus on common conditions that separated and connected practitioners. This could be a result of interdisciplinarity that incorporates music and computer science among other things, causing participants to have different interpretations of what the practice was. Mike, a senior leader at MusicEngine talked (somewhat jokingly) about the interactions of these disciplines as 'turf wars' in which practitioners see their own specialisms as the 'centre of the universe'.

These features of practice have already been alluded to from an external perspective where engineering dominance is argued as negative disciplinary approach that should be abandoned in favour of agnostic approaches to all disciplines involved (Born, 2020: 200). They have also been dissected from within, where the remoteness of the site of AIM from its context of use is argued as a potential source of bias (Holzapfel *et al*., 2018: 49; Porcaro *et al.*, 2021). I add to these by examining the differences and commonalities of individual experiences within the habitus of AIM, where my ethnographic observations first hinted these broad boundaries between engineering and music, developers and users, represented the surface issues of the complexities of practice. Through the habitus of my participants, I therefore examine these complexities through the construction of a typology of the approaches to AIM, and how they form a coherent whole. This builds on the issues highlighted in the literature through an understanding of how and why these conditions of practice are created and their meaning for the direction of AIM.

4.2 A Typology of AIM Practice

To examine AIM practice and its 'turf wars', I use the individual perceptions of practitioners to construct a typology based upon my sample. Becker (1940: 41) argues that the construction of typologies avoids an excessively general knowledge created when the differences within a field of study are overlooked. These constructed types are not introduced through parameters that all participants exemplify; instead, each type is built up through individuals' experiences that are linked with varying degrees of exception (Becker, 1940: 46; Bailey, 1994: 22-4). Types are therefore constructed through the practice approach of this thesis, examining the assemblage of embodiment, materiality, and discourse in the habitus.

AIM PARTICIPANTS – PRACTICE TYPOLOGY				
Technical Approach				
Pseudonym	Role / Characteristics	Gender	Age	Method
Mike	Senior Academic Staff	Male, He/Him	50-59	Ethnography
Julie	Doctoral Researcher	Female, She/Her	18-29	Ethnography
Christian	Research Fellow	Male, He/Him	30-39	Interview
Peter	Research Fellow	Male, He/Him	40-49	Interview
Hugo	Academic Staff	Male, He/Him	30-39	Ethnography
Applied Approach				
Pseudonym	Role / Characteristics	Gender	Age	Method
Adam	Doctoral Researcher	Male, He/Him	18-29	Ethnography
Christine	Doctoral Researcher	Female, She/Her	18-29	Ethnography
David	Doctoral Researcher	Male, He/Him	30-39	Ethnography
Edward	Academic Staff	Male, He/Him	50-59	Interview
Henry	Academic Staff	Male, He/Him	N/A	Ethnography
Jack	Commercial Developer	Male, He/Him	18-29	Interview
Joseph	Doctoral Researcher	Male, He/Him	30-39	Ethnography
Nathan	Academic Staff	Male, He/Him	N/A	Interview
Oliver	Senior Academic Staff	Male, He/Him	N/A	Ethnography
Philip	Commercial Developer	Male, He/Him	30-39	Interview
Samuel	Commercial Developer	Male, He/Him	N/A	Interview
Tom	Academic Staff	Male, He/Him	N/A	Ethnography
User Approach				
Pseudonym	Role / Characteristics	Gender	Age	Method
Ben	Doctoral Researcher	Male, He/Him	18-29	Ethnography
George	Academic / Comm. Developer	Male, He/Him	N/A	Interview
Martha	Doctoral Researcher	Female, She/Her	18-29	Interview
Ross	Research Fellow	Male, He/Him	30-39	Interview
Steven	Doctoral Researcher	Male, He/Him	30-39	Ethnography

Table 2: AIM Participants – Practice Typology

The figure above organises the participants of this study into the three types: technical approaches that use musical data to develop foundational technical models that can be used across numerous contexts; applied approaches that attempt to bridge the gap between technical methods and musical context by developing specific use-cases; and user approaches that examine and develop how AIM use-cases are experienced by users. This section shows how and why these approaches are constructed.

4.2.1 The Technical Approach

It may seem obvious that technical work is required to develop AI. The technical approach in AIM, however, refers to the development of technical methods and models as the primary objective of practice, using music as a resource to achieve these objectives. I begin the examination and construction of this type through the technical motivations of practice. Christian, a visiting research fellow at MusicEngine in his thirties began his career as an electrical engineer before discovering a link between his skills and audio machine learning. He describes the constraints of model improvement as a driving factor of his current practice:

> transcribing music, for instance has a really big difference with speech recognition because when you do speech you have a single voice that is happening all the time so in that field let's say the models that are being studied – obviously they can improve – but let's say the trend is really close

Christian has chosen to engage in his practice because of the technical complexity and novelty of the challenge. The close trends of what he considers to be well-researched, and less complex areas such as speech recognition makes it difficult to make significant improvements – music is seen as a topic that doesn't hold such constraints. Christian's practice also exemplifies how the technical objectives of AIM are socially shaped, where 'politics and negotiation are key processes through which technical possibilities are, or are not, put into practice' (Wajcman, 2006: 777). He makes active decisions to work on particular forms of technological design over others through negotiations regarding the constraints of his field, positioning himself for success in AIM through technical rather than musical perspectives. In addition to this social negotiation of the technical, this approach is

shaped by the material agency of its methods. Hugo is a senior academic at MusicEngine who views his position as a data scientist as the core of AIM practice observes how AIM has emerged because of model capacity:

> my community, the MIR community was mostly restricted to analysing music data, but there's been clear evidence that, sort of the methods that can analyse data or can be versatile methods to generate or create music as well. And we see that sort of uhm, an increase in papers in the MIR community that are about computational creativity whereas before the communities were slightly distinct

Where Christian's rationale is based on the social conditions of standing out from the fine margins of technological practice, Hugo observes a transition of topics within AIM from music analysis to music creation, afforded by technical capacity. The technical approach to AIM is therefore constructed through practitioners' responses to perceived social and technical conditions. ANT suggests that these conditions are always related within a network, enabling further examination of the influence of technical capacity that Hugo discusses (Latour, 1994: 33; Sayes, 2014: 143-4). If the output of practices changes because of technical capacity, the emergence of that capacity can also be examined within the network of AIM. Christian explains that capacity increases such as this result from social decisions to pursue technical progress with an indifference to the significance of its output:

> I think that simply doing this transcription has a lot of connections with a lot of fields to make advances. Again, why would we be interested to have a model that is capable of multi-dimensional sequences or whatever? So far, we don't know, maybe we'll see in the future.

Although he sees his advances as connected to other fields, they are not his objective as the purpose of his actions are to make improvements to the technical model he is working on, despite the ambiguity of its uses. The technical approach therefore uses music as a resource and by-product of technological improvements, but music is not a factor in the social negotiation that shapes the technology. By using emerging capacity to direct practice, the technical approach reflects the aims of computational creativity, where machine capabilities are argued to be limited by human involvement (Loughran & O'Neill, 2017). Rather than

developing technology for a certain application, practitioners develop technical artefacts until their capacity enables applications through computational means. Mike, a senior leader who praises the interdisciplinary strengths in the institute nevertheless extends this approach to a *need* for technical work to be isolated from contextual aspects of design:

> there are theoretical or *technical problems that need to be solved independent of the users*, because in fact the solution will be useful across a whole range of different applications and products and users [my emphasis]

Mike distinguishes the focus on technical problems from other aspects of AIM but also introduces rationale for that distinction. The value of technical practice extends to its exclusion of other contextual aspects of AIM development work because separation allows more general applications of his technology. The technical agency that facilitates the transition from music analysis to creation is in turn facilitated by the detachment of the technical approach from the specific contexts of its topics. These findings confirm the isolation of technical development discussed within the literature, but they depart from the growing view in the literature that isolation is a weakness in design (e.g., Born, 2020; Morreale, 2021; Huang *et al*., 2023). They instead argue that isolation enables greater and wider technical advances, reflecting the desire for objective solutions to AIM as scientifically aligned practice in the literature (Agres *et al*., 2016; Loughran & O'Neill, 2017). In wider AI development, Aitken (2023) argues that the isolated development of foundational models is common, as they can be separately contextualised for specific applications on the condition that foundations can be scrutinised. I will therefore examine how the boundaries of the AIM typology co-exist, and how this impacts this separated process of foundation, contextualisation, and scrutiny in section 4.3. First though, I expand on what is being referred to when the literature, my participants, and interpretations discuss technical approaches.

4.2.1.1 Deep Learning Capital

Within the technical approach, the majority of practitioners value and compete for dominance through a specific focus on learning models. My participants most frequently focus on deep learning, where multiple layers of neural networks are used to identify, predict, and generate

information (sound) from large, often arbitrary datasets (Briot, 2020: 1). They also refer to 'neural networks' here, but as Cope (2021: 169-70) argues, both 'deep' and 'neural' networks ebb and flow in popularity in the field despite the current popularity of deep learning. I use 'deep learning' as an umbrella term to encompass both of these models, following Seaver's (2018) view that no variations of practitioners' understanding should be excluded through strict predetermined definitions. I argue that deep learning acts as a specific cultural capital in AIM practice that strongly influences the technical approach. David is not a technical researcher, but is in the final stages of his PhD and has observed how he and his colleagues have all been influenced by deep learning, although some focus on it more than others:

> everyone here at some point makes a neural network, right? Uh, some people might make one, that's good and does what they want it to do and they write about it, that's probably where I'm going to be at. And then they do all of the other stuff surrounding their topic… And then there is going to be people who maybe make two or make three and maybe like write paper a year… they're going to be scratching their head going like "if I change my learning optimizer in this way, that's never been done before I can revolutionize AI and generative AI completely"

Deep learning has an omnipresence within AIM. Despite differing objectives, all practitioners dedicate some time to the development of these methods that have seen a rapid rise in use within AIM and the wider AI field (Briot, 2020; Cope, 2021: 169; Micchi *et al*., 2021: 264). David also introduces the differences of value placed on this technical method. For technical practitioners, deep learning is not a matter of routine, but a method that they aim to develop and gain dominance over. It is therefore a specific capital in Bourdieusian terms as practitioners view their ability to embody its skills and knowledge as something they can compete for to gain advantage (Everett, 2002: 70). Ross, a postdoctoral researcher whose practice represents the least technical approach to AIM (more on this later), acknowledges the value of deep learning and explains why it has become an important feature of the practice:

> there's definitely a trend effect that's for sure. Like, but there is a trend effect because it's very efficient, like let's not hide that like it does wonderful stuff like it is able to learn stuff very, very efficiently.

Ross argues that deep learning methods are used because they work, which causes a trend that then characterises the practice. Suchman (1999: 264) observes that technologies are stabilised through continuous reproduction in practice; the use and re-use of deep learning methods through rationale of efficacy until they become a trend exemplifies this and serves to stabilise its importance. The practice is therefore built up around this collection of related technical artefacts, but their design is not guided in isolation through their technical imperatives (Wajcman, 2004: 35; 2006: 774; Sismondo, 2011: 92). Focusing on the efficiency of deep learning in isolation overlooks a key technical requirement that is entangled with the social world: the need for huge quantities of data for success. Ben, a doctoral researcher observes how these resource requirements of deep learning introduce the influence of industry in the shaping of the practice:

> they've got the money and resources to train on, like the whole Internet or something. You know, giant music databases for deep learning. One of our students, one of the students has [industry] data, I think [company], so [they have] a database bigger than anyone else… And *that influences* […] [they do] spectacular things that no one else can replicate, because [the company] say you can't have it. Yeah, they can pioneer in that way and get people excited about stuff which they all then scramble to do.

The rationale that Ross previously described – that deep learning is technically proficient – is therefore conditional on resources. Ben acknowledges that although the combination of deep learning and data leads to 'spectacular' results, it also disenfranchises other practitioners based on their social and economic circumstances. Industry engagement in AIM practice therefore aids the establishment of deep learning as cultural capital by leveraging the power of economic capital in industry to 'pioneer' the methods which other people then try to follow. This trend of AIM where technical advances are driven in areas with industry involvement and investment is indicative of the wider AI landscape, where industry has outperformed academia, non-profit, and state production of AI models for almost a decade

(Maslej *et al*., 2023: 50). The standards of the technical approach are therefore dependent on the interests of capital power that often shape the decision-making within technological innovation (Spencer, 2017: 45).

Deep learning is objectified as specific capital here through exchange; industry invests economic and material capital in practice for control of the practices and materials that embody cultural capital (Bourdieu, 1986: 19). Deep learning capital and by extension, the technical approach are therefore frequently aligned with the economic field of power. Bourdieu (1993: 40) argues that practices are characterised by heteronomous and autonomous principles; those aligned with economic capital are guided by the heteronomous principle and therefore are less autonomous in their actions. Technical practitioners who compete for dominance through deep learning capital are therefore guided by the heteronomous principle, resulting from both the social influence of capital and resources, and the technological stabilisation of trends that they follow, limiting autonomy from external power. This power is not, however, limited to industry objectification of cultural capital. Academia and industry both influence the development of these trends.

4.2.1.1.1 Industry & Academic Influence

This study is predominantly built on research with academic AIM practices. As discussed in the methodology, this is partly a result of difficulty accessing practitioners in the commercial development of AIM (Seaver, 2017; Bonini & Gandini, 2020), but also because academic and commercial fields are increasingly entwined in AI practice (Hagendorff & Meding, 2021: 3). The influence of industry on the emergence of deep learning as a form of specific cultural capital in AIM is not limited to the direct and overt acquirement of deep learning capital through exchange that is seen in Ben's example above. Before individual practices can be heteronomous with industry artefacts, Mike, as a leader in his fifties, describes his experience of industry's economic and social role in the negotiation of academic AIM practice:

> we draw up a list of possible projects, you know, some of which are informed by industry: that they say here's a particular need, uhm, some of which might even be

> funded by the industry, or partly funded so they would be, so they're identifying needs. We identify, you know, academically, what would be interesting projects

This industry presence and influence is 'scripting' AIM through continuing struggles for the meaning of its materials of practice, where both design and interpretation can alter the material's agency (Akrich, 1992: 216). By negotiating, facilitating, and funding practice, industry has a role in both design and interpretation in AIM. This exemplifies Mol's (2010: 264) view of networks as 'co-ordinated', where there are perpetual efforts between social and technical actors to shape their conditions and construction. Mol stresses how co-ordination isn't achieved by a central strategist, that networks don't have centres and instead credit should be given to all the entities and actors involved as is reflected in these struggles of AIM practice. The agency of industry-backed technical artefacts was argued by Ben as influencing because other practitioners 'scramble' to keep up, but it continues through the negotiation that Mike discusses between his institute and external economic actors. Furthermore, institutes beyond these negotiations of practice in academia are also influencing the coordination of deep learning capital for technical researchers. Christian (postdoctoral researcher in machine learning, thirties) perceives a preference for particular methods in scientific publications, regardless of quality:

> if you try to submit a paper or whatever and you haven't done deep learning, it's like, […] it can get a bit difficult maybe even for the reviewer to take your work, maybe that work is fine or maybe it's not but if it doesn't have deep learning… everything that is getting the state of the art in terms of performance, must be a system based on deep learning, it's the way.

Christian experiences a difficulty in competing against the cultural capital that is ascribed to deep learning with different technical methods (he calls his own work classic machine learning). Bourdieu (1986: 20) argues that cultural capital can be institutionalised through formal acknowledgment (such as qualifications and some forms of intellectual property) and standardised procedures for acquirement, which secure the holder constant conventional value within a social space. From Christian's perspective, deep learning capital is therefore institutionalised within these peer-reviewed publications as he competes for

acknowledgement within them but perceives restrictions on technological production through the capital of deep learning as a result.

The perceptions, constructions, structures of practice have stabilised deep learning as a form of specific cultural capital that is prioritised within the technical approach to AIM. It is co-ordinated through its objectification as an effective and conventional method of practice, through practitioners' embodiment of the skills required to design it, through the institutionalisation of publications and IP, and through economic exchange. Although technical practitioners isolate themselves from musical context to enable greater impact of their technology, they are not isolated from external influences on the aims and methods of practice. The following section returns to individual technical practitioners, examining how these conditions affect their actions in practice.

4.2.1.2 Technical Workforces

The technical approach to AIM has been seen to follow state-of-the-art technical innovation, aligning it through the heteronomous principle with industries that lead the AI field. There are, however, social heteronomous factors in the construction of the technical type beyond a blinkered pursuit of innovation. Hugo, a leader at MusicEngine, argues that beyond industry's direct coordination of practices, practitioners' actions are also indirectly influenced by industry through motives of career building:

> a lot of our students they are immediately interested in securing an industry position once they graduate and they are actively looking into linking their PhD topics to topics that the company might be working on. Uhm, so yes, this has affected some of our research priorities

The Bourdieusian concept of practices centres around individual actions as struggles for advantage, but this objective for advantage highlights a departure from the aspects of the technical approach discussed above. Technical practitioners have argued that their practice is disconnected from contextual consideration to ensure technical output (AI models) are more impactful across wider settings. Hugo observes, however, how this sociotechnical decision-making in design is necessarily entwined with career building. Discussing technology design,

Wajcman argues that the 'need for a part to integrate into the whole imposes major constraints on how that part is designed' (Wajcman, 2004: 35). This conceptualisation of sociotechnical construction is a valuable method of examining design decisions as career decisions. Within technical practices, not just the artefacts but the practitioners are shaped through a need to fit into the 'whole' of the workplaces and workforces. This expands the rationale of the technical approach in competing for deep learning capital, as Mike argues practitioners are positioning themselves as effective workers in the topic area of music technology, but also to a wider market of deep learning industries:

> I guess the newer music industry of Spotify, Deezer and those type of companies they're [AIM practitioners] certainly uhm, very highly regarded by those companies… But of course, if they've been working on artificial intelligence, so particularly deep learning is what probably the majority of students are doing. They could easily apply that same knowledge to image processing, speech recognition and language processing… People are able to get jobs in these other areas

The conditions of the technical approach where an isolation of context was earlier described as a means to successful and versatile technology are also a construction of social positioning. It is not just the technology that is versatile but the practitioner. The technical approach to AIM is a production of the sociotechnical embodiment of deep learning capital that is specific to AIM and wider AI practices. Within these parameters, individual career building is consequently directed towards industry positions because the scientific success of learning model research is often strongly correlated with industry collaboration (Hagendorff & Meding: 2021: 3). The conditions of the technical approach are a source and consequence of ongoing coordination between practitioners, industry and academic institutes, and the technical artefacts they develop. Practitioners argue that objective science that is isolated from musical context enables wider applications of their technology, but this isolation can also lead to greater influence of personal biases and assumptions, narrowing its potential affordances (Banerji, 2018; Gioti, 2021b). Beyond this individual influence, isolation from music in AIM instead leads to the direction of practice towards external industry goals.

4.2.2 The Applied Approach

In contrast to the use of music as a resource for technical ends, applied practitioners attempt to bridge the gap between technical foundations and functional applications. They use the development of technology for the purpose of creating, as the name suggests, musical applications. I examine here how work to connect technical and functional design in this approach places practitioners as the common denominators that link design decisions; musical context is constructed through the engineers' perception in an attempt to make the technology relevant for particular musical applications. I begin, however, with the motivation behind the applied approach. Christine is a doctoral researcher with a background in natural sciences, which is somewhat reflected in her position that technological development should make sense in the real world:

> The thing I really like about what I am doing is that it is important to ask if it makes sense doing it, like you can build it but why would you, does it really make sense, do we need it, will someone use it? I really like this aspect of it, it has to have a proper cultural justification, it's not only about progressing technology

The applied approach still develops technology, but not for the purposes of technical progress and deep learning capital accumulation of the previous type. Instead, a practice of 'proper cultural justification' is constructed through questions that the engineer must answer as the rationale of their work. By undertaking both technological and musical design paradigms, the designer can engage in the specific deep learning capital discussed above while also directing that technical practice towards its cultural context. This approach suggests a similar perception of the engineer's role in AIM to Gioti (2021a), who argues that the engineer should approach design as an artistic task to close the gap between technical and artistic tasks. The departure from isolated technical practice is therefore achieved through the agency of the engineer. Joseph is a doctoral researcher in his thirties who characterises himself as 'musician that happened to be decent at computer programming' despite his educational background in engineering. This theme continues in his description of his practice, where he balances technical work and contextual musical goals:

> until now honestly, I was considering that what I was doing was AI research because I was working with neural networks… [but] it depends on the type of affordance, some design strategies that you as a tool builder design for musicians to use… I'm feeling nowadays that I'm working more in music than in AI, right? It's like AI is just an excuse to build a mapping in my case, you know as an instrument

Although the methods Joseph uses are common to the technical problem solving of the first type, the applied approach is differentiated through rationale and objectives. By focusing on outcomes and designing technology as a means to a particular end, Joseph feels like his work has grown more relevant to musical contexts. He focuses on a specific affordance for the necessary underlying technical work in a departure from the 'whole range of different applications' that are described as possible from work in the technical type. His differentiation from technical practitioners is therefore a result of his own design strategies where he actively repositions technical work through his own explicit agency in design. Rakova *et al*. (2021: 18) argue that following individual beliefs about the direction of innovation is one of the only visible methods of diverging from the dominant standards of institutions in the AI industry. But reliance on personal agency in the shaping of AI could exacerbate the practitioner's own biases and ideology within their designs (Bailey & Barley, 2020). Oliver, a senior academic at MusicEngine with postgraduate degrees in both electrical engineering and music composition, argues how the practitioner's opinions grow in importance through the design problems of the applied approach to AIM:

> there is relatively little out there that's actually going to give you concrete guidance in the kind of things you ought to design that don't yet exist… you can't just go and ask a performer 'what instrument do you want? We'll build it', because the answers you get back are really boring and they don't actually want those things, like if I ask a violinist what they want they'll say they want a violin that sounds better or maybe I want something that's easier to tune and they're just not interesting answers.

Oliver perceives a problem with music innovation through the needs and objectives that should be followed in AIM design. In the belief that musicians' needs are misguided, the assumptions of engineers are given precedent over the musical context of AIM, and

applications are based instead upon engineers' own views. This reinforces criticism in the literature that art and technology collaborations are often disinterested in the socio-political practices of the arts (Beck & Bishop, 2018: 231). However, Oliver believes his background in musical research and practice allows him to draw on his own musical knowledge in design:

> [it's] a kind of uh, instinctual kind of artistic driven process about imagining what you think would be useful to come into existence and then having done that you could do the technical work, and then you can analyse how people use it

Oliver's work draws from both technical and musical knowledge while bridging the gaps between technical capacity and musical functions. He is functioning as a go-between that Bijsterveld, & Schulp (2004: 667) argue have been significant in driving innovations in fields of musical tradition in the past (e.g., musician-instrument makers). These approaches to human-computer design, however, neglect the ideological differences between designers and users in favour of functional use-cases from a singular perspective, where a 'design saviour complex' presents solutions with cultural influences that do impact user agency (Irani & Silberman, 2016; Banerji, 2018; Keyes *et al*., 2019). Applied AIM practice therefore reflects commercial music software development, where Pardue & Astrid Bin (2022: 8-9) observe that lower pay for labour compared to other tech markets creates a dependence on music enthusiasts who believe they 'know' their markets. The developers' assumptions therefore limit critical engagement with wide musical perspectives, leading to reproduction of hegemonic knowledge within music tech cultures driven by competition with other developers. Steven, a doctoral researcher (thirties) working to understand users' needs for AI in music therapy observes how the oversight of differences between designer and user derives from the preservation of practitioners' agency:

> what happens is academics feel like they have authority over users because they know, because they have read, and because they have knowledge so they know what's best. So, the idea of you know, being informed by the users, there was resistance, because of the idea of experts

Reckwitz (2002: 254) argues that intentions and standards belong to practice rather than the individual agent because they are routinised through the discourses of the wider environment.

The engineers' expertise that Steven observes are therefore routinised in practice before individual practitioners rely on them in the applied type. Oliver's view that musicians' needs are 'not interesting' therefore begins earlier through the lens of Steven's perception, where the ideology and knowledge of AIM prioritise the practitioner's own expertise to guide design. These actions that construct the applied type are influenced by the individual's perception of practice conditions (habitus) also serve to reproduce them (Bourdieu, 1989: 19; Nicolini, 2012: 5). In the following section, I therefore examine how the values of practice that facilitate the applied approach are established, to begin an examination of their effect on the development of AIM.

4.2.2.1 AI Meta-Capital

The specific deep learning capital seen in the first type through scientific and industry objectives exists within the umbrella of AI methods. Beyond the specification of individual methods and topics, AIM is constructed through a general focus on AI development which I argue here is a source and consequence of AI's emergence as a 'meta-capital' that exists beyond individual practices and fields. Oliver's role in the management of his institute has led him to believe that the state policy and funding that he negotiates emphasises the value of AI as a broad symbolic target rather than a specific drive for particular technologies:

> I don't think [the funding body] … is necessarily interested in picking winners and losers in terms of like what topic areas within AI are to be prioritised or not. From that they're just said look we'll leave that to the peer review process and we'll let it emerge we'll just have a real scattering of AI related research

The autonomy of topic lent by funding bodies creates ambiguous technical boundaries that enable the construction of AIM practice within an AI framework. Through a Bourdieusian (1981: 307) lens, this can be seen as inevitable because the boundaries and structures of fields are not dictated by prime movers such as funding bodies, but by the struggles within practices. It is those struggles that create the 'scattering' of practices through their own self-imposed technical boundaries, constructing both AIM as a whole and influencing the approaches to it that create the typology discussed here. This ensures that no matter which

agent gains advantage, the state-identified focus on AI is prioritised. He continues, arguing that the state policies for AI are instead political and economic:

> I think it's a matter of public relations at a certain point, making announcements like AI [funding] to say this is going to be a priority and we're [the government] going to get a lot of international attention for that. Or, maybe it's because, maybe it's because they see that as, you know, boosting the career prospects of the people they train or maybe they think it's going to make the economy more vibrant

In contrast to technical practitioners who often aim to pioneer deep learning and benefit from the specific capital attributed to it, Oliver perceives state funding of AI as an investment in economic and political power that transcends the technical output of practices. In Bourdieusian terms, AI would also be considered specific capital – the embodied capital (AI-related skills) that actors compete for within the scientific field for economic reward (Everett, 2002: 70). However, Oliver's observations highlight how AI acts across different fields, demonstrating a need to extend the examination of its capital beyond this and other AI-specific practices. Couldry (2003: 670) proposes an expansion of non-specific capital in the Bourdieusian approach, that if a significant form of symbolic capital within one field impacts its relationship to other fields, then new embodiments of capital can have meta-value. This is observable where the holder of symbolic capital can exercise power beyond their own field, or where multiple fields can gain prestige through exposure to symbolic capital such as the value ascribed to media capital that transcends multiple fields in society (ibid; Lundahl, 2022: 1442). Attempts to capitalise on the attention around AI-related research links engineering, economic, and political fields in this way.

Practitioners, institutions, and the field of power focus on and expand the technical capital of AI, reproducing its significance beyond individual practices as a non-specific symbolic meta-capital. AIM practice is facilitated through the relative autonomy afforded by this meta-status of AI, as opposed to the growing heteronomous alignment of specific deep learning capital between the technical approach and industry in section 4.2.1.1. Sismondo (2011: 94) suggests that Bourdieu's framework is most valuable for examining science through a focus on these capital relations, how capital does and does not move across boundaries and therefore shapes

knowledge production. This has been found here, as specific deep learning capital shapes approaches to practice through the habitus, but the state-identified focus of AI beyond practice boundaries shapes AIM as a whole. The following section highlights how this can influence practitioners' capital value beyond AIM.

4.2.2.2 Career Building with AI Meta-Capital

Although the emergence of AI meta-capital exists through these types as a crucial condition of the field's construction, it is particularly important in the applied approach. In technical practice, the specificity of deep learning capital that workforces require was seen to prompt practitioners to alter their designs to make them employable through their output and experience of particular technical artefacts. Through the focused musical functions of their work, however, applied practitioners do not always benefit from the technical capital of their work. Christine (doctoral researcher, twenties) discusses how the methods and objectives she uses to apply AI to specific musical hardware and software are not inherently beneficial for her ongoing career:

> these projects are like engineering solving a problem, and if you reach state of the art you get hired in a company which is great if what you work on is relevant and people want to pay you to implement it… But my project is a bit more like, would people actually spend lots of money implementing it in their systems? I don't know

Christine observes that in her work, state-of-the-art models are not enough, they also must be in an area that is relevant to industry to provide economic benefits. She maintains this uncertainty regarding her technology despite being partly funded by an industry partner, suggesting that there is a distinction between the capital ascribed to her *partnership* with industry, and the capital ascribed to the *output* that is produced. For this reason, she does not think her research output will be saleable because her industry partners have not asked her to create any specific product or capability, only "examples of using AI and deep learning in their devices". The capital that Christine is competing for is therefore different to technical practitioners. Rather than producing deep learning capital that external actors are directly interested in and are willing to exchange other types of capital for, applied practitioners are

competing for AI meta-capital. Her industry partners value *association* with AI, strengthening the claims of Neumann *et al.* (2021) that AI is being positioned as an aspirational revolution within capitalist strategies. Christine will not benefit from people who will 'pay you to implement' the output of practice, but her industry partner benefits from the image of AI that she embodies.

Applied practitioners therefore rarely position themselves as suppliers of isolated technical artefacts, instead competing for AI meta-capital through their embodiment of skills and experience. David, a doctoral researcher who was in the final stages of his PhD and thinking about imminent career moves – eventually working for a general audio, rather than music-specific equipment manufacturer – explains the value of general claims about AI in his practice rather than pursuing careers based on particular technical conditions:

> If someone asks me who wants to hire me, it definitely has a lot of AI in it. The AI aspect of it is quite small I would say, I use some neural networks but actually its partially because I feel like I should do that. I mean it makes sense, it's not like completely pointless… it's not purely guided by scientific need but also, just thinking about, very pragmatically about my future and how to position myself

David jokes about his perceived need to overemphasise his own AI capital to succeed, highlighting its value within and beyond AIM. However, he also admits that this perception has physically altered his design in practice, if only minutely. Spencer (2017: 45) argues innovation is reproduced under the conditions of capital rather than labour; aspiring labourers' actions in AIM are defined by acts of self-preservation in the context of the needs of external capital power. In the previous section, I argued that AIM practice is facilitated and constructed as a result of AI meta-capital, where autonomy of topic from state funding in AI allows the struggles of practitioners to define the conditions of AIM. The entanglement of design and career-building shows how AI meta-capital is also important in the boundary making of AIM practice types. Although applied practice is characterised by its protagonists as a balance of technological development and musical context, the influence of external power alters innovation by encouraging greater focus on AI as self-preservation rather than as

a design strategy. However, commercial AIM practices claim to present a different approach within the applied type of practice, the following section examines this claim.

4.2.2.3 Commercial AIM Practices

Although industry and academia are entwined through funding, negotiation of action, and resources, there are departures between the two. Samuel is an AIM researcher who spent seven years in academia before moving to a commercial AI lab with links to the music industry. He believed rigid scientific paradigms in academia conflicted with the musical context of technology:

> scientists, their job is, is science, obviously. They are preoccupied with proof of concept. They are preoccupied with the trainer model, that the model is properly trained, otherwise they can't do a paper and uh [laughs]. But in music, if the model is properly trained, it's not so interesting because you just repeat the music on which it was trained. So okay, maybe we need improperly trained models.

Samuel argues that science and music are in opposition because the need to publish papers constrains approaches to AIM that incorporate the needs of musical contexts. The dominance of science and engineering disciplines in academic AIM therefore advances scientific knowledge and artefacts to the detriment of musical interest. Commercial product development, in contrast has a vested interest in contextual understanding because designs that align with users' interests are more likely to be adopted, enabling greater commercial success (Wilkinson & De Angeli, 2014: 617). These commercial needs, however, also impact what Samuel is 'preoccupied with' in his own output, as he has had to overlook his perception of musicians' interests:

> musicians want to subvert everything which is very cool, it's what we want. But, uh, you know you have to do something useful in practice sometimes, if only to get recognized. Again, I have a license of our technology to [music tech company], it provides us more visibility and it's not subverted

Samuel has a desire to focus on AIM systems that enable subversion (where users can make independent musical choices that depart from the uses that are explicitly intended within the

system's design) based on believes about users' needs. However, he has to make heteronomous choices that align with the wider commercial needs of his employer to be recognised. This shaping of output reflects the demarcation of the scientific and musical in academic practice, with the economic and musical in commercial practice. The value Samuel places on subversion as musical innovation must be subordinated in favour of top-down designs that are tangible as products for commercialisation. Woolgar (1990) describes this as 'configuring the user', although the configurations are not intended negatively, they place constraints on the user and their actions, in this case overtly against the engineer's perception of users' needs. These commercial needs also continue to highlight the influence of AI meta-capital; although it is not referenced here to maintain anonymity, the commercial press release announcing the partnership that Samuel discusses mentions AI and artificial intelligence seven times. AI meta-capital also eclipses commercial practitioners' beliefs about technical approaches to system design. Jack, a freelancer in his twenties who develops technology for commercial employers observes how he has to prioritise AI over simpler technological methods:

> I kind of like the more low-tech tools that are out there… I would much rather use that than super complex and heavy AI systems. But at [company], that was kind of like the main selling point that for like the products we had so, you know, I did end up working on AI stuff, because that's just what we were doing.

AI meta-capital – as is suggested by the 'meta' classification – influences practices in both academic and industry settings. Neither Jack nor Samuel is directly competing for AI or deep learning supremacy, but they overlook their own design values to meet the needs of employers who view the current capital ascribed to AI as a useful selling point. This use of AI as a selling point has been observed in commercial AIM products like music generation and mastering services that 'overstate their AI narrative as part of a rich imagery that has seemingly played well with audience engagement' (Bown, 2024: 16. See also: Sterne & Razlogova, 2019). Although Samuel argues that commercial practitioners can incorporate contextual musical interests in their development, this ability can also be mitigated by their commercial obligations. Rakova *et al*. (2021: 18) argue that change in commercial institutes

is only achievable where individuals or 'tempered radicals' promote new practices themselves; as AI meta-capital aligns engineers with the interests of the companies they work for, this 'radical' position is seldom observable.

4.2.3 The User Approach

In AIM, the technical approach develops underlying technological capacity in isolation from context to provide a foundation for its uses across numerous contexts. The applied type bridges the gap between this capacity and its functionality by designing technology for musical applications based on the engineer's perception of context. Finally, the user type examines how the functions of technology impact people at the point of use. George is a senior lecturer and independent music technology developer who gives an example of this through his decision-making process when using AI in his projects:

> very close to my heart is how can technology enhance human ability, I've used AI sparingly in interactive systems because it can disenfranchise or it is, it is an opaque layer… Machine learning for example you give it a load of inputs, it gives you outputs but not a lot of information of how it got there. Maybe that will change, uhm, but yeah, it's one of those things I feel I should be involved in

As is common throughout these types, George feels an external pressure to include new and complex forms of artificial intelligence in his work. The difference between user practice and the others, however, lie in the decisions against the technical trends that he perceives. George's practice is not positioned towards innovations of the technical underpinnings of his technology's functions, but of its effects on the person using it. He discusses the shortcomings of machine learning as a problem that he overcomes with decisions not to use it or to reduce its use, rather than attempting to find technical solutions. He consequently exercises greater autonomy from the AI meta-capital and deep learning capital that frequently guide the actions within the other types here, though not complete autonomy as all AIM requires involvement with AI. The innovations of machine learning that are the focus of technical practice are instead seen as out of his hands: *maybe that will change*. Mackenzie (2017: 75-6) argues that this role – undertaken by user practitioners in AIM – is inherently

essential in the context of AI and machine learning because the perpetual output of technical development makes matching existing models with functions a challenge in and of itself. The existence of the technical approach that develops non-contextualised models contributes to this ubiquity of models therefore necessitates the work of user practitioners as a distinct group who depart from objectives to pioneer foundational AI. Instead, a user-centred approach is taken, as described by Martha who is undertaking a PhD following education in the natural sciences and a period working as an artist in the music industry:

> I'm doing it for iterative development, which is just a process that means that I spent a lot of time interviewing and talking to people and questionnaires, et cetera to make sure that as I'm building this tool that already took me two years to just justify that this would be a good tool to build

The user type departs from the focus on the engineer as expert seen in the applied type despite Martha's experience and knowledge of musical context. She instead values the study of users' needs as a part of her practice, developing technology through strategies of purposeful and participatory useability design that internal reflections of AIM describe as best practice for musical contexts (Sturm *et al.,* 2019a; Bown, 2021). But the type also reflects the observation that these best practices are infrequently engaged (e.g., Morreale *et al*., 2020), as the features of this approach to practice are anecdotally described as uncommon by most of my participants, and the time-consuming nature Martha discusses would slow technical progress if all engaged in it. The marginal position of these practitioners also impacts the construction of their approach as they actively engage in boundary-making to differentiate themselves from dominant groups. Where the applied type characterised themselves as a bridge between technical work and music context, user practitioners such as Ben who also has a background in music as opposed to engineering, purposefully place themselves in opposition to technical practice:

> I feel like there's more informatics people. But I just kind of feel like […] I don't really know. There's definitely a talk, I even got a little bit annoyed in a meeting one day, they were talking about doing things for like deadlines and stuff and people were

> saying most of us are doing MIR research, and I said 'but I'm not doing it, don't lump me in, I don't want anything to do with it'.

Ben's opposition to norms is clear here, speaking up against the characterisation of the field as MIR (music information retrieval) research, which is an academic community focused largely on the technical problems of analysing music data. Bourdieu (1989: 15-6) argues that these individual struggles are undertaken in vain against the dominant groups in fields and serving only to reproduce the conditions for others. Ben though, is purposefully maintaining the status quo of the field through boundary-making that differentiates his objectives from the dominant group. In doing this, Bourdieu (1993: 106) argues that practitioners attempt to create new positions through distinctive marks in which they can succeed. However, the approach they take coincides with the emergence of a concept in the dominant groups that has similar connotations: user-centred practice. To understand the significance of the user approach among the dominant groups of AIM, I examine this concept and how the user type in AIM continues its boundary-making alongside it.

4.2.3.1 User-Centred Doxa

By working in opposition to technical practitioners as the dominant approach to development, user practice is constructing new conditions in AIM. Everett (2002: 69) argues that in Bourdieu's cycle of reproduction, when non-dominant groups work against norms, they create a symbolic violence that can cause a revaluation and appropriation of new norms by dominant actors before the cycle begins again. These norms appear in practice as *doxa*, the common language and concepts that are perceived as expectations within the habitus and therefore influence actions (see section 2.3.1.2). Ben observes how the focus on users that Martha described as an important part of her practice has been adopted in the dominant technical practice as common language or doxa:

> there's one guy I know he does deep learning, he's amazing… but when it comes to designing user application at the end, that's just where they've done their models but their supervisors are telling them they have to talk about application

Although the dominant type is integrating the concepts familiar to the user type, Ben highlights differences in the extent of their use where technical researchers are told to talk about them after development. This is a marked contrast to the two years of justification that Martha conducted before development above. User-centred language beyond the user approach is therefore an emergence of new doxa within AIM that indicates a change in what practitioners believe they have to participate in (Fligstein & McAdam, 2011: 20; Wanka & Gallistl, 2018: 4). However, Ben expresses discontent with the spread of this doxa and attempts to draw new boundaries that highlight the contrast in their motives and value:

> ISMIR are doing a thing where they ask people to do user studies and submit to them but that doesn't make any sense because they do machine learning and beat tracking so it would be so difficult to get a paper in through those reviewers… it's good that they're citing it as a thing because it's important to be user centred, but I think it's more of a selling point for them.

The growing use of user-centred doxa by individual practitioners is influenced by mezzo-level agents (ISMIR is a conference and paper publication); but as a user practitioner, Ben does not derive value from these influences. He instead sees user-centred doxa as a use of language that has become commonplace across AIM but has different meaning for different contexts. This use of doxa reflects common approaches to interdisciplinarity in scientific practices, where terminology is borrowed from other practices and reduced to checklist items (Ben's 'selling point'), rather than used as a method of informing approaches (Szymanski *et al.,* 2020). Ben, however, utilises this doxa as a method of boundary-making in the Bourdieusian struggle for dominance by clarifying his opposition from others' practices to establish his own 'epistemic authority' over it (Sismondo, 2011: 93).

The objective for user-centred doxa is influenced by wider practices engaged with AI meta-capital. AI development and deployment across multiple fields has led to perceived risks, creating a focus on 'responsible', 'trustworthy', and 'ethical' practices through approaches that are user-centred, human-centred, or have a 'human in the loop' (IEEE GIEAIS, 2019: 45; Ada Lovelace Institute *et al*., 2021; Shneiderman, 2022), and Micchi *et al.* (2021: 265) argue that this language is evolving in AIM environments from 'audio rendering' and 'generated'

music to ‘co-creativity’ and ‘creative use’. To this end, Holzapfel *et al.* (2018: 52-3) argue that user studies should be included as an ‘ethical dimension’ of AIM research that addresses ubiquitous issues of remoteness, bias, and conflict avoidance. It is this approach to users that Ben disagrees with as he argues only technical work (machine learning and beat tracking) can succeed in the context of the dominant mezzo-institute of ISMIR, devaluing user-centred doxa as an afterthought. He feels he cannot submit his own work in this context because his focus is on user impact as an objective rather than as an ethical dimension of technical research. Beyond AIM, Mike (fifties, senior leader) observes how this adoption of specific user-centred doxa is driven within the field of power:

> the focus on user experience… I know the EU pushed this quite strongly that that research should be user, should involve the users from the beginning right from the scoping. So… not just kind of, you know, “I'm going to produce a product and then we're going to test out on users and see what they think of it” without actually finding out in advance what a user might be interested in.

This top-down promotion of user-centred approaches highlights the importance of geopolitics on AI development. O’Hara and Hall (2021: 80-1) argue that different geographical areas have different approaches to cyberspace, where the EU favours anticipation and regulation of technological impact. Their push towards user-centred practices therefore reflects its conflation with wider discussion of responsible innovation in practice. The benefits of being seen as aligned with responsible practices promoted by the EU demonstrate the selling point that Ben refers to, where differences remain between user-centred doxa as an ethical dimension, and a user approach towards user optimisation as a primary objective.

4.2.4 Summary

This section has examined AIM through the types of approach identified and constructed in my sample, characterised by practitioners with differing motivations, methods, and objectives in their practice. These types of practice in AIM are influenced by industry science (foundational scientific research in the private sector), commercial developers (products and services associated with AI), and state actors through funding, negotiation of research

projects, and provision of resources. Figure 2 positions the types in relation to one another within the boundaries of AIM practice.

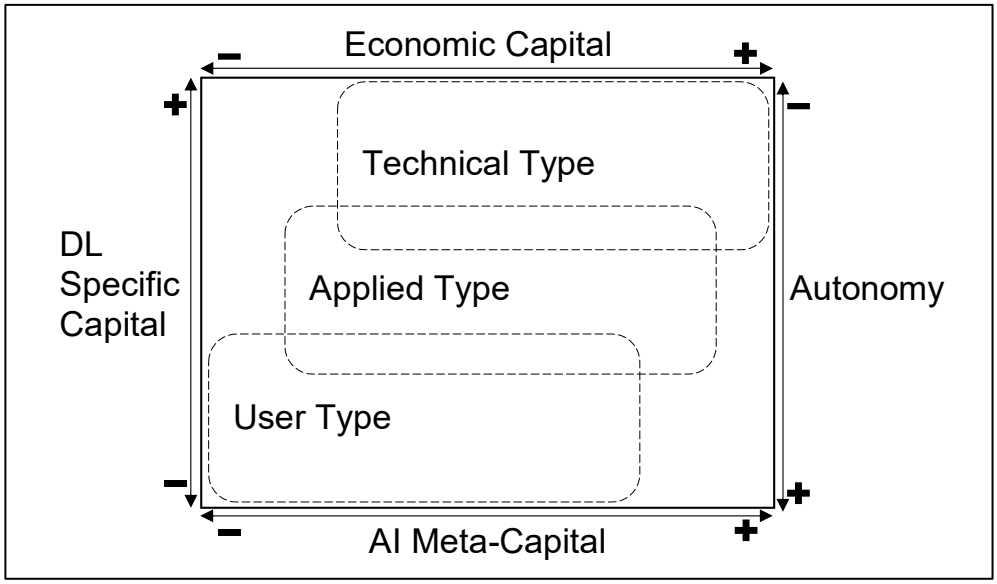

Figure 1: Relations of AIM Practice Types

The technical type is the dominant approach to AIM, which uses music data to develop foundational technical capabilities. This type is largely isolated from practical applications and effects within musical contexts to enable a focus on technical advancement and universality in contrast to increasing calls for multidisciplinary contextualised practice (Sturm *et al.,* 2019a; Born, 2020; Morreale, 2021; Huang *et al*., 2023). The industry science sector shapes the dominant technical type by enabling greater advances and specific deep learning capital accumulation for practitioners who are aligned through the heteronomous principle. This creates further influence through indirect soft power, as industry science accumulates capital and sets trends that other practices follow.

The applied approach connects foundational technical methods with musical context by developing their efficacy within specific use-cases (e.g., melody generation, automatic orchestration, intelligent instruments, etc.). Less emphasis is placed on developing the state of the art, and practitioners' agency is instead leveraged to redirect technical methods towards practical objectives. This positions them as expert decision-makers in both the engineering and musical contexts of AIM technology. Applied AIM therefore reflects wider patterns of AI and human-computer design where singular perspectives limit user agency and

amplify the engineers' assumptions (Irani & Silberman, 2016; Banerji, 2018; Keyes *et al*., 2019; Pardue & Astrid Bin, 2022). These assumptions are also guided by commercial developers, however, who value association with AI through products, services, or involvement with practices, leading to competition for AI meta-capital. The emergence of specific deep learning capital and AI meta-capital therefore extend Sismondo's (2011: 91) view of the corporate mode of science, whereby action is controlled by well-defined commercial interests, shaping knowledge towards profitable outcomes as opposed to public interests.

The user approach contrastingly examines and designs how AIM is experienced based on users' needs. Although the user type is engaged in the design and deployment of AI – or else it would not be a part of AIM practice – practitioners are infrequently engaged in the accumulation of deep learning capital through pioneering heteronomous work on foundational technical models. They also describe decisions against the use of AI where other methods are believed to produce better outcomes for users. The type therefore presents a contrasting approach. This is constructed partly through deliberate boundary-making where practitioners view themselves as a minority, struggling against the dominance of the technical approach. But it creates conditions in which relative autonomy is exercised from both specific deep learning capital and AI meta-capital.

State bodies facilitate the construction of AIM practice by taking a non-specific approach to AI funding. This transcends the drive for specific output, instead aligning nations with the general economic advantages of emerging AI economies and the political soft power of innovative action. This focus both capitalises on and reinforces the position of AI as meta-capital. The competition to accumulate AI meta-capital also shapes AIM practices through the trends of other non-specific AI. The user-centred doxa that user practitioners use to draw boundaries with dominant technical practice have grown in use as a method of aligning all practice in AIM with the movements for responsible AI. AIM reflects wider AI practices where growing claims of principles such as user- and human-centred design are employed without contextual understanding or measures for practical implementation to project an

image of trustworthy AI (Binns, 2018: 9; OECD, 2023). This use generates further opposition between the types of practice, raising questions regarding their interoperability.

4.3 Cumulative Innovation?

The above typology is constructed on the habitus of AIM at the individual level; but how these different types are connected as a practice is unclear. The differences of approach discussed within the types are often rationalised through the interoperability of AI and a sense of collective progress in innovation. How each of these types contributes to this innovation can therefore aid an examination of AIM impact on music work as technological impact is first coordinated within internal structures, where objectives, artefacts, and impacts are, or are not integrated into innovation (Wajcman, 2006: 777; Mol, 2010: 264). This section explores how development is communicated between the approaches to practice in AIM, and how these conditions effect innovation in the practice.

4.3.1 Disciplinary Preservation: "Who are these ethereal engineers?"

To understand how innovation is linked between these types of practice in AIM, I begin by looking at how practitioners communicate with one another. Mike (senior leader, technical approach, MusicEngine) argues that in and beyond his own institution, AIM practice supports collaboration between practitioners:

> we try to encourage collaboration and collaborative spirit amongst people. But it's remarkable because it's so different from, you know all other scientific fields that I've seen… when we go to conferences people are very willing to share the code they've written. You know, it just seems that there's a very collaborative spirit

Mike highlights how AIM practice is collaborative through its materials; the underlying technical properties of AIM design are shared between practitioners as code which can enable others to understand their developments. This way of collaborating reflects Haraway's (1988: 581) discussion of 'situated knowledges', where objectivity is achieved through the partial perspective of its agents. Through this lens, the collaboration through material transmission of code is limited to the perspectives of practitioners who embody the discourses and skills necessary to engage in the underlying mechanics of AIM (technical practice). Even within this approach, Mackenzie (2017: 22) argues that code can never fully explain the

combination of knowledge and data used in the construction of AI. Beyond this partial perspective, Mike's description of collaboration is vague, twice mentioning its 'spirit' and describing the weaknesses of other comparator practices rather than expanding on his claims regarding his own. Mike's focus on communication through technical artefacts may result from his situated knowledge in the technical type. The experiences of other types of AIM practitioners can therefore highlight the wider effect of these conditions of practice.

The focus on material sharing discussed by Mike has implications beyond the technical approach to AIM. Adam (applied PhD researcher at MusicEngine) has a background in music, and discusses his perception of these dominant engineering paradigms in comparison to his own knowledge and applied approach:

> I've definitely had like days and weeks, maybe even months, where I've just kind of felt like an alien… when I did my last review, the big thing was like: "okay, cool. You've got this art stuff, you've got this philosophy stuff, you've got your text specifications in there, but you're like you're not really vocalizing to the engineer why we should care about it". And I had months of this. Months and months and months of: you need to talk to the engineers. And I'm like: what do you mean? Who are these ethereal engineers? I am talking to you.

Within the approaches to AIM in my typology, technical practice is the largest, but this example also highlights how technical discourses are often prescribed in other types of practice. Adam is faced with a need for explicit engineering value in his work, which rather than resulting in direct repositioning of his actions, leads to confusion and a perception of himself as an outsider. This could be read as Adam's stubbornness; he does not want to communicate his position to other paradigms and thus blocks communication between practitioners. The requirement, however, contradicts the discourse of technical practitioners, who earlier argued (section 4.2.1) that their work can be isolated from other areas of AIM, whereas Adam experiences a requirement for integration. Rather than stubbornness then, Adam's experience reflects Epstein's (2008: 169) argument of the cultural authority of science, where the scientist's dominant position enables them to repurpose others' actions around their own interests to maintain their power by reproducing the need for their own

values in a system – by centring collaboration around the technical approach, its dominance is reproduced (see also: Gieryn, 1999).

Georgina Born (2020: 200) describes how non-technical disciplines are subordinated in AIM communities, making the field impenetrable to non-STEM practitioners. My findings build on Born's understanding by highlighting how this disciplinary subordination is pervasive beyond the disciplinary level as Adam's background in music highlights an ability to break through the disciplinarity impenetrability that Born describes, but actions and experiences continue to be shaped at the micro-level within the habitus. Regardless of disciplinary background, discourses, embodiment, and material standards within the practice alienate AIM practitioners who do not conform to the norms of the dominant technical approach. This highlights similarities with difficulties faced in broader fields of design where applications are designed largely separately from AI technical development such as Human-Computer Interaction (HCI). AI is seen by application designers as a notoriously complex subject matter arising from a lack of common language and workflow between themselves and AI developers (Holmquist, 2017; Yang *et al*., 2020: 2-3). However, at a wider level, David (thirties, applied PhD researcher) observes how the AI meta-capital that draws funding to AIM is also a cause of this disciplinary subordination, in turn contributing to the construction of this habitus in practice:

> even though music is in there, they made it a lot more clear, "we are scientists", specifically computer scientists or engineers. I understand this is where the funding comes from, this is where more money is involved, but yeah, I am a bit worried that […] uhm, that these fields that, like people who do more qualitative research into music, that they drift apart at least in our department

Despite the constituent parts of practice – 'AI' and 'Music' – David's perception of his institute's boundaries highlights a hierarchy between these disciplinary ideas. Different approaches to AIM do exist, but when they are introduced to the wider context of AIM practice, they are refocused around the discourse of the dominant approach. The technical approach is isolated to enable innovations that are interoperable, but Selbst *et al.* (2019) argue that AI cannot be ethically interoperable without incorporating the social

considerations of their context in design. The dominance of engineering paradigms has been shown to create the conditions for applied and user approaches to be constructed through differentiation; this is where the contextual approaches that Selbst *et al*. call for appear. But where these approaches differentiate, they also *drift apart* – cumulative practice only occurs through the non-contextualised situated knowledge of technical foundations, or through the necessity for non-technical researchers to talk about the science that engineers care about. Both can be seen as features of the conditions – for knowledge to count as truth, it must fit into pre-determined disciplinary parameters – defined by the dominant technical groups (Haraway, 1988: 581; Sismondo, 2011: 90).

In the following section I examine how these conditions of boundary-making and disciplinary preservation in individual and collaborative practice impact responsibility for development through the lens of feminist STS.

4.3.2 Responsibility: "you can't not be a feminist if you're in a position like this"

The lens provided by feminist STS is useful in highlighting how these conditions of technological practice create an environment where responsibility is shifted away from dominant actors. Although the number of female practitioners is argued to be growing in the institutes I examined, AIM practice is dominated by male engineers (Hu *et al*., 2016: 765; Holzapfel *et al*., 2018: 50; Born, 2020: 194) – represented in the small number of female practitioners I identified and who subsequently accepted involvement in this project. Furthermore, many of the institutes in which the observations and interviews of this thesis were carried out had exclusively male senior staff at the time of data collection. Martha (user PhD researcher, twenties) believes that these conditions place responsibility for change on her as a minority in the practice:

> I mean it's a burden, right?... I was the only woman in my lab for two and a half years… that is batshit sorry, that is insane. And to me, as a person who like, obviously like you can't not be a feminist if you're in a position like this… I feel like it's not just my job to make sure the AI I'm using is, you know, morally acceptable. It's also my

> job to make sure that the next generation of people who make these AIs led to something that's a little less biased

Cockburn (1999: 190) observes how new technologies are often dominated by male designers, masculinising emerging dominant skills and discourses before lending aspects of that practice to women, benefitting men. Martha enters the practice as a minority and works against the masculinity ingrained within it, shifting responsibility away from those who established the conditions in the first place. Although this marks a shift from previously observed conditions of technical culture where women historically supressed their femineity to enter practices (Wacjman, 2004: 14-5), the burden of feminist action on female practitioners maintains inequity. By working to change the conditions imposed by others, new practitioners reproduce the effects seen by Cockburn because prior engineers maintain their positions within the practice that feminist practitioners are working to debias.

Martha describes her need to be a feminist through the representation she embodies and a perceived responsibility for how that gendered representation impacts technological output. These issues of gender disproportionality that shift the burden of responsibility are also observable through wider characterisations of technical practice. Suchman (1999: 260) argues that technology production is often approached as 'collective technical labour', where technical briefs are handed off between separate stages of development, but responsibility for their outcomes is also passed on. The typology of AIM reflects such stages of development as each approach engages in boundary-making from the others through objectives and methods of development. In wider AI practices, Drage *et al.* (2024: 8-9) argue that these conditions can limit collective responsibility for AI and cause neglect of maintenance after development, which is necessary to prevent 'algorithm drift' that alters the functions and impact of AI. I therefore examine how responsibility for technical development is passed between the individual practitioners and types of AIM as a 'collective technical labour', and how it impacts output.

4.3.3 Collective Labour: "you… have to build it yourself to understand it"

Suchman's view of collective technical labour is replicated in the development and deployment of foundational AI in society, where uncertainty about the roles and responsibilities within the AI value chain (developers, providers, users) presents challenges for socially responsible decision-making (Madiega, 2023: 7). It is also observable in AIM through the differences of approach in my typology, and the beliefs of practitioners within them who argue the separation is necessary for innovation in AIM. In this section, I examine how this vision of collective development is an ideal that that is seldom experienced in practice or output. Joseph (thirties, applied PhD researcher) explains the ideal of collective AIM development:

> We need musicians, a lot of musicians that find clever ways of using the tools that we are generating and we also need, you know, excellent computer scientists to generate algorithms you know and they seed ideas that then spring into tools

The value of separate stages of development stems from the expertise of practitioners – Joseph builds tools based on the algorithmic ideas of technical practitioners, and musicians can then find uses for them. However, as was seen in previous sections, there are often obstacles for collaboration between these stages of development, which can also impact the technical output of the field. Christian (technical postdoctoral researcher, thirties) believes that the conditions of practice impact collaborative or collective innovation:

> it's difficult to collaborate in this area even though they are kind of connected… obviously the conclusion you get from one field may affect the other but I think that in the daily research, uh, it's not that much, but I think that's applicable for any kind of research. There's more research that's happening in one field maybe connected to another one but after a long time you don't actually feel the innovation.

Christian's belief that collaboration is only possible through the conclusions of work shifts responsibility away from the design practice (his *daily research*) to the design itself. Technical output could therefore be unaffected by the boundaries of practice, as it is exempted from the daily difficulties of collaboration. However, Christian then reflects how

the conditions of AIM practice also constrict its innovations until they are not felt beyond his specific field. These constraints are often seen where interdisciplinary design is guided by distinct disciplinary backgrounds, as each discipline limits the perspective and heuristics of development, creating problems and solutions that are incompatible with other areas of the development chain (Nguyen & Mougenot, 2020: 1338; Yang *et al*., 2020 2-3; Hess *et al*., 2021: 425). Consequently, such approaches are seldom found to have impact beyond their own disciplines that understand their complex AI models. Where interface designers are separate from AI experts, for instance, they do not feel like AI has led to innovations of user-design, and where it has been used it has the effect of putting 'lipstick on the pig' of previous methods (Dove *et al*., 2017: 279; Holmquist, 2017). In AIM, practitioners do often share some disciplinary backgrounds and knowledge despite their differing approaches in the typology, but still face difficulties when trying to build on the developments of technical researchers like Christian. In his development of composition-aiding technology to understand how users react to AIM, Ben, a doctoral user approach researcher argues that technical underpinnings of his work are not as interoperable between applications as the central argument of the technical type in this study suggests:

> There's a big drive to open-source everything is always online now and GitHub, but I don't normally pinch code from colleagues or things like that. I think because it's so technical with some of these deep learning models, you have to actually build it yourself to understand it.

Although technical materials (code) were discussed as collaboratively shared in previous sections, Ben believes there are obstacles to integrating and building on them in his own practice. Christian's view that innovation cannot be felt beyond his own field is therefore correlated with Ben's reticence to use the materials of other practitioners and stages of AIM development. The technical type isolates its actions and collaborates through technical output; when other practitioners don't use others' output that they can't fully understand, 'innovation' does not move between the 'types' of AIM practice. While conducting fieldwork at MusicEngine, however, Ben did not always give this need for understanding the same level of importance:

> *[Ben] has changed the AI method of generation to Google's Magenta – he mentions this in passing and when asked how the music training of the models was different and whether they affected his work he simply shrugs it off – "I don't know, it's just whatever Google use… the AI is what it is"*

Ben demonstrates a reduced personal responsibility to understand complex models from large companies as opposed to open-source material from other practitioners on Github (code-sharing website). This decision-making regarding AI exists beyond AIM and highlights similarities between expert developers and end-users'. Elish (2019) argues that understanding is a necessary cautionary measure in wider human-AI interactions because accountability for the weaknesses and errors of AI is often directed at humans who possess limited knowledge or control. However, in practice Shneiderman (2022: 55) argues that because it takes effort to assess the trustworthiness of systems, users instead rely on established organisations who they assume they can trust. My findings show that this extends beyond users: developers also shift responsibility to companies they trust.

Collective technical labour is discussed as a characteristic of AIM through claims to AI interoperability in technical approaches, but the conditions in which responsibility is handed off from one stage to the next prevents innovations and outputs from being cumulatively developed (Suchman, 1999). Rather than accepting responsibility for others' work, Ben places emphasis on building his own technical specifications to understand the complexities of AI, but in some cases, because of those complexities, Ben mirrors the decisions made by general users by simply opting for a recognisable brand. The heteronomous alignment of deep learning capital and economic power in industry discussed in section 4.2.1.1 therefore impacts decisions beyond struggles for capital in the technical approach, as it continues to shape other stages of development through the trustworthiness of its objectified capital. Cumulative development of AIM is therefore possible through the trust and capital attributed to heteronomous sociotechnical actors.

In both cases, where scrutiny of foundational AI is overlooked through complexity or trust, the cumulative development of AIM is limited. Aitken (2023) argues that isolated foundational AI practices – such as that described in the technical approach of this chapter –

are effective and responsible only where they are contextualised through scrutiny in later stages of development. In AIM this contextualisation is rarely applied to the output of the isolated technical approach. The following section examines how these issues with cumulative innovation stem from the lack of collective or collaborative practices.

4.3.4 Technical Innovation: "almost like a scam industry"

The barriers for collective technical labour to produce cumulative innovation discussed in the previous section stem from partitioners' perception of technical artefacts. Edward is a software engineer who moved from industry to academia in his fifties. Through his relatively recent acclimatisation to the practice, he provides evidence as to why practitioners may perceive a need to scrutinise technical artefacts in the process of cumulative innovation:

> so many of the papers in machine learning and AI, they're just garbage… I've thought about it almost like a scam industry, there are aspects of it, I'm not the only person to say this, there are aspects of it which are a scam. It's about generating constant stuff that nobody reads and nobody can test and you just get away with a lot because people have careers and they want to keep their careers going

Edward builds on the rationale for Ben's decisions not to cumulatively develop AIM output from other areas; the need to understand AI is impacted by technical output that 'nobody can test' limiting the cumulative innovation of AIM through shared knowledge. The focus on isolated underlying models generates a high turnover that Edward believes is a scam based on volume rather than quality. This increasing volume is an observable trend: journal publications in AI have more than doubled since 2015 to around 300,000 articles per year (Maslej *et al*., 2023: 32). The volume of AI output is perceived as a method of self-preservation, obstructing later stages of development from building on the work of others. Christian (technical postdoctoral researcher, thirties) reaffirms how this need to protect career progression limits innovation before these later stages, impacting the novelty of his own output from the beginning:

> Obviously there is a […] a thing that we research usually don't take that many risks. Because if you take risks and something does not work you cannot publish. Uhh, in

> that sense the things that are wide enough to be applied, they cannot disrupt something in the market I mean, they are too similar to things that already exist

This builds on Edward's discontent with AI research as a *scam industry* where quantity is favoured over quality because technical researchers create echoic output which minimises innovation in an attempt to ensure possibilities for publication. Holzapfel *et al*. (2018: 48) observe how the constraints of this general academic environment of 'publish or perish' encourage engineers in AIM to focus on the trade-offs between design and performance in system design to the detriment of use-cases and impacts. But these findings show how these trade-offs run deeper, impacting technical progress. Despite the view in technological development that an overemphasis of contextual, ethical, and philosophical approaches to AI can slow down innovation (Steen, 2021: 254; DSIT, 2023), the contrary position here has a similar effect. Rather than 'slow' environments of multi-perspective innovation, the isolation of the types of practice that enable fast-paced publication can also limit innovation. The conditions of practice that lead to isolation of the dominant technical practice from context can also be seen as a constraint on the ability of other practitioners to build on their work through cumulative development. My findings therefore offer a different perspective on the challenges of these conditions to the literature: Mackenzie (2017: 75-6) argues that pairing existing AI to functions is a huge task because of the variety and quantity of models produced. Rather than undertaking this task of pairing models to functions, applied and user approaches to AIM scrutinise the output of the technical approach as 'garbage', or simply as too time consuming or complex to use, instead relying on their own ability to build systems from the ground up or trusting the models of established commercial organisations because of their accumulated capital.

4.3.5 Summary

The types described in section 4.2 create a conceptually coherent whole. Innovations of technical AI models are constructed in the first, these enable AI-powered musical functions in the second, before functions are tailored to users' ergonomic needs in the third. However, the oppositions and boundary making that construct the different approaches of the typology

continue to affect the practice as a whole. Collaboration between the types is limited by the dominance of engineering paradigms from the technical approach. This causes the types to drift apart as practitioners feel alienated by a need to communicate and adapt their work to the interests of the dominant approach, while responsibility for cumulative innovation is passed down from the technical type through material (models) that they do not have time or expertise to understand. The findings of this chapter show how engineering dominance influences AIM beyond the high-level struggle for the disciplinary direction discussed in the literature (e.g., Born, 2020; Porcaro *et al.,* 2021; Morreale, 2021; Huang *et al*., 2023). It also impacts everyday practices and development regardless of practitioners' disciplinary allegiances.

AIM practice therefore reflects the collective technical labour described by Suchman (1999: 260). This moves beyond the necessity for a culture of differing specialists resulting from the sociotechnical complexity of algorithmic and AI design (e.g., Dourish, 2016; Mackenzie, 2017; Seaver, 2017) and describes how the handoffs of technical tasks also create handoffs in responsibility. This responsibility is then felt as an isolated burden rather than collective development by new practitioners, who work to fix the problems they perceive in the practice. Collective technical labour is seen as an effective way of managing the complexity and breadth of technical briefs in AIM design, but the conditions of practice that impact collaboration also impact cumulative development between these briefs.

In applied and user approaches, the technical output of the practice that collaboration is built upon is seen as either complex, time-consuming, or poor-quality. Cumulative output with this technical resource is characterised in two ways. First, through time spent re-treading ground to scrutinise the work of other practitioners when using independent technical foundations. This shifts the focus of applied and user approaches away from the applications and impact of AIM, and onto technical problems (the dominant paradigm), through a burden of responsibility they feel for their systems. Second, some practitioners rely on the deep learning capital that recognisable industry bodies hold, reflecting choices made by non-expert users. Although these practitioners work to develop use-cases and user experience, responsibility for foundational AI that Morreale (2021) argues requires musical contextualisation – just as

Aitken (2023) argues wider foundational AI needs contextual scrutiny – is shifted to commercial organisations where design is inherently opaque. The aspirations of many technical practitioners to work in industry, and the experiences of commercial practitioners highlight how foundational practices are similarly focused on the heteronomous link between engineering and economic paradigms through the pursuit of deep learning and AI meta-capital, as opposed to the interests of musical workers.

This raises questions regarding how impact is influenced by AIM design. Chapter 6 will therefore return to the construction of AIM alongside music workers to examine its impact through a comparative analysis of development and deployment strategies. However, I first introduce music workers' perspectives to identify how AI relates to existing relationships with technology in professional musical contexts.

Chapter 5 Sociotechnical Music Work

This chapter introduces the second group of participants within this study: music workers. Unlike the previous chapter, music workers are not examined through a typology, as the value of such a systematic construction of practice would be negligible owing to existing social studies of music practice that I draw on through literature in the analyses here. Instead, I build on this understanding by engaging with a diverse sample of professional music workers in the western recording industry in the specific context of technological use and impact. Sterne (2003: 384-5) argues that technology is embodied through the habitus and the sociologist can therefore provide insight into technology as a social action. This chapter attempts to do that by exploring the rationale and meaning making behind technological use, towards an understanding of how emergent AIM is changing music work.

In section 5.1, I compare the perceptions of music between AIM practitioners and music workers, finding that although the former often hold interest and skills in music as the subject of their practice that is often used to exercise design choices, there is a key ideological difference between them and music workers: the latter made a choice to pursue music as a profession. This does not mean that AIM practitioners' musical needs and experiences are flawed, but that workers' views of music as a career are different. In section 5.2, I therefore examine how my sample of music workers make sense of technology within these conditions of practice. I find that technological use is constructed around four decision-themes within the data: (1) artistic decisions develop workers' embodiment of creativity in the long-term; (2) practical decisions enable workers to conduct and maintain work in the short-term; (3) aesthetic decisions provide fulfilment through technology that relates to the workers' tastes; and (4) economic decisions enable financial gain through competition with others. To highlight how these decisions are combined and balanced simultaneously, I conceptualise them as axes in the context of Bourdieusian field theory.

This chapter therefore introduces the perspectives of music workers into the analysis of AIM practice to contrast the meaning-making of the technical between two social groups in an emerging sociotechnical network. This also demonstrates how workers make meaning of

technological use within their wider careers towards the second guiding research question of this study: 'How does the emergence of AIM relate to the existing relationships between workers and technology in music creation careers?' In doing so I follow Susskind & Susskind's belief that technological change can be understood through current and emergent reference points:

> 'The mistake here is to presume that because we cannot foresee any revolutionary changes, then we should not extrapolate from what we already have. If we work within our current frame of reference and in the context of technologies that seem steadily to be taking hold, then we are more likely to have a sense of where we are going than if we choose to ignore the future' (Susskind & Susskind, 2015: 154)

The findings of this chapter can therefore be used as a lens through which to examine the uses and impacts of AIM in the following chapter.

5.1 Musician or Music Worker?

The previous chapter examined the practices constructing AIM through three approaches. The technical type constructs innovations of AI models with music data, the applied type continues and integrates these AI innovations within functional musical design, and these functions are tailored to users' ergonomic needs in the user type. Although the dominance of the technical approach and its discourses presents constraints on the cumulative design of applied and user practices, these peripheral approaches in AIM practice are creating functional technology that can be used by music workers. To build understanding of its impact in the context of music work, I expand this examination of AIM through a social constructivist lens that engages with relevant social groups of design and use as actors whose behaviour influences one another and the construction of technology (Pinch and Bijker, 1987; Pfaffenberger, 1988: 241). By comparing the musical perspectives within groups of AIM practice and music work here, I introduce music workers' positions as distinct from technology design, therefore providing valuable contextualisation for AIM impact.

5.1.1 Concerning Hobbies

During ethnographic observations at MusicEngine, I described myself in broad terms: I was conducting an ethnography of AIM practices to examine how their technology could impact music work. Despite this attempt to avoid guiding participants' presentation of themselves based on my needs, they still made assumptions about me that revealed some perspectives on music within AIM. During observational visits, practitioners often framed the physical world of MusicEngine through musical lenses, with unprompted descriptions and opinions of their musical relevance. Some expressed discontent, observing that the lack of musical instruments, equipment, and access to academic music training was incompatible with the institute's music focus. Others defended the department: I was told on two separate occasions that there was a guitar 'somewhere' in the offices and some practitioners could play it very well. The practitioners that fell into this camp were most likely to ask about my own musical experience beyond academia such as the instruments I play, but I was struck by one question about my background: "classical or jazz?". My background is in popular music, and I thought

it interesting that in a world that designed AI music futures, the view of music practice could be rooted in such traditional ideas of what music is. Perhaps for this reason, distance from musical facilities was also argued as apt by some AIM practitioners who believed they should not think of themselves as music practitioners at all.

Although I did not prompt these discussions, the attempts to frame the physical environment could have arisen from my requests to be shown around the site at MusicEngine, a practice I continued with every practitioner I observed regardless of the number of times I had visited. This also resulted in new areas being introduced to me; in field notes from my penultimate visit, I describe being taken to a recording studio for the first time:

> *Julie takes me to see a music recording studio. She is the first person to talk about this room, which is odd as I have talked with other participants a lot about the facilities. On the way we walk past hand-made instruments that are on display in cabinets (many have a rudimentary look, made of plywood with wires exposed). When I ask what they are she is unsure, they are designed here, she says, but she has never heard them played, she thinks it is a shame that instruments are reduced to models rather than used for their design purpose. We arrive in a music studio with standard equipment: a drum kit, guitars, amps, microphones, etc., but unusually for a room like this, a circle of small speakers facing inwards towards a central point, suspended in mid-air by thin wire that trails from the ceiling. She says it is nice to come to this room to unwind and remind herself that she's actually doing music because the workspaces are geared towards computer science*

As the only practitioner to show me this studio, Julie (a technical practitioner) appears to contradict the previous chapter's argument that the technical approach to AIM is the most removed from musical context. But she separates this musical environment from her work: it is a place to unwind from AIM practice rather than a part of it. As we had to walk between offices, floors, and departments to reach this shared space, this more musical environment was both cognitively and physically distinct from Julie's AIM practice. My experiences of AIM practitioners' musical perspectives therefore add an extra dimension to the need for contextual engagement in this study; in addition to the disciplinary construction of practice

that favours isolated technical discourses, music is perceived as recreational in the habitus of AIM practice. This develops from decisions that are made before entering in the practice, as Ross, then Nathan – user and applied AIM practitioners respectively – explain:

> I'm not very original in the sense that I've always had this duality between do I want to do music or science when I was growing up… it felt that science were much, much easier to do as a profession, and music as a hobby than the opposite.

> there is this you know, kind of dichotomy that you are either a scientist or you are a musician, you need to choose in life… if you are mathematician, you can do music as a hobby. It's just something you do when you're not working. And it makes little sense in the current society to say that you want to do both.

This introduces a common reality of becoming an AIM practitioner, where backgrounds and interests in both music and science ultimately lead to a choice that music is a hobby, and science is a job – else they would not be AI practitioners. This position was seen to influence approaches to development in applied research where practitioners believed their knowledge of music as recreational practitioners gave them licence to make decisions about music workers' needs (see section 4.2.2). However, I argue here that this is a false sense of expertise, not because AIM practitioners' musical needs, knowledge, or experience is flawed, but because it is different from that of music workers. A recreational interest in music could be anticipated of engineers who specialise in music-based development, but it does draw attention to the key ideological difference between AIM designers and users in the western recording industry that can be traced to a single decision: music workers made a contrasting choice to pursue music as a profession (though I cannot guarantee they consider science their hobby). These differences of position create contrasting perceptions on music work as the site of AIM impact.

5.1.1.1 Contrasting Perspectives

Narratives of AI in work often focus on the potential for jobs to be complimented or substituted; safe or unsafe; secure or unsecure (Gibbs, 2017; Susskind, 2020; Bearson *et al*., 2021). Ashton (2022: 104-6) argues, however, that these oppositions fail to acknowledge that

working practices are assemblages of sociotechnical conditions and actions that cannot be unanimously classified as safe or unsafe. I therefore examine music work as an assemblage distinct from music-as-hobby to build an understanding of how these conditions influence and are influenced by the use of AIM. Amber, a working composer and session musician, believes this distinction is important in technological design as sociotechnical changes have a different meaning for workers:

> [A] if everybody working in the development of creative music technology could keep the humble musician in mind whilst they're doing so then they might be able to create technology that is beneficial for us all, but we'll see.
>
> [K] *What do you mean by humble musician?*
>
> [A] Well I mean if I, if I had a job, if I had a nine to five that earnt me lots of money and then in my spare time, I created music for fun I think I would have a very different perspective on it, but I don't have a different source of income and music is my whole life.

As a multi-billion-euro economy in Europe alone (Oxford Economics, 2020), it may appear an obvious statement that people rely on music as a source of income. However, many continue to work in the industry despite low pay and poor conditions because they have a passion for music and enjoy their work (Speers, 2016: 67; Watson, 2016: 13; Murgia & de Heusch, 2020). This can reduce the perception of music as work because the view of artists in 'cultural struggles' is normalised and even valued by both producers and consumers (Cohen, 2012). Amber's desire for developers to approach music as a profession is not, therefore, given. In AIM, Martha, a user practitioner (the most contextually engaged approach to AIM), believes there is little difference between professional and amateur musicians:

> [there's a] really small distinction between someone who says: "I do music", and: "I'm not a musician, I'm just an amateur", it's just the same exact person who, just is a professional because someone has paid them to play on this record. You know, the difference is so small.

This view is not representative of all AIM practitioners but reiterates the differences that exist between construction and context discussed above, showing how these positions create differing ideological views. Both of these views must be examined to understand the impact of AIM for music work as the sociotechnical cannot exist without the sum of its parts – its qualities are a consequence of collective builders' and users' actions and materials (Hacking, 1992). Mol (2010: 261) therefore argues that in addition to the material possibilities afforded by artefacts and their construction, technology must also interest users and be compatible within their context because it is not introduced to an empty world but alongside preestablished conditions. This chapter therefore examines the conditions of the music worker that make up the world the AIM is emerging in and impacting.

5.1.2 Music Workers' Needs

To introduce the music worker sample of the study through their working conditions, I return a final time to AIM practice. When describing his approach and perception of needs in the design of music technology, Samuel, a commercial AIM practitioner with an applied approach to musical functions discusses musicians' needs:

> In music, you don't have a need for anything. People never needed uh, I mean in the Middle Ages in the Western Middle Ages, music was vocal. You don't need instruments to do music, but when somebody turns out with some sort of primitive violin, musicians are happy to use it but they don't need it… nobody needs a synthesizer or nobody needed a DX7. But it was very successful because it's fun. No, no, I mean we do things, in my opinion, we do things because it's fun. That's it.

Samuel argues that although technologies (instruments) have shaped musical transformations throughout history, those technologies do not determine all musical action. However, decisions based on 'fun' do still have a wider impact on musical practice. In his study of art worlds, Becker observes that the 'limitations of conventional practice are not total. You can always do things differently if you are prepared to pay the price in increased effort or decreased circulation of your work' (Becker, 2008[1982]: 33). For music as a hobby, these prices are of reduced consequence, but if music is a sole source of income as argued by

Amber in the previous section, effort and circulation are important career-building factors. For this reason, Caves (2003: 73) argues that artistic careers are not self-sufficient on creative work but also rely on humdrum inputs: ordinary economic actions and objectives that enable creative work to reach consumers. My participants' practices are characterised through the balance of these humdrum and creative inputs in contrast to Samuel's perception of music because of their positions as workers. They are not the top 1% of musical 'superstars' artists who dominate the market and thus have financial freedom from the humdrum, they are workers (artists, arrangers, mixing engineers) within the 'long tail' – the dominated 99% where revenue is disproportionate and therefore the ability to earn a 'living wage' from recorded music is reserved to a minority (Klein *et al.*, 2017: 227; Coelho & Mendes, 2019; Hesmondhalgh, 2021: 3606). For example, the highest-profile artist by streaming figures in my sample, Melvyn, has around 200,000 monthly listeners on Spotify alone. He is a successful recording and performing artist, but he argues that he does not have the agency to change his musical output based on his own creative interests:

> the environment we created around the project was somehow, I would say the fastest way to make living out of it, yeah, and it came with a price… I realized that we were stuck in a in one label, what I what I was saying earlier, and every time we were trying to get a bit out of this label, make the project evolve to something else, you know… we don't want to do the same music as seven years ago. The partners around us they are not like mean industry people, you know, but more like asking themselves, how can we make a return around this project? Because we cost a lot of money, we have to make them a lot of money as well.

Melvyn observes how his obligation to provide a return on investment for his record label forces him to maintain the conventions that have gained him success (when he describes being 'stuck in one label' he refers to musical style as opposed to his record label, whom he refers to as his 'partners'). He thus demonstrates a reluctance to pay the price of exercising agency from the constraints of his practice argued above. Becker (2008[1982]: 39) expands this understanding by arguing that exclusively artistic decisions require political and economic freedom from the organisational constraints that exist across all worlds of social

action. Although Melvyn has achieved success, he doesn't perceive such freedom in his career. Becker's view of organisational constraints is clearly laid out through Melvyn's discussions of his obligations to his record label. However, Amber and Annie both show how less clearly defined networks exist where workers navigate humdrum and creative inputs based on their circumstances to maintain a career:

> I used to have a rule that it was worth doing a job if it was interesting but badly paid, because it might lead to well-paid stuff, but obviously it was also worth doing a job that was well paid even if it was soul destroying. And I used to have these categories of how I would accept work. And then you go through a phase of accepting everything otherwise you can't make a living. But now I'm in a slightly nicer stage where, yeah, I'm drawn to things I know are going to be artistically fulfilling.

> I'm a composer… I tend to take on string session work that I see will have links for composing as well, you know? So, like the label gets in touch to see if I can do some strings for them, then I might get work in composing as well… it's a really good way of getting in doors

Although these examples show how workers can shape their own practices based on their artistic interests, they also highlight how these interests are influenced by other career needs. Amber and Annie are both music workers who balance composition and session work, albeit through different instrument specialisms of voice and strings, respectively. This is a commonly discussed 'entrepreneurial' approach – leveraging multiple roles and jobs as can be seen across my participant sample in table 3 below – to working in an increasingly competitive music industry where a lack of infrastructural support in changing markets has put emphasis on workers' generalist skills and adaptability (McRobbie, 2002; Thomson, 2013; Haynes & Marshall, 2018). Beyond workers' artistic interests then, economic decisions to take 'soul destroying' jobs that pay well, or to accept less relevant job roles as networking strategies show that within my sample music work is not a creative venture that exists outside of the socioeconomic demands of regular work, it is a professionalised and strategic practice that exists within a network of other processes, practices, and materials that workers respond to (Hracs, 2016: 53; Gandini, 2016; Ashton, 2022). I therefore examine through this lens of

music as work how my sample of music workers (see table 3 below) make sense of technology within their practices, and how this effects their decisions surrounding technology. These findings can then be used to expand the discussion of AIM in its societal context to an informed view of its place in the relationships between workers, work, and technology in the western recording industry.

Music Workers' Roles				
Pseudonym	Roles, (Instrument / Technology)	Gender	Age	Method
Amber	Composer, Session Musician (Voice, Orchestral)	Female, She/Her	50-59	Interview
Annie	Composer, Session Musician (Strings)	Female, She/Her	30-39	Interview
Cyril	Composer, Media Artist, Teaching (Digital, AIM Use)	Male, He/Him	40-49	Interview
Dan	Producer, Beatmaker/Seller, Artist (Guitar, Digital)	Male, He/Him	N/A	Interview
Dennis	Composer, Media Scoring, Sync Work (Orchestral, Digital, AIM Use)	Male, He/Him	40-49	Interview
Dominic	Artist, Arranger, Transcriber (Piano, Orchestral, AIM Use)	Male, He/Him	18-29	Interview
Elaine	Artist, Producer, Artist Engagement Platform, Teaching (Digital)	Female, She/Her	30-39	Interview
Helen	Mixing Engineer, Producer (Digital)	Female, She/Her	18-29	Interview
Jeremy	Record Label: Head of Innovation (AIM Use)	Male, He/Him	30-39	Interview
Lee	Artist (Voice, Digital)	Male, He/Him	30-39	Interview
Melvyn	Artist, Producer (Voice, Guitar, Digital, AIM Use)	Male, He/Him	30-39	Interview
Morgan	Composer, Arranger (Orchestral, AIM Use)	N/A	N/A	Interview
Regina	Composer, Performer, Sound Engineer (Harp, Digital, AIM Use)	Female, She/Her	30-39	Interview
Toni	Artist (Guitar, Voice)	Female, She/Her	18-29	Interview
Zach	Mixing & Mastering Engineering (Analogue, Digital)	Male, He/Him	30-39	Interview

Table 3: Music Workers' Roles

5.2 Technological Decision-Making in Music Work

Within the assemblage of creative and 'humdrum' inputs in musical careers discussed in the previous section, music workers also navigate the use of technology. In discussing 'technology', I refer to any artefact – acoustic, analogue, digital, etc. – that workers use in the creation and distribution of musical products in the western recording industry. Utilising concepts and theories from STS, I examine how technological decisions are socially and technically constructed by music workers, and how this relates to the construction and structure of practices within the musical field through a Bourdieusian lens. I therefore bring together key insights about music industry labour, examining empirical data from interviews using a theoretical practice approach, and scrutinising findings against prior knowledge in the literature. Rather than producing revelations about broad conditions of music work introduced above (this field is well-examined, see: Hesmondhalgh, 1996, 2019; Menger, 1999; Caves, 2003; Banks, 2010; Lingo & Tepper, 2013; Thomson, 2013; Hoedemaekers, 2018), I propose to examine how specific decisions regarding technology use are navigated within these conditions.

Technological use is constructed around four decision-themes within the data: (1) artistic decisions develop workers' embodiment of creativity in the long-term; (2) practical decisions enable workers to conduct and maintain work in the short-term; (3) aesthetic decisions provide fulfilment through technology that relates to the workers' tastes; and (4) economic decisions enable financial gain through competition with others. However, these decisions aren't made in isolation from one another; they are instead combined and balanced within the habitus. This simultaneity is visualised in figure 3, where decisions for technological use (brackets) are superimposed on a Bourdieusian field diagram (Bourdieu, 1993: 49; Benson, 1999: 366). Following Bourdieusian field-theory, these decisions align with internal and external interests and are relative within the specific field of music production as they never represent complete autonomy or heteronomy from/with the wider field of power (Hesmondhalgh, 2006: 215). They never constitute, for example, solely practical or artistically driven action. Such a binary view would cause a boundary line between technical and artistic, despite the impossibility of identifying objectively 'at what moment a worked-

upon object becomes an art object, that is, at what moment form takes over from function' (Bourdieu, 1984[1972]: 21). Haynes and Marshall (2018: 469) argue for this reason that the binary art/commerce boundary is oversimplified and unobservable in music. My analysis builds on this claim by highlighting how sociotechnical actions are constructed in musical careers as an extension of the specific context of the music worker introduced in the previous section.

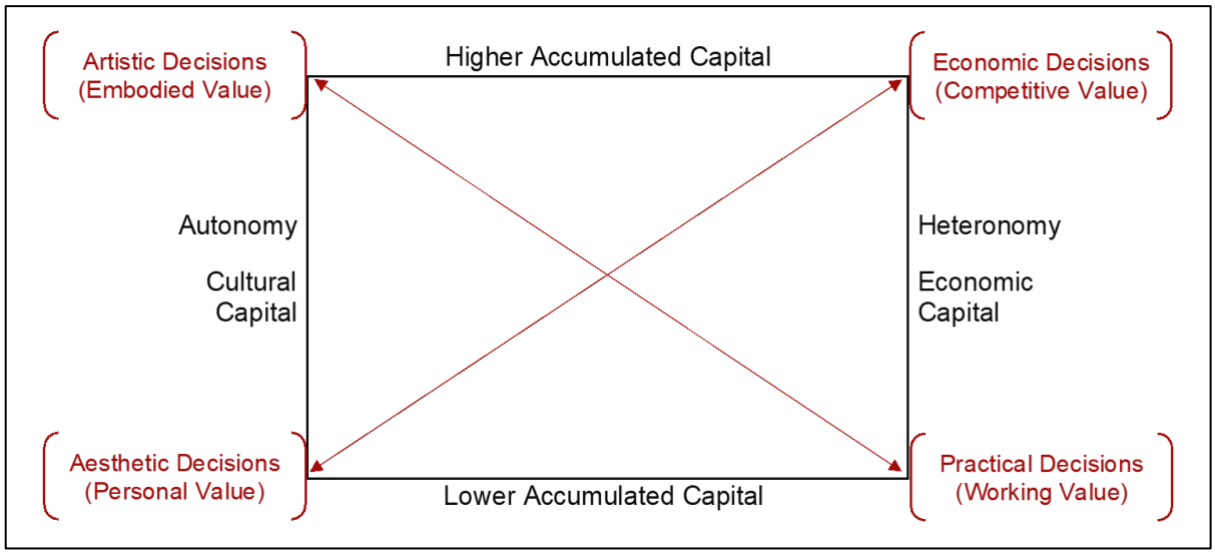

Figure 2: Music Workers' Technology Decision Field

5.2.1 The Artistic-Practical Axis

This section finds that artistic and practical decisions for technology use are rationalised through objectives of long-term embodied creativity and short-term working efficiency. I conceptualise how these decisions are balanced between autonomous and heteronomous alignment on an artistic-practical axis, where technology is used as a method of augmenting workers' actions within their practice.

5.2.1.1 Practical Decisions

The decisions that guide technological use in music work demonstrate how workers make sense of technology in relation to their own practices. Practical decisions, for instance, are guided by the value of a technology's functions within existing workflows. Dominic is a

composer, arranger and transcriber who views technological tools as a practical method of undertaking musical tasks:

> it just kind of like narrows the gap between like what I'm thinking and what comes on to the paper. So, if I have like an idea then I can just write that down in like five minutes and then hear it with the MIDI playback… it's a, it's definitely a big help to the, to the process.

Dominic's view of technology aligns with the augmenting effect of technology on work, whereby the abstract creative roles of workers are maintained while tools reduce routine and monotonous obstacles to productivity (Autor, 2015; Susskind, 2020: 22). Dominic's description, however, is not particularly useful in understanding the social context of why the practical functions of technology are valuable within his work. Why, for instance, is productivity valuable within his work? Technology's agency to alter workflow seldom impacts decisions of use in isolation as there are also social motivations for obtaining these technological effects; technological work impact should therefore be examined alongside an understanding of how workers make sense of technology through their perception of their sociotechnical world (Wajcman, 2006: 777; Orlikowski, 2007: 1436-7). Dan, a hip-hop producer, artist, and beat-maker similarly identifies the practical impact of technology in his practice, but expands on the influences of his ongoing decision-making:

> Cubase 5 is an instrument for me because I use it in the way that Jimi Hendrix uses his guitar, you know, like I sort of know it inside out… like I use Cubase 5 when they're up to like [version] 12… I've started trying to learn Ableton, but I'm like when I've used Cubase 5 for like two decades, trying to use Ableton means I can't have a session with someone because I'm trying to learn something. So it's more about the expedience of it to get something done so you can keep the workflow going.

Dan's account begins to uncover why practical decisions influence his technological use beyond the mechanics of usability. He places value on technology that he is familiar with and prioritises this value to maintain working standards that he sets for himself. This working value reflects what Banks (2014: 242-6) calls 'being in the zone' of cultural work, where workers project a harmonious or immersive sociotechnical relationship that demonstrates

their own labour value as they work seamlessly within their environments. Dan believes that the disruption caused by learning to use new technologies would impact his workflow and therefore his ability to maintain his work as he currently conducts it. But he also specifically highlights how this becomes an issue when working with others, reflecting Banks' view of the need for seamless competence with technology in work to demonstrate labour value. He therefore relies on an out-dated digital audio workstation (DAW) – Cubase 5 – to prioritise and maintain his position in the short term and cannot make sense of disrupting his workflow for the benefits of newer technology. Materials have therefore become embedded in Dan's perception of practice to the extent that he does not believe he can work effectively without them, producing agency over the career directions that Dan navigates. However, Helen expands on how this embeddedness also enforces workers' agency over their actions, providing further rationale for practical decisions in technological use:

> the fantasy of: "oh, if I had this outboard or this mixing desk my mixes would sound like these amazing professional people". You know, the pros are actually just doing it on random technology that they're used to and they can have full control over it and they know what it does

The perception of control can expand understanding of practical decisions. In musical practice, Bijsterveld & Schulp (2004: 654-5) argue that the peculiarities of instruments enable musicians to gain a mastery in their work that they hold on to as a means of subsistence for their careers. The same feeling extends to the technological tools like DAWs that Dan considers to be one of his instruments. Instrumental mastery is, however, an outdated measure of success in an industry where work is often characterised by an entrepreneurial ability to exploit diverse revenue streams as opposed to relying on musical virtuosity (Thomson, 2013: 522). Nevertheless, this entrepreneurialism also emphasises the importance of reputation, as the music industry is a gig economy where cultural and social capital is accrued through past work (Portman-Smith & Harwood, 2015; Gandini, 2016). Making technological decisions based on the working value of flow and control enables workers to exploit these career conditions, maintaining consistency, reputation and careers. Dan, however, introduces a new dimension of practical decision-making that can override the

control problems and inefficiencies of learning time, highlighting the simultaneity of practical and artistic value in music work:

> I had time to learn [the bass guitar]. But that came cause I had a drive for it because I couldn't really create the bass I wanted in Cubase, you know? There wasn't a VST [Virtual Studio Technology] that could do what I was doing. But the thing is, with like Ableton or like fruity loops and, you know Logic, it's like, I can do the same thing in Cubase man

Decisions regarding technical learning time are often outweighed by a need to maintain workflows and control, but working value can also be found in new possibilities afforded by technology. Dan will not learn to use modern versions of DAWs because he feels he can achieve the same results by 'being in the zone' with his old version, which therefore provides no advantage to the negative impacts of learning-time and (short-term/possible) control loss with new technologies. Mol (2010: 261) argues that the technical possibility afforded by artefacts is not enough for technologically mediated practices to emerge, there must also be a coordination of users' interests and value of output. Dan's decision to overlook new software grows from such coordination as he believes technology is not providing new possibilities of interest to his practice. However, where new capabilities are provided that he perceives a need for, the impractical time requirement of learning to use that technology is a trade-off he is willing to make. Dan therefore demonstrates how workers balance contrasting needs within their careers as he decides to utilise the practical capabilities afforded by technology based upon an assessment of his artistic needs. The following section further explores the impact of these artistic values on decision making.

5.2.1.2 Artistic Decisions

Practical decisions are made through the possibilities that technologies afford. However, music careers are built upon increasingly individualistic positions based on workers' perception and acquisition of skills (Gibson, 2003: 208-9; McRobbie, 2016: 70-1; Purves & Himonides, 2021: 218). Decisions regarding technological use therefore balance practicality

with artistic skills. Elaine describes how the practicality of drum sampling technology motivated her initial use, but an artistic value has grown as a result:

> if I was to get a drummer in, I wouldn't really know what I was asking for and I wouldn't really know what I wanted to do, but I think it's about experimentation and that, and that freedom to experiment, which has been given to me by technology, I suppose, is what kind of makes this process really fun and is what's giving me my creative identity.

Beyond the practical affordances of technology that are used as rationale for her initial use, Elaine's ongoing decisions continue to reflect Banks' (2014: 244-5) description of 'being in the zone', where natural and productive cultural workflows make workers feel that they embody creativity in their practice. The prior view of immersion in technology as an expedient method of working is therefore dependent on the workers' perspective as Elaine utilises immersion differently, constructing a 'creative identity' that is often seen as a portrayal of artists' unique independent labour value (Hoedemaekers, 2018: 1367). Technology is therefore entangled with the social practices of workers, making the habitus a valuable site in the examination of how technology and its agency is constructed as a social action (Sterne, 2003: 384-5). The perception of technology through practicality in the habitus drives its use through working value, whereas artistic decisions construct technology as an identity-building device. However, the boundary between these decisions is described by Regina, who expands on the balance of the practical and artistic as a feature of musical careers:

> when I make new pieces it usually involves something that I'm exploring for the first time. There might be cases where I'm simply relying on the skills and technologies I already know, especially of course, if the time frame doesn't permit... But usually, the projects I find the most interesting are those in which I am actually facing a challenge to develop, to work with new technology.

Practical decisions for technology use often revolve around short-term career requirements; Regina argues however, that newer, less practical technology is more interesting to her. Artistic decisions are therefore aligned with autonomy, demonstrating opposition to the

working value of practical decisions that are heteronomous with the external time sensitivities of work that she doesn't have control over. For this reason, decisions on the artistic-practical axis reflect Bourdieu's opposition of autonomy and heteronomy, or cultural and economic capital, which he argues in the context of cultural production results in 'art for art's sake' the first instance and in 'mass audience' art in the second (Bourdieu, 1993: 49; 1986; Everett, 2002).

Artistic decisions made based on the 'challenge' of technological use align with Bourdieu's (1986: 18) concept of embodied capital as an investment of time, where short-term personal cost is tolerated for long-term personal improvement. Bourdieu argues such accumulation is not outwardly strategic because embodied capital is non-exchangeable for other capital, but it is tied to social perception of competition for power within fields (Banks, 2012: 81-2). Halford & Savage (2010: 945) build on this theory, however, identifying that embodied capital has a positive impact on career building because practitioners can gain power from the value placed on it in their specific context. In the western music industry, for example, workers rely on workflow and commodifiable output in the short-term, but they also must balance a construction of long-term immaterial labour value that enables them to gain work and audiences through their individualistic identity, reputation, and embodiment of artistic skills (Lingo & Tepper, 2013: 350; Gandini, 2016; McRobbie, 2016: 70-1; Hoedemaekers, 2018). Despite the autonomy/heteronomy opposition that practical and artistic decisions reflect, both therefore have benefits for music workers' careers, through short-term economic benefits of practical alignment with external demand in the first instance, and long-term accumulation of specific embodied capital in the second. The technological decisions that are made along the artistic-practical axis are never, therefore, taken in isolation but situated within the conditions of music work practices.

5.2.2 The Aesthetic-Economic Axis

Through artistic-practical decisions, workers use technology as a method of augmenting their actions within their practice, rationalised through objectives of short-term working efficiency or long-term embodied creativity. In contrast, aesthetic-economic decisions are rationalised

through perceptions of the self and others, as workers position themselves for personal or competitive gain within music production. This creates a scale from individual to collective positioning, beginning with personal fulfilment, then competition in niche markets, and finally economic decisions for competitive economic advantage in the field overall.

5.2.2.1 Economic Decisions

Economic decisions of technology use reflect practical decision making through their alignment with the heteronomous principle. While practical decisions aim to maintain workflows in the short-term, economic decisions follow an evaluation of the economic and competitive benefits that workers may derive from technological decisions. Zach, a mixing and mastering engineer explains his economic technology decisions:

> I've invested a lot in analogue gear as a way of differentiating because there's a lot of people out there now that do mastering with like plug-ins and a laptop and pair of small KRKs and stuff like that for 20 quid a track or whatever. And some people that's all they wanna pay, but, you know, it's not really worth it… having the nice gear allows me to justify having higher rates

This approach to technology reflects Pfaffenberger's (1988: 241) understanding of technological impact as a network of social actions and behaviours that influence one another. In this way, Zach's economic decision-making moves beyond the consideration of his own technological use; he develops rationale through an analysis of other workers, their technology use, and how this impacts market conditions. In this way, technological decisions are an extension of economic strategies like branding where workers research and develop an image that sets them apart from competitors (Taylor, 2024: 112-3). Through this strategy, Zach bases his technological use on market observations of inexpensive technologies that have enabled a saturation of services that undercut him, an impact of 'democratising' technology that has been observed through digital innovations such as home studio technology and streaming services in the music industry (Hracs, 2012: 459; Birtchnell & Elliott, 2018: 17; Hesmondhalgh, 2021). He utilises this understanding of sociotechnical context to adapt to 'sunrise' (digital/virtual) and 'sunset' (analogue) technologies based on

'cost-benefit-risk' assessments that have become key skills in the success of musical careers (Purves & Himonides, 2021: 218, 229). Economic decisions therefore approach technological use as a method of career-building that positions workers to compete within social and technical contexts. Annie, a composer and session musician expands this social contextualisation of technology decisions through her involvement as a paid music worker in the development of music technology:

> I kind of almost had the mentality that I'm, I'm not going to shoot myself in the foot, I'm just gonna take on the work… I've done it once before, but it was a different kind of approach and it seemed quite interesting. And I knew that my name was going to be associated with it, so I was just like, let's give it a go. And also, it's like if I'm not gonna do it, then someone else is, you know?

Annie is describing her decision to take a job recording samples for a new technological platform that aims to emulate her instrument, which could in theory reduce the need to hire musicians such as herself for recording work. She believes her practice exists in competition with others who will gain advantage over her if she does not approach decisions such as this technology engagement as economic opportunities. This approach to music work as an agglomeration of roles and revenue streams has become a common method of sustaining careers, as technologies enable workers to undertake more work while also driving down costs and therefore necessitating this extra work for financial security (Thomson, 2013: 517-9, 522; McRobbie, 2016; Negus: 2019; Tolmie, 2020). Annie's economic decision therefore reproduces her own perception of routine competition in the habitus and demonstrates reduced autonomy from the structures of her field (Reckwitz, 2002: 255).

Haynes & Marshall (2018: 18) argue that artists reluctantly step into these entrepreneurial roles as result of market forces, but by being entrepreneurial they can also exercise the autonomy and individuality of artistic work that has intrinsic value to succeed in opposition to conventional and routine work. Annie's reluctance is visible as she opts to take work because she doesn't want to be uncompetitive ('I'm not going to shoot myself in the foot'), but she also alludes to autonomy within her approach. She bases her decision on an assessment of the technology as 'different' and 'interesting', believing value could be derived

from associating her name with it. Her practice is not, therefore, exclusively guided by economic decisions. Annie introduces the final theme of technological decision-making (aesthetic) that aligns with Bourdieu's concepts of symbolic capital (as she legitimises choices based on her own perception and opinion of technology) and social capital (as she believes value lies in her association with particular materials and practices) (Bourdieu, 1986: 21; 1989: 17). The following section therefore introduces the aesthetic decisions that workers balance with economic perspectives.

5.2.2.2 Aesthetic Decisions

As can be partially seen in Annie's example above, aesthetic decisions often reflect workers' personal opinions of technology. Bourdieu (1984[1979]: 47) argues that a pure aesthetic disposition is a practice without function, separate from economic and social conditions of the world. Therefore, actions that are wholly influenced by personal aesthetic disposition are seldom seen in my sample because they provide limited competitive advantage or function to working musicians. Hracs (2016: 43) argues that a prioritisation of professional personas over autonomous aesthetic production has been shaped by digital technological change, lowering barriers for entry and increasing competition in music production. However, this can also be seen as a continuation of a gradual 'de-autonomisation' of art through industrialisation where production is guided by but not entirely reducible to economic calculation and capitalist demands (Banks, 2010: 255, 259). I therefore do not identify aesthetic decisions as a leading consideration in technological use but find how workers' personal aesthetic values factor into their professional practice. Dan, for example, discusses how his aesthetic decisions are constructed within wider socio-economic conditions:

> part of hip hop is to sort of be in the know, what's going on, wherever it is, whether it's a street thing that's going on, like whoever's been killed in the ends, you know, whatever is the hottest garms to wear and stuff like that. And also […] sort of the newest technology and what people are using. You know, you kind of want to be at the forefront, like I wanna be like a, a pioneer innit. And so far, like my whole career, that's what's kept me at the forefront

Dan builds his practice around the collective aesthetics of his genre, competing for advantage to be at the forefront of the group. Prior (2008: 302-3) argues that Bourdieusian concepts can uncover the social dynamics of music beyond the 'loose conglomerations of style' in genres by situating practices in socio-economic contexts that are in-part defined by musicians. In this way, Dan's aesthetic decisions are aligned with the field structure through the heteronomous principle because they are built on *illusio* – a 'belief in the game' of hip hop – that identification, participation, and reproduction of the aesthetic norms of his genre will and have been perceived as the source of his success (Prior, 2008: 311; Wanka & Gallistl, 2018: 4). His aesthetic decisions are not autonomous from the collective and are entwined with his economic competition, as is clear both through his need to be 'in the know', and through his indifference in equating technology, clothes, and murder as areas of aesthetic value in which he can compete.

Although professional music practices require a balance of economic and aesthetic decisions, they are not always reducible to economic action as is suggested by Dan's approach. Zach observes how his use of analogue equipment for economic gain (see section above) has led to, and been overwritten by the personal aesthetic value he places on the technology:

> I'm going to use it for the rest of my life even if I could do it more efficiently, because I've already got it, and I've got it because I prefer it, I'm a human being and I like this stuff... you're not gonna make these cold, hard, rational decisions about which is more efficient, you're going to be attached to certain things and keep using them.

By arguing that he has grown attached to the technology that enables economic advantage in his work, Zach makes meaning of his economic decisions through aesthetic value. Siciliano (2022: 2) observes how workers construct aesthetic experiences of the technologies they use to create a possession over their work in what he calls aesthetic enrolment. Such enrolment is often employed by managers as a method of controlling routine workers, keeping them in suboptimal conditions (e.g., low pay) through a sense of fulfilment in their tasks and interactions with cultural technology (Siciliano, 2016: 692). Although creative workers are often self-employed, they engage in self-exploitation to manage environments of informal

and discontinuous gig work; Zach's ongoing aesthetic decisions therefore reflect aesthetic enrolment that keeps him in work regardless of economic rationale (Watson, 2016: 11). Further examination is needed however, to understand how these developments in personal value are constructed in the sociotechnical context of music work. Elaine, a composer and artist expands this view by highlighting how her past technological decisions have shaped her career more widely, leading to a greater focus on aesthetic decisions:

> it was about like efficiency… that's how it kind of started as a producer and I think that led me towards the style of electronic music that I like now, that I had maybe always been on the peripheries for me, but I think it's a sort of, it's a practical thing and a stylistic thing, I suppose. […] Yeah, the decisions to kind of work with technology, it is an aesthetic consideration now, but I think it wasn't the initial draw

Elaine's experience expands understanding of aesthetics as a source and consequence of technology in music practice. She first made practical labour-based decisions to use technology, but this has shaped her consideration of the technology that is now rationalised through the aesthetic-economic axis. Griswold *et al*. (2018: 346) argue that technological practices can be examined as expressions of social statuses and groups through Bourdieu's view of material culture but can be expanded through the shaping view of materiality in STS. Elaine's experience is a case in point. The production technology she uses is embedded in the material culture of a particular genre: electronic music, which coordinates her ongoing aesthetic technological decisions through the consideration of what is stylistically relevant – perceived and expected through the habitus – within that social group (ibid; Bourdieu, 1989: 19; Prior, 2008: 311). However, her perception of norms in this group that was once at her periphery has only grown as an aesthetic consideration through her participation in it; that participation is enabled by technology that afforded practical gains and therefore also influenced her aesthetic values (Latour, 2005: 72). Elaine's aesthetic technology decisions are built on technical affordances, monetisation, and her perception and responses to collective preferences. My findings therefore reflect what O'Grady (2023: 145) argues is a commonly used but unreliable method of understanding technological value in music: aesthetic

alignment with social norms. They also build on this perspective by contextualising workers' aesthetic values within wider career-building uses of technology.

5.2.3 Summary

The axes presented here are constructed around different objectives and conceptualisations of technology. Although some workers occasionally make isolated decisions based on individual motivations, the majority are a balance of either or both axes within the habitus of working practices.

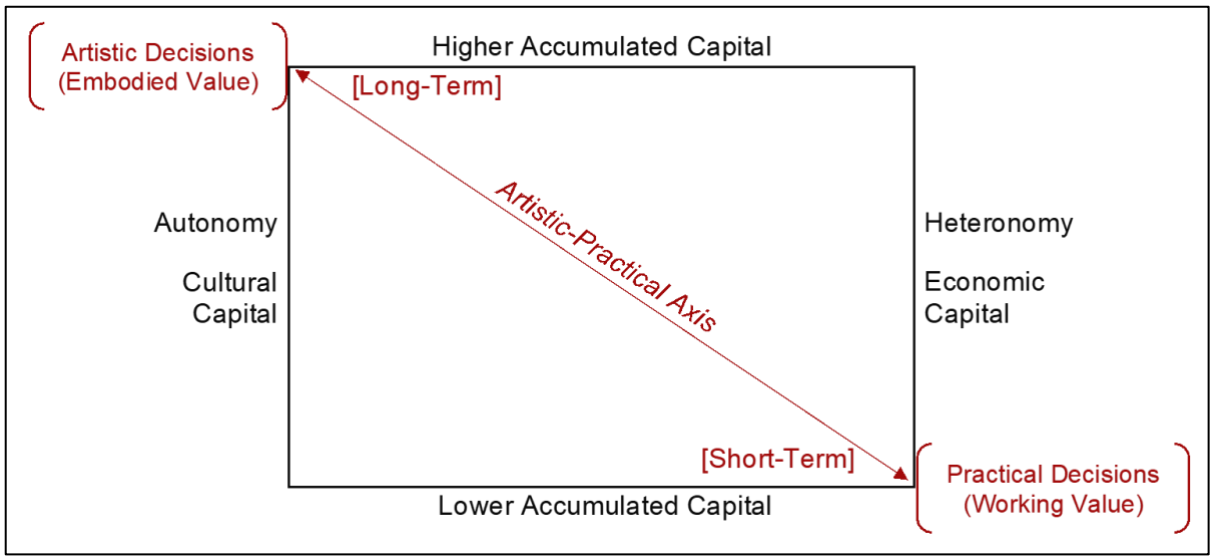

Figure 3: Artistic-Practical Axis of Technology Decision-Making

The first axis discussed, artistic-practical, explains technology use through the motivation to maintain and improve workers' actions in the long and short term. Practical decisions to use pre-AI technologies often favour the use of familiar technologies to ensure efficiency and control, allowing workers to maintain workflows in response to immediate heteronomous influences like external time constraints. In contrast, artistic decisions are used to exercise autonomy from short-term career requirements, instead building long-term embodiment of cultural creative capital. These are conceptualised as an 'artistic-economic axis' (figure 4 above) because workers balance both considerations of working efficiency and artistic embodiment within their careers to increase labour value through technology that effects actions. These actions show how the sociotechnical practice is constructed within the structured conditions of the western recording industry, where successful workers often

require short-term adaptability skills and long-term immaterial labour value to gain work and audiences (Lingo & Tepper, 2013: 350; Gandini, 2016; Hoedemaekers, 2018: 1360-1).

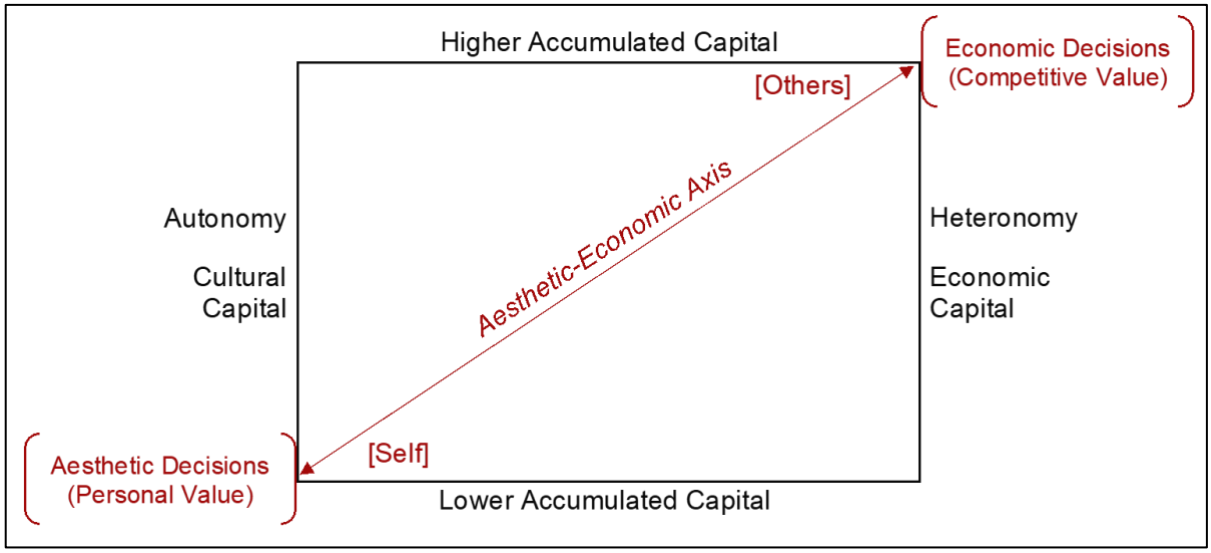

Figure 4: Aesthetic-Economic Axis of Technology Decision-Making

The second axis, aesthetic-economic, defines technology use through its influence on the positioning of artists' practice in relation to taste and markets (figure 5 above). Economic approaches build on evaluations of others' actions such as technology uses at the micro level or resulting macro sociotechnical conditions. By making economic decisions, workers attempt to gain direct economic and competitive advantage from technology use. As digital technologies have reduced the costs and bar for entry to musical work, this economic approach to technology is source and consequence of the landscape of entrepreneurialism where workers are often reliant on the utilisation of new and shifting revenue streams to succeed (Thomson, 2013; McRobbie, 2016; Haynes & Marshall, 2018; Beck & Bishop, 2018: 229; Negus: 2019; Tolmie, 2020). Aesthetic decisions, which are characterised by workers' personal tastes and interests in technology and its associations, are consequently a diminishing influence in technology use because they overlook the demands of competition in the current music industry landscape (Hracs, 2016: 43). But artists do often balance the two. Workers position themselves within situated contexts (niche markets, musical genres, socio-economic contexts) based on personal taste and economic advantage in specific practices as opposed to mass markets of the wider field (Hesmondhalgh, 1996: 474). Furthermore, aesthetic dispositions are often developed because of workers' engagement with

these specific practices (Prior, 2008). This merging of the aesthetic and economic extends to workers' sociotechnical relationships. Workers develop aesthetic relationships with technology to gain possession over otherwise non-creative economic decisions and rationalise enrolment in the sub-optimal conditions of discontinuous and precarious work that often exist in music work (Siciliano, 2016; 2022; Watson, 2016).

In using or considering the use of technology in music, it has been argued and evidenced that differences between AIM practitioners' views of music as a hobby, and workers' views of music as a career create more complex meaning-making in the latter group than is assumed by the former. This chapter has therefore introduced the perspectives of music workers into the analysis of AIM practice to contrast the meaning-making of technology between two social groups in an emerging sociotechnical network. Towards the second research question of this study, this foundational understanding of sociotechnical relationships in music demonstrates how workers make meaning of technological use within their wider careers, which will be utilised as a lens through which to examine the conceptualisation and consideration of AIM in the following chapter. However, by contextualising the practice of technological production in this way, I have also introduced the site of AIM design to the field of music work. Wajcman argues that 'the cultural dimensions of technology have figured little in the sociology of work' (Wajcman, 2006: 779). The following chapter expands understanding of AIM work impact by examining development and use as shaping factors alongside one another.

Chapter 6 AIM Impact

The two previous findings chapters presented the conditions in which technology is developed and used through sites of academic and commercial AIM practice, and sociotechnical music creation work in the western recording industry. They found that AIM is constructed through three broad types: technical, applied, and user approaches. Innovations of isolated technical AI models are constructed in the first, enabling AI-powered musical functions in the second, before functions are tailored to users' ergonomic needs in the third. However, the size, funding, and paradigms of first dominate the latter two, leading to a proliferation of general-use technical AI models and limited cumulative innovation of AI built for specific uses and user contexts in music work. At the site of use, music workers make sense of technology in their practices through two axes that balance autonomous and heteronomous alignment: artistic-practical decisions approach technology as an impact on labour actions, and aesthetic-economic decisions as an impact on the positioning of workers' practices within the music field.

In this chapter, I examine how the impact of AIM in the western recording industry is shaped by the practices of AIM development and technological use/meaning making that occur within these conditions, building on STS theories of technological impact that argue understanding requires simultaneous engagement with both 'projected and actual users and uses' (Wanka & Gallistl, 2018: 5). In section 6.1, I find that self-preservation of both AIM practitioners who shift responsibility for impact to workers, and music workers who pre-empt and adapt to technology as a method of aesthetic-economic competition perpetuate its deployment, introducing and reproducing its use in a process of normalisation. In section 6.2, I examine the argument of AIM practitioners that augmentation is a solution to replacement as the negative impact of AIM. Despite benefits of augmenting AIM, workers still perceive a need to draw boundaries between the technology and their own action to maintain autonomy.

6.1 Normalising AIM

In this section, I observe that despite moves towards contextualised innovation by applied and user types of practice in AIM, the conditions of the practice lead the conceptualisation of its impact as neutral. This enables developers and other dominant technology controllers to maintain development and deployment while responsibility is handed off to music workers who accept liability as an integral aspect of competition within their own practices. I then argue that AIM normalisation is shaped by attempts to predict and adapt practices to benefit from perceived technological futures, which reproduces those conditions of competition for others. These findings are concluded to result from a common motive of self-preservation; individuals engage in everyday Bourdieusian competition by aligning their practice with their perception of social conditions to maintain and gain advantage (Bourdieu, 1981: 307; 1984[1979]: 95; Banks, 2012: 81). These actions (in)advertently shape the impact of AIM on music workers.

6.1.1 Shifting Responsibility

In Chapter 4, I found that although differences in approach to the construction of AIM existed between types of practice that engage with technical innovation, application design, and the optimisation of AIM for users, attempts to innovate AIM as an agnostic practice of technical, social, and musical discourse as is increasingly argued for inside and outside the practice were constrained by the dominance of a technical paradigm (Born, 2020; Porcaro *et al*., 2021; Huang *et al.,* 2023). This section finds how these conditions deprioritise the understanding of impact but shape it nonetheless. Oliver, for example, observes how impact awareness could be valuable but is not utilised within the practice:

> the way that we relate to one another as people and as communities, is, shaped subtly and sometimes less subtly by the technologies we use… It would be very very useful in general, to be able to kind of speculate in an informed way about what those shifts might be and ask ourselves, now with our engineer's heads on… do we want to do it that way [now] we have some notion of what might come out of it. But I think right

> now there's still just a lot of feeling around and looking back and saying what happened afterwards.

Oliver believes that if engineers better understood how their technologies could shape society before design, they could make informed decisions about the development of AIM and the impact they want it to have. However, he reduces practitioners' understanding of impact to a passive commentary that is disconnected from the action of development. Practitioners cannot, therefore, make purposeful decisions about the impact of technology in design, reflecting anti-ideological stance of design in the computer sciences that Keyes *et al*. argue: 'has constrained our ability to question and challenge the consequences of the work we put into the world' (2019: 2). Where AIM practitioners do engage with the impact of AIM, however, it is often not the practitioner but the technology that is viewed as neutral, with negative impacts resulting from external factors that should change for positive impact to be achieved. Ross, a user practitioner examining perceptions of AIM, shifts the responsibility for the impact of his practice to the conditions of its use in this way:

> this technology has to be put into a political and social context… my personal opinion would be that copyright should not exist completely, and that shouldn't be the way artists survive, like there are other ways to do that and all the problems related to copyright disappear if you change the political system. Of course, if you don't change the political system it's going to be very scary for studio, studio artists, or like composers that compose for like advertisement or things like that

Bourdieu (1989: 18) argues that not only objective actions, but individual and collective perceptions within the structural constraints of practices contribute to the construction of reality. The structural conditions of AIM can be seen to influence practitioners' positions on the impact of their practices. In addition to the limits on interdisciplinary and contextual engagement in design discussed above, I found in section 4.3 how the development of technical artefacts is constrained in AIM practice as technical responsibility is handed off between stages of development, impacting practitioners' perception and ability to cumulatively innovate within the practice. This culture of shifting responsibility extends beyond the artefacts through which practitioners perceive their world. Ross also shifts

responsibility to other practices, arguing that negative consequences of AIM are the result of contextual conditions as opposed to technological change. Kalluri (2020), however, warns that the framing of AI as a neutral actor whose negative impacts are only the result of an unfair society reproduces structural conditions, shifting power to dominant actors who develop and harness AI for their own gain (see also: Spencer, 2017: 145; Boyd & Holton, 2018: 337-8). By placing responsibility outside of technology design, Ross constructs rationale for maintaining his own practice as it is, despite the negative 'scary' impacts that he believes will result under current conditions. This view of neutrality as rationale for maintaining AIM practice is continued by Peter, who accepts the capacity of technology to impact music workers, but uses a wider macro-level narrative to argue that negative impacts are balanced by positives:

> Definitely a lot of jobs would be cut right. People who make low-level or mid-level creative things, they will be cut but artists and artist movements in general, they will react to this and we will see a flourishing of something we don't know which is provoked by this quote: "threat" that that we are facing. So, I see people that live in that friction and they that they fear it but I don't fear it myself. I see that this is like a huge opportunity.

Peter rationalises the impact of his practice by drawing boundaries between levels of creativity in the musical field. He believes his practice presents a 'huge opportunity' for workers and doesn't think cutting low- and mid-level creative jobs is a 'threat' that people should 'fear'. This reflects shifting power to technology controllers as AI is introduced to workforces (Boyd & Holton, 2018: 337; Kalluri, 2020) because Peter decides which jobs are worth saving and cutting as part of his practice. This choice of language also reflects Ross' belief that musical context makes AIM 'scary' for some workers, evoking common discourse of technological unemployment when considering AI impact. Peter utilises this conceptualisation to reproduce a widespread argument in AI impact discourse that the technology will follow the neutral impact of historical technological change at the macro-level; the 'opportunity' for new work enabled by AI counteracts the displacement of other workers (Autor, 2015; Acemoglu & Restrepo, 2018; PwC, 2018; Szczepański, 2019). The

aim of this study is not, however, to predict mass job displacement, but how AIM development intersects with its uses to shape music working practices. Peter's lens of unemployment can aid understanding of this shaping relationship.

By making sense of AIM employment neutrality through boundary-making between lower-level creativity and 'artistic movements', Peter, like Ross, shifts responsibility for impact away from AIM practice. Akrich (1992: 216) argues that technology can be scripted with agency in design that defines how it interacts with and affects society, but that this can be overwritten by users who interpret the technology with new meanings. Through this lens, Peter characterises AIM impacts as either scripted through technological design (cuts) or resulting from users' interpretation of the technology that changes its meaning (opportunity). Although he identifies the negative impact of job reduction as a direct result of his technology, he views it as neutral for two reasons: (1) negative impacts should not be feared because the jobs that are cut are deemed as low-level, and (2) positive impacts can result from users'/music workers' actions and adaptations to new technologies. This responsibility for adaptation to technological change is observed by Dennis, a media composer in his fifties who believes music workers such as himself should be accountable for the negative impacts of technology:

> Part of the idea, is a fear about technology replacing humans. Like is this is going to take away our jobs and, I don't have a lot of sympathy with that idea like I think people who are replaced by like like technology deserve it. Like like if if you create things that are that off the shelf, you know

Dennis takes responsibility for the impact of technology on his own practice as a method of maintaining his career – it is his job to be creative enough to avoid replacement. AIM technologies are in this way no different from any rules (illusio) or common language (doxa) that individuals perceive through the habitus as a necessary method of competing within fields, as Sterne argues: 'technologies are little crystallized parts of habitus. At a basic level, a technology is a repeatable social, cultural and material process' (Bourdieu, 1993: 257; Benson, 1999: 464; Everett, 2002: 69; Sterne, 2003: 376). Dennis' responsibility for success despite technological change, for instance, is no different from music workers' responses to

the wider conditions of music work. Limited access to support, collective rights, and stable work creates a sector where workers who participate do so despite these conditions because of an emotional investment in music, often therefore requiring a degree of self-exploitation to compete (Speers, 2016: 67; Watson, 2016: 13; Murgia & de Heusch, 2020). Responsibility for impact is therefore often located with workers as the end-users of AIM resulting from the conditions of AIM practice and the musical field, but the following section argues that perceived responsibility in work also shapes the introduction and impact of AIM within music working practices alongside AI development.

6.1.2 Pre-Empting and Adapting to AIM

As AIM is an emergent practice, both AIM practitioners and music workers talk about AI in music as a fluid concept rather than as concrete artefacts that will remain in their current state – its technologies will develop both technically and socially in the music industry. The integration of AI to working practices is therefore contingent on beliefs about the position of the technology within this progression, and how this will change over time until its normalisation. Annie discusses a perceived need to pre-empt how the technology will change her practice, positioning herself for this future:

> it's important to be open to the changes, even if, like you don't love the idea of it, you should be like okay: "how can I get involved in this?" Because like if you're just gonna be like: "no AI, I'm gonna ignore it and pretend it's not there", then probably you're gonna become a bit of a dinosaur

In the previous chapter, economic sociotechnical relationships were discussed through Purves & Himonides' (2021: 218) observation that shifting landscapes of sunrise and sunset technologies necessitate workers' analysis and adaptation to change. Annie highlights the importance of sunrise technologies as she perceives a need for familiarity with emerging technologies that enables competitiveness in practice. This expands Mol's (2010: 259) argument that technology must *interest* users, consumers, and other stakeholders beyond its development to be integrated within a world system. Annie's view demonstrates how this idea of 'interest' in technology requires understanding beyond an interest in the artefact itself.

She is not driven by a direct interest in AI and its capabilities, believing that workers' indifference to the technology is itself unimportant. Instead, her interest in the longevity of her practice leads to economic decisions for use, taken in response to market conditions where other people's interests and uses of AI could render her obsolete if she ignores it and the technology is normalised in practice.

This attempt to pre-empt the normalisation of technology could point towards the establishment of the conditions that Annie predicts. Reckwitz (2002: 255) argues that practices become routine through social reproduction, and transformations occur where agents take interpretive action against these everyday routines. By predicting that the normalisation of AIM will occur and acting in a way that she believes will become routine, Annie's interpretive economic action is producing the conditions that she is trying to protect herself against. Although normalisation is constructed through pre-emptive use, AIM practitioners' heteronomous engagement with music workers and dominant actors in the music field also shape the process, as shown by Samuel, an applied commercial AIM practitioner:

> major music labels are not very technical, they are wary of technology… So, sometimes they are a bit difficult to approach, but we have to work with them because you can't work against them. So, so the best way to work with them is to work with the musicians because their job is to promote the musician… very quickly you become also involved in promotion because they want […] it's also possible to say that, okay: "I did my music with AI and it's so cool"

Samuel appeals to the dominant actors in the musical field to accumulate social capital associated with them, recruiting music workers to use his technology as intermediaries for his own access to power actors in the structures of the musical field (Bourdieu, 1986: 21). In doing this, he is aligning himself with the power of existing dominant controllers in the industry who often expand into new markets by investing in new innovations to ensure they maintain positions of power (Hagen, 2022). He also observes how this is possible because music workers can benefit from association with novel AI; music workers and AIM practitioners alike can compete for AI meta-capital (see section 4.2.2.1-2) as it exists beyond

field-boundaries – Annie above identified value in early engagement with AI because those without it could become obsolete. This allows AIM practitioners to engage in what Compagni *et al*. (2015: 267, cf. Boyd & Holton, 2018) call 'discursive persuasion', where technology use is legitimised and expanded through positive narratives of early implementation in working practices. However, Halford & Savage (2010: 946) argue that as these technologies become widespread, their use no longer provides inherent capital value as they become the norm. By utilising AI meta-capital as an incentive of AIM use to employ musicians as intermediaries and offer them as exemplars in discursive persuasion, Samuel introduces new technologies to dominant actors and contributes to its normalisation. This process of normalisation leads to the reduction in inherent capital value of technology in the perception of workers, as shown by Amber, a composer and session musician:

> if it got to a point where people were [using AI], then I wouldn't feel guilty because it wouldn't feel like a hidden secret, it's just what everyone is doing… if it becomes the norm and you don't use it you just look like a dinosaur, you know?

Amber makes sense of AIM through an illusio of the musical field, only using technology that is widely accepted as opposed to the needs of specific aesthetically defined practices (genres and sub-cultures). Bijker (1993: 121) theorises that technological *stabilisation* is achieved where it is accepted by relevant social groups, leading to a stable position in its development; this stable position then leads to *closure*: a consensus that ends controversy surrounding the technology. Amber's observations highlight how this stabilisation of AIM in music work is necessary for her to feel closure regarding her concerns of its use, where she believes she would feel guilty using technology that is not commonplace. Her approach therefore reflects reduced agency through the self-imposed exploitation discussed in the previous section, as she pressures herself to follow perceived rules and norms of the industry. More than this, however, the normalisation of AIM would reverse her position from a trepidation for its use, to a trepidation for abstention – she is afraid she will 'look like a dinosaur' if she does not follow others' example (as was warned by Annie that the top of this section). Amber therefore does not compete for a dominant position in the field through economic uses of technology but perceives heteronomous pressure from its normalised uses.

Once the technology is stabilised in the field its inherent value as a method of competitive economic gain therefore diminishes for workers like Amber who make practical decisions to follow norms that enable them to maintain pre-existing practices. This is not to say that value cannot be derived from its use, but added value is not explicitly gained from use where workers feel obliged to do so. The following section examines how the balance of economic and aesthetic values in music work can alter engagement with AIM as it becomes normalised in practice.

6.1.2.1 Diverging from Norms

Although normalisation can influence the uptake of AIM as workers perceive a need to evade obsolescence, these economic decisions also balance aesthetic values as workers attempt to align their actions within existing markets. Dan, a producer, beat-maker, and artist describes how decisions to use technology are defined through a boundary between competing for advantage within the field overall, or within specific markets:

> it depends on the type of artist you are if you care about integrity and I've realised I don't really care. I'm like: "what gets the banger done?" You know what I'm saying?... I just want to get to making a song that satisfies people… other people they're like, no, this is my niche audience and they need to know that everything I've done is pure from me.

Dan believes his method of production is unimportant to mainstream markets and therefore prioritises the generation of output through any technical means necessary, regardless of its impact on his own 'integrity'. In doing so he responds to the limited value placed on the labour of creation in favour of exploiting artistic goods (revenue from intellectual property) in the recording industry (Cohen, 2012: 150; Hesmondhalgh, 2019: 105; Drott, 2020). However, both sides of the boundary he describes are still economic decisions; they are what Bourdieu (1993: 126-7) calls the two modes of middle-brow cultural production that either target the widest possible public through the 'average spectator' or specific markets through social categories, but both have the objective of achieving profitability. This common goal between the two can be seen through Elaine's sense-making of AIM within her practice as

active responses to the normalisation of AIM that can result in both participation and rejection based on the perception of her practice:

> I suppose if, if people around me were using it and it was enabling them to make what I perceived to be better compositions than they used to make, I would think, well, I ought to try the same thing. […] If it was a sort of genre that was sort of borne out of it, I would either partake in it if I was quick enough to be first, or I would go the other way and completely reject it if I was late.

Elaine makes sense of AIM through both artistic-practical and aesthetic-economic lenses. Through the first, where artists engage with technology to influence their action, she argues that the normalisation of the technology in other workers' practices would only impact her decision making where the technology perceptibly improves her artistic action. This use suggests the agency-reducing effect discussed above as she believes she *ought* to participate because of the technology's affordances. However, cultural technological norms have less significant impact on her work. Through an aesthetic-economic lens, Elaine's consideration departs from the workers above who feel pressure to use normalised technology to remain relevant as she believes there are differing ways that she could position her practice alongside the technology. Prior (2008: 310) observes how workers at the fringe in the music industry often defend their positions as individualistic and autonomous artists by staving off orthodoxy, utilising new ideas before they are appropriated by mass market agents in struggles for position. Elaine's AIM sense-making reflects this practice of fringe work within the wider context of the music industry where styles and practices cross over between niche and mass appeal as they are introduced in the independent 'test market' before adoption by larger dominant actors (Hesmondhalgh, 1996: 474). If she is early enough to be at the fringe of an AIM movement that she aesthetically values she will participate, but she would react against it if a normalised sociotechnical practice emerges before she is involved.

Elaine's actions are therefore aesthetically driven but are not separate from external pressure as she reproduces the conventions of niche and fringe practices observed by Prior. Rather than basing decisions for use solely on her own taste, she is reacting to technology based on its relation to her understanding, belief, and reproduction of collective values in her specific

area of practice (genre/group): Bourdieu's *illusio* (Prior, 2008: 311; see also: Klein *et al*., 2017: 222).

6.1.3 Summary: Self-Preservation

The individual influences of AIM practice and music work presented here are not intended to be exhaustive because individual instances of technological design and use can have different effects on different people. Instead, these perceptions of technological futures highlight how the impact of AIM is co-constructed at a basic level by individual action through what Banks (2012: 81) sees as the lowest common denominator of Bourdieu's practice theory: self-preservation. The example of AIM practitioners shifting responsibility away from their practice, for instance, reflects the handoff of responsibility for artefacts between stages of design common to the conditions practice as introduced in section 4.3. Steen (2021) argues that integrating this responsibility within practices can be beneficial for innovation but can also slow the process down and increase costs. Therefore, by following and extending the norms of practice, individual practitioners avoid these costs through self-preservation, improving their own competitiveness (Bourdieu, 1993: 257; Benson, 1999: 464). Music workers continue the theme of self-preservation seen in AIM development by accepting responsibility and shaping the stabilisation of emergent innovations in the field as an integral factor of competition. In doing so they respond to music industry conditions where individualised self-exploitation and entrepreneurialism is viewed as a pre-requisite for success, and although divergence from these market pressures is possible, it impacts the practitioner's ability to earn a living and maintain their practice (Becker, 2008[1982]: 33; Speers, 2016: 67; Watson, 2016: 13; Murgia & de Heusch, 2020).

In this context of a perceived needs for self-preservation in AIM development and use, both AIM practitioners' and music workers' approaches to AIM construct its normalisation. Beyond the aesthetic-economic decisions discussed in Chapter 5, workers make economic decisions on assessments of other competitors' relational practices and on predicted normalisation of the technology and their own position as a result. This meaning making guides both early adoption of AIM through general heteronomous competitiveness,

adaptation to emerging aesthetically aligned sociotechnical practices (to participate or oppose), before existing aesthetic-economic decision-making is applied to the conceptualisation of future stabilised technologies within the field. These aesthetic-economic decisions can therefore contribute to the normalisation of AIM that workers believe they are pre-empting and reacting to; transformations in the routine conditions of practices are informed by interpretative action and expectations (early adoption), and by social reproduction of those conditions (adaptation) (Everett, 2002: 69; Reckwitz, 2002: 255). Everyday actions of self-preservation, whether interested, indifferent, or oppositional, can therefore contribute to the proliferation of AIM in music work through normalisation, where workers feel they must engage with the technology at differing stages of its development and deployment to maintain their own practices.

6.2 Augmenting Labour

This section engages with the dominant narrative of impact in AIM, that technology designed to augment workers either makes work easier or the worker better; augmentation is therefore often proposed as a beneficial alternative to replacement. Workers' experiences and perception of the positive and negative impacts of AIM augmentation are examined here to contextualise this argument of AIM development within music workers' practices.

6.2.1 Opposing Replacement in Design

The previous section found that approaches to the positive, negative, and neutral impacts of AIM practice can be seen as an extension of the development handoffs seen within the collective technical labour of AIM practices, where responsibility for impact is shifted beyond stages of AIM practice to external users and conditions of use, often in response to perceived risks of technology replacing human workers. AIM practitioners (often in applied and user types) continue to react to the risks of technological unemployment where they design technology for specific objectives that benefit the user. Utilising a common dichotomy of AI replacement and augmentation discussed in AI work impact discourses, they stress their opposition to AI as automation or replacement, instead advocating for augmentation, complementation, human-in-the-loop, or other variants of human-machine enhancement as beneficial strategies. This is shown by Nathan, an applied AIM practitioner who describes his objectives:

> [R] So, could you just start off by explaining your research and role in [department]?
>
> [P] … it's really not, the goal is not to have replacement or to have something which can generate music by itself. It's really more creating new instruments and new means of creativity

This binary opposition was introduced by Nathan after the first question of the interview, as he immediately defined his work against a view of AI as a replacement for human workers. This is common across my sample where replacement is raised as a straw man argument that distances AIM practice from technological unemployment – the most prominent negative

impact of AI on work in the public perception (Keynes, 1930; Leontief, 1983; Autor, 2015; Mokyr *et al*., 2015; Bastani, 2020; Peters, 2020; Susskind, 2020) – and reflects approaches in AIM literature where augmentation is used as a positive solution to risks of replacement (e.g., Savery & Weinberg, 2022: 53). However, Ashton (2022) argues that this dichotomy can overlook the equal potential for augmented human-machine relationships to degrade as well as improve working conditions. There is, for instance, limited evidence of expanding skills and qualifications in the overall workforce resulting from technological change, and humans often become monitors of digital processes as opposed to enhanced creative workers in industry 4.0 (Kim *et al.*, 2017: 3; Salento, 2018: 375).

Nevertheless, the design and communication of AIM as an augmentation of musical labour represents an acknowledgement of responsibility for impact, as practitioners argue its benefits. But the recurring theme of countering risks of replacement with augmentation reflects the findings of Szymanski *et al.* that 'In practice, "responsibility" often involves demonstrating potential public benefits, and a relatively narrow range of potential benefits become routinely cited' (Szymanski *et al*., 2020: 5). Through the perspectives and experiences of music workers, this section therefore examines the benefits argued by AIM practitioners, which can be split into two areas of AI-augmentation through the lens of artistic-practical axis introduced in the previous chapter. The first of these is raised by Nathan above, that augmenting AI is perceived as an artistic tool with the potential to expand creativity, as discussed by Samuel, an applied commercial AIM practitioner:

> there are other companies that would like to produce music without having to pay musicians for it… our point of view is something which is more in a way traditional, we want to do music instruments… you can have a distinction between creativity *with* AI, and creativity *from* AI. Uh, if we are referring to creativity, uh, *with* AI it's not a new paradigm because it's creativity with technical means… the piano is technical progress at one point it didn't exist, so you are being creative differently, or you can even be inspired by, by your piano… in this case, we, we try to have an AI-powered instrument, if you wish, to be a partner, partner to the musician. Then this partner can

> inspire a musician, can answer to the musician, can provide new ideas just like a human musician in some way

Samuel presents the capacity of AIM to provide ideas and inspiration as a method of enhancing musicians' creativity in contrast to the negative of technological replacement. This approach to impact reflects Shneiderman's (2022: 30) argument that AI augmentation can empower people to create novel, interesting, meaningful music; instruments are observed to have extended the possibilities of what musicians can do while holding on to creative agency, and AI is argued as 'likely to carry forward that tradition'. Both Samuel's belief that creativity with AI is the same 'paradigm' as 'creativity with technical means' such as the piano, and Shneiderman's belief that AI will 'carry forward' the effects of previous instruments, suggest that technological change is stepwise and linear while overlooking the mediating effect of new human-machine augmentation on human requirements and experience within complex sociotechnical environments (Peters, 2020: 490; Neumann *et al*., 2021: 2).

Gioti therefore argues that designing AI as a tool for musicians can only close the gap between automated and artistic tasks when this design is 'regarded as *artistic* in nature', and where 'closer collaboration between developers and artists can ensure that the machine learning models… meet the needs of *artistic* practice' (2019a, my emphasis). Although I found in Chapter 4 that AIM practice is dominated by technical paradigms that shape innovation, Samuel, as an applied practitioner, is an outlier who has collaborated with artists. Nevertheless, the ideological differences between music workers and AIM practitioners creates a perspective of music as a hobby in AIM design, where Samuel argued musicians 'don't have a need for anything', and they only use technology 'because it's fun' (see section 5.1.2). His approach therefore reflects Gioti's belief that AI design should be approached as an extension of, and innovation for *artistic* practice. The musician is therefore treated as an autonomous artistic actor in contrast to my findings in Chapter 5, where sociotechnical musical practices were found to be constructed through decisions beyond artistic considerations. There is another approach to AI augmentation described by Martha, however, that does incorporate these other aspects of music work:

> I always want the creator, the creative person to be at the centre. So, whether it is to facilitate their work, make it easier, or just maybe because I can put myself in their shoes, right? I feel like I want technology to be working for me and not, you know, instead of me, or be constrained or feel afraid by it… the people I've talked to have gotten to a point where they're embracing the technology as long as it doesn't put them out of their job and it doesn't take away their creative integrity and freedom. They're very happy to work with tools that can make their lives easier.

Martha continues to oppose fears about technological replacement but contrasts the approach to AIM as a method of expanding the creativity of the user with its characterisation as a practical tool to make workers' lives easier. This approach therefore invokes the second aspect of the artistic-practical axis of technology use; artistic decisions are made based on long-term accumulation of embodied creative capital and practical decisions are made based on the ability to maintain the workflow and positioning of music careers (see section 5.2.3). Through her user approach, however, she identifies that augmentation is not a benign solution to the negative impacts of replacement because workers continue to rely on a balance of autonomous and heteronomous needs when using AI tools. However, she focuses on the impacts of her own technological development, asking whether its functions constrain the user. Bown (2021: 9) argues that although this approach is a positive method of designing functionally useful AI use-cases, it draws attention away from contextual social considerations which require sociological engagement to understand. This is because the effects of technology do not exist in isolation, and they therefore require an understanding of interactions between impacts in the context of pre-existing sociotechnical environments (Ekstrand *et al*., 2018: 343; Selbst *et al.,* 2019). The enhancement of creativity argued for by Samuel, for instance, could make workers' lives easier as argued for by Martha, but it could also affect their perception of creative integrity and freedom that she describes, highlighting how the impacts that she discusses intersect between multiple use-cases.

Boyd & Holton (2018: 342-3) respond to single hypotheses of transformation in AI work impact by emphasising the need to examine simultaneous interpretations of uncertain technological change that result from social diffusion, cost, and acceptance. This began

above, where the uptake and acceptance of AIM was seen through aesthetic-economic pre-emption and adaptation to technological innovations that are expected or perceived to become normal in music work. In the following sections, I continue this exploration of AIM's social diffusion by examining how developers' hypothesis of beneficial augmenting AIM (where music work can be made easier, and music workers better) is perceived in context through the lens of workers' artistic-practical decisions and values. Where possible I do this through workers' experiences of AIM but expand beyond specific technological interaction through their perceptions and interpretations of the implications of AIM functionality within their sociotechnical practices.

6.2.2 Compartmentalising Efficiency

The automation and efficiency of mundane and time-consuming tasks is a recurring argument for the practical complimenting effect of AIM in musical practice (De Man *et al*., 2017; Fiebrink & Caramiaux, 2018; Ianigro & Bown, 2019; Dahlstedt, 2021: 878). Dominic – a composer who subsidises his work with arranging and transcription jobs – makes sense of AIM through practical value in this way, drawing boundaries between creative and non-creative aspects of his work:

> where I see it helping a lot is like automating a lot of the processes that don't require the human creative touch. Like editing scores and stuff like that or like editing audio. You're already seeing like things where you get some, some kind of audio which has like some frequencies that are unwanted, and AI can just go in and like cut all of that out which would take like human hours to do right?

Technological work impact is often discussed through the mediating effect of organisational and state policies regarding deployment, as technological uptake is often driven by the interests of capital power, not workers (e.g., Spencer, 2017; Salento, 2018). As a field of largely discontinuous, self-employed work however, music production practitioners like Dominic demonstrate how they are ultimately the decision-makers when using new technologies, operating within and responding to the structures of their practices. Gibbs (2017) for instance, argues that policy should be used to encourage the use of AI to augment

work in a way that encourages a focus on human creativity in work. Dominic makes this decision himself, centring the consideration of AI use through the lens of traditional workplace technologies that reduce routine labour (Autor, 2015: 5). By confining AI to routine labour, he draws a boundary that maintains his own agency for the 'human creative touch'. He therefore aligns his personal input with the autonomous pole of the music field while delegating the practical needs of his career to machine action, maintaining the benefits of heteronomous alignment but distancing himself from it. This boundary is also drawn by Julie, a technical AIM practitioner who argues the benefits of her practice for workers:

> any part in this pipeline that someone don't want to have to do because it's too mundane or it's too time consuming, energy consuming, there can be an AI solution or alternative to undertake such boring tasks for them if they want. It's not compulsory, of course.

Although Julie identifies the same practical decision as Dominic, she goes on to frame these benefits as a solution that workers can opt-in to. Earlier in the chapter (section 6.1.3), I found how the independent conditions of self-preservation in technological innovation and use lead to a perception of normalisation, expectation, and need for music workers to adopt and adapt to new methods of working that result from emergent AIM. In this context, practical AIM uses are more complex than being 'compulsory' or not. Julie's perception therefore reflects solutionism that practitioners in the applied and user types of my sample often distance themselves from, as it posits technical solutions that overlook the causes and context of problems in music, and therefore cannot demonstrate how they overcome them beyond isolated functionality (McPherson *et al*., 2019: 207, cf. Morreale *et al*., 2020: 162; Harkins & Prior, 2022: 85-6). I therefore examine how these uses of AIM influence working practices beyond decisions to opt in or out of their functional benefits.

6.2.2.1 Inhuman Demand

Zach describes the knock-on impacts of practical AIM use. He is a mixing and mastering engineer who believes he needs routine work within his practice to manage demands on his creativity:

> even if it's doing the repetitive tasks, you as a human being, you can't be 100% switched on creatively like all the time. Like sometimes you need to take an hour to do something that's a bit easier. So, I mean like if AI is taking care of all the easier stuff, that doesn't mean I can suddenly spend 8 hours being like at the top of my creativity, that's not how humans work, you know?

Music workers often take an entrepreneurial approach to multiple creative and non-creative roles to maintain careers in the music industry (McRobbie, 2016; Haynes & Marshall, 2018; Murgia & Heusch, 2020). Thomson (2013: 522-3) argues that as musicians' careers grow, they begin to collaborate with non-creative support networks (booking agents, managers, accountants, etc.) to increase their earning capacity and creative time. Although these efficiencies beyond the worker's creative practice are beneficial, Zach doesn't believe benefits would continue for compartmentalisation and delegation of tasks *within* his creative practices. In contrast to the belief that AI-augmentation of routine work frees human workers to focus on their unique creative skills that separate them from machines (Pasparakis *et al*., 2021; Savery & Weinberg, 2022: 53), he instead argues that his productivity would not increase because he could not meet increased demand on his creative capacity. He has achieved a balance between creative and routine work that enables him to succeed. Banks (2014: 247-8) finds that creative productivity is often achieved by 'being in the zone' of cultural work: a state of immersion that is valued but difficult to achieve, so workers often undertake tolerable routine work that is then 'punctuated by moments of transcendent bliss'. Zach's view reflects this as he cannot 'be in the zone' for 8 hours a day. The practical benefits of AI are therefore integral to the existing balance of artistic-practical decisions in music work because augmentation of one aspect (practical) does not enable workers to overcome other (artistic) struggles of practice.

Nevertheless, if the ability to improve efficiency in routine aspects of work do enable greater productivity regardless of Zach's concerns about creativity, he argues these efficiencies would pressure all workers to adapt to a new pace of work:

> if AI speeds up these processes, it's gonna turn the whole thing into such a volume business, like, if you can now, using AI, mix a track in 45 minutes, how much can

> you really charge for that? You know what I mean, it devalues it to the point where you have to be super productive… I don't think you can do it.

As was argued in section 6.1, the conditions of AIM's development and use can construct its normalisation where workers feel pressure to use it to maintain their practices. Zach describes an extreme example but raises concerns beyond his view of creative capacity, to overall capacity where his work becomes a 'volume business' through normalisation of newly efficient practices. AI augmentation through practical uses can therefore enable a transition of scale described by Taylor (2024: 46), where cultural production becomes commodity production through productive labour practices that devalue workers' output as Zach argues. This is exacerbated by the benefits of technology that create dependence on its use, which can also create inequality (in this case, non-competitiveness) for those who can't or don't use it (Hagen, 2022). Zach believes routine AIM efficiencies could shape his practice through unachievable demand for creativity and output that he would have to follow to remain competitive, which is also observed by Helen, a producer and mixing engineer:

> the increase in pace kind of comes with a pressure to be that fast all the time. And I think that's not quite what creative work is... It's like actually about taking a second to consider what you want something to sound like and, and what might work and what might not. It might be that you go to a few places that don't work, and that, I'm worried about that being considered wasted time. I actually think it's often a really important part of the process where you're learning.

Helen expands on Zach's belief that the pursuit of efficiency serves to normalise it, placing unattainable demand on creativity. O'Neill (2016: 603) argues that increasing use of technology to reduce inefficiency can lead to workers' internalisation of efficiency as an approach to work that reduces spontaneity and creativity through new expectations. Although Helen views creative work as necessarily inefficient, the benefits of practical AIM use create a perception that shapes artistic aspects of practice. The conditions in which she uses creative skills are therefore degraded by breaking down the boundary she draws between autonomous and heteronomous alignment in her practice, devaluing her autonomy to 'waste' time in the face of increased efficiency. Beyond her personal view of what creative work should be,

however, she also argues that this impacts conditions in which workers learn the skills necessary to do their job. This again contradicts the argument that humans can utilise skills in tasks that AI does not perform (e.g., Pasparakis *et al*., 2021; Savery & Weinberg, 2022: 53) by looking beyond the direct affordances of the technology. The sociotechnical construction of practices highlights how technical solutions to specific tasks can shape practices overall through both macro and micro-level influences, seen here as workers perceive and react to the new costs of exercising and developing time-intensive creative skills in the context of greater efficiency (Boyd & Holton, 2018: 342). This shaping of artistic decisions is therefore a knock-on effect of practical AIM use; however, AIM is also increasingly capable of augmenting creative tasks with direct benefits and risks within workers' artistic practice.

6.2.2.2 Creative Efficiency: Unfulfilling Work

The use of AI for mundane tasks enables workers to draw boundaries between their own autonomous action and alignment with heteronomous career needs by shifting those actions onto technical actors. However, the view of AI as a tool for routine tasks treats emergent technology through historical lenses and is therefore rapidly growing out-of-date as generative models are increasingly capable of creating, recommending, and editing music interactively and autonomously (Susskind & Susskind, 2015: 159; Fiebrink & Caramiaux, 2018; Briot, 2020; McCormack *et al*., 2020: 42; Caramiaux & Donnarumma, 2021; Dahlstedt: 2021: 875). The integration of these more creative applications of AI within working practices can blur this boundary, but workers still attempt to maintain separation. Annie is a composer who describes her feelings about using the algorithmic functions that exist within her current workplace technology:

> I actually have a drum sequencer where I can choose my samples, and it will suggest samples to me… that the algorithm has determined are similar. And I can very quickly change things arbitrarily. But I think that's something I do when I don't have time, because if I have time, I want to actually be more considered about it and have a bit more agency in that decision

Annie views algorithmic functions as a means of maintaining her career, making practical decisions as a response to external time constrains. By using algorithmic recommendations to speed up the process of selecting samples (short excerpts of musical content created by other people that are used in new compositions), she does not view machine agency as a method of increasing her productivity through the automation of mundane tasks as was discussed above. Instead, she believes that AI augmentation transforms her 'considered' work into an arbitrary process while reducing her own agency but uses it nonetheless in pursuit of working efficiency and professionalism. These values have grown in importance in music where political drives for creative economies have associated the role of the creative worker with traditional professions while handing off responsibility for risks from organisations (and the state) to individual workers (Lingo and Tepper, 2013; Born & Devine, 2015: 141; McRobbie, 2016: 40-5). New technological uses are often avoided for working control through pre-AI practical decisions citing learning time as rationale (section 5.2.1.1). Annie's decision here, however, highlights how the integration of algorithmic decision-making within existing technology doesn't require such a trade-off in learning time as decisions are made for her. In addition to reigniting Helen's earlier warning of reduced ability to develop creative skills when pursuing efficiency (see also: Heer, 2019: 1848), Annie acknowledges issues of agency within creative AIM use.

Wanka & Gallistl (2018: 8) argue that STS theories of constructivism are valuable in understanding how agency is 'scripted' to non-humans within the habitus as a method of positioning materials within fields of practice (see also: Akrich, 1992). Like Dominic above (section 6.2.2) who separated AI use between routine and 'human creative' work, Annie makes sense of AI use in this way through practical decisions that 'script' it with agency for the heteronomous aspects of their work; this is achieved either by drawing clear boundaries that delegate non-creative roles to AI, or by reclassifying creative tasks that have been delegated to AI as arbitrary. This introduces agency as a crucial consideration in a way that has become common through the integration of AI beyond creative practice. Hohenstein & Jung (2020) argue that in AI-mediated communication, humans use AI where it benefits them through efficiencies and apportion blame to the technology as a scapegoat for unsatisfactory

areas of action. Dominic and Annie's delegation of agency to AIM enables them to gain practical benefits of heteronomous alignment, while also distancing themselves from it by (re)classifying practical tasks as less considered or creative to maintain autonomy in their work.

Although Annie identifies practical benefits of using technology for creative tasks, her attempts to separate practical from artistic agency are not always successful. She observes how practical decisions to delegate areas of her composition to melodic loops (short extracts of music usually written by another artist and available as a compositional tool in digital audio workstations) can impact the fulfilment she finds in her work, and how AI could exacerbate this effect:

> I'll use a melodic loop just because like I'm rushed for time but then I will always switch it out with something that I've done, I won't like leave it in there. But like sometimes I'm like then trying to like change it a bit, but like I, I prefer what was there originally and that bothers me a bit, like I wish what I created could be better… like, what's the point of me at this stage? Like it might as well just let the AI do the whole thing, you know? Yeah, I think, I think that would be a bit demoralising.

When external material that Annie uses for practical reasons takes on agency beyond her intention as a placeholder, it makes her work less fulfilling. She believes this relationship would continue as AIM progresses. Once it is advanced enough to compliment her work creatively – adding compositional elements that are better than she could produce herself – she would no longer value her own action in the process to the extent that she equates complementation with substitution. This perspective challenges Autor's principle that 'tasks that cannot be substituted by automation are generally complemented by it' (2015: 6), as she doesn't argue that the technology could automate her role as the composer, but that it 'might as well' once it can complement her in this way because her work would become 'demoralising'. Banks (2010: 255-9) argues that the industrialisation of music practices is often believed to 'de-autonomise' art, but work is not wholly reducible to heteronomous alignment as workers identify varied strategies of exercising agency. Annie's loss of autonomy and meaning derives from such a strategy, delegating agency to technology for

tasks that exist because of heteronomous constraints and allowing her to maintain autonomy elsewhere. However, benefits of AIM can be and are identified by other workers who use strategies of exercising or locating their own agency alongside the technology within practice to maintain autonomy.

6.2.3 Artistic Authorship

Artistic decisions for AIM use are often based on clear identification of roles between the worker and technology, enabling a location of the music worker's authorship alongside AI use. Morgan, a composer with a back catalogue of AI-augmented music, responds to these conditions of opaque AI responsibility by identifying the human action within technology design, crediting those actors as collaborators:

> I mean if I work with a computer scientist, which I often like to do, then you know always it's a collaboration with them. There's no doubt about that. And you know, I'm quite, we're quite clear about this and I also assign you know royalties and some of my pieces to people I've worked with… I find it quite frustrating actually, when I see artists pretend that it's just an AI, and that someone hasn't, hasn't made that… AI that generates notated music, if I didn't write that music, but I've orchestrated it. I feel like I should treat that in the same way that I should treat anyone else's music that I've orchestrated.

Morgan approaches AIM use as a collaboration with computer scientists, making sense of AIM through traditional social roles as Guzman & Lewis (2020: 79) argue is common when new technologies emerge within practices. By assigning the collaborator role to human proxies rather than the technology, Morgan minimises the impact of AIM on their own practice by emphasising that although the collaborators have changed, their own actions have not: Morgan augments (orchestrates) musical material in the same way they would when working with a human artist. This approach therefore introduces AIM practitioners as influencing actors in music production both through the shaping of technologies within practice and directly on the actions of music workers. When assigning credit to the computer scientist behind AIM development, Morgan says: 'I'm quite, we're quite clear about this'; this

collaboration in practice is negotiated because Morgan faulters in taking sole credit for the collaboration, instead, two parties have agreed on the way to define their relationship and practice. The perception of this negotiation can be seen from both sides as I also interviewed a computer scientist that Morgan had worked with in the past (although each didn't know the other was participating in the study). Edward is an applied AIM practitioner who describes his experiences working with musicians towards collaborative music production and the need to emphasise his own action in the process:

> One thing that does frustrate me slightly, well a lot actually. I've been in situations where people who tried to have said… I'm going to credit the software! [shakes head] No thanks. It's, it's me, thank you very much, I did all the work, I spent the hours sitting, you know working which way to turn it, which way to tweak it. I'm tweaking the hyperparameters. People don't realise this

Edward and Morgan don't mention specific names, so exactly how (or if) they shaped each other's views on the relationship between the music worker and AIM practitioner in musical production is unknown. However, both describe how the acknowledgement of the AIM practitioner's role as a collaborator in music production requires agreement between the two. I argue that these negotiated collaborative relationships are important in music work because (1) some inherent values of collaboration for musicians are lost when the collaborator is a computer scientist outside of their field of practice, and (2) AI is often designed by an opaque network of practitioners, meaning workers don't know who to credit.

On the first point, beyond the literal sharing of musical ideas, music workers engage in collaborations to access the audiences of their counterpoints and grow their professional networks within the industry (Haynes & Marshall, 2018; Hoedemaekers, 2018). The value of a collaboration with a computer scientist offers none of these benefits as the stakeholders, audiences, and social networks exist in separate fields; these collaborations can moreover have negative connotations where crossovers with objectivist and anti-ideological views in science lead to criticisms of music as 'corporate art' (Beck & Bishop, 2018: 237-8). However, as argued in section 4.2.2.1, AI is developing across multiple fields as a form of meta-capital and artists can therefore – as has been seen in this chapter already – gain from

the use of AI beyond musical material as its capital value transcends the boundaries of fields. It is in this context that Edward and Morgan describe 'frustrations' at musicians claiming AI is an autonomous agent; they are benefiting from AI meta-capital while overlooking AIM practitioners' work and its influence on the technology and music.

On the second point, the process of identifying actors to credit in AI is complex as they are designed in complex structures that are not locatable to a single source or site (Dourish, 2016; Seaver, 2017; Holzapfel *et al*., 2022). For instance, Edward doesn't mention it here, but his technology is a modified version of an existing AIM model; should the music worker also credit the computer scientist behind the original model? In such an approach that attempts to highlight the human work within AIM, whole stages of design such as the dominant technical AIM approach discussed in Chapter 4 would be overlooked as they develop AI models in isolation, handed off through the collective technical labour of AIM practice. It is in the context of such complex and opaque structures that Elish (2019) observes responsibility shifting to the human user whose job it therefore is to take responsibility for assigning agency in musical production whether through Melvyn's view that he is the creator using AI tools, or Morgan's view that AIM use is a collaboration with a developer (but only the single person they directly engage with in the process). This approach enables workers to locate their own artistic autonomy in practice, but at the risk of 'frustrating' AIM practitioners like Edward who might want credit for their personal input.

These challenges and questions of agency are often restricted to individual ethical challenges in music work because as Dornis argues, where 'there is no direct human involvement in the AI application's production process, the argument goes, the output of such processes cannot be protected' (2021: 2). AI-augmented artists therefore have no obligation to credit AIM practitioners unless they have contractual agreement to or directly collaborate with artists in the production of the work of art as Morgan argues for. AI developers are not legally entitled to the 'double reward' of benefits from both the production of AI and the 'meta benefits' of its output (Ramalho, 2017: 16; Dornis, 2021: 4), but these collaborations and negotiations between workers and AIM practitioners highlight how new power dynamics and methods of working can shape not only workers' musical practices and output, but agency in their

practice too. The following section examines how the encroachment of new forms of agency within individual practices is further complicated by subjective artistic values that music workers place on the musical output of collaborations with AIM.

6.2.3.1 Identity Issues

Music workers find both positive and negative impacts to practical AIM use that delegates mundane and creative tasks to AIM in human-machine relationships. This continues for artistic uses where music workers benefit from AIM through designations of authorship to identify their own agency. Dominic appears to continue this trend when he explains how in his experience of composing with AIM, he and other musicians involved were necessary because of a musical deficit that enabled them creative control, thereby reinforcing the benefits argued above:

> you can do a lot of things with, with AI… we kind of managed with the AI to like get some chords and the melody, which I still then had to like, kind of edit… but it was like the AI wouldn't have got anywhere close to like, producing an actual track in like a jazz setting. Whereas we just kind of came together with four jazz musicians and a singer and we played through it once and it was already like a finished track.

Later in the interview, however, regardless of this view of himself as essential in its creation, he reflects that he does not feel the work is his own:

> It kind of depends on how much, how much of the actual song came from the AI and how much of it came from, came from me. Yeah, I mean, I don't really feel like the AI song was really my song because I would have made a lot of different artistic choices.

Dominic's agency is not replaced because he believes he is necessary to create a 'finished track', but he cannot make all the artistic decisions that he would without AIM, and therefore does not feel ownership for the work. This view of shifting ownership is important in music work where the cultivation of individualised identities or 'brands' are essential for recognition in the saturated market (Lingo & Tepper, 2013: 350; Hoedemaekers, 2018: 1366-7). If the use of AIM alters their artistic approaches and output, workers' ability to earn a

living would be impacted because audiences often detect inconsistency with established identities and perceive it as inauthentic (Taylor, 2024: 56-9). These issues of identity and authenticity are therefore a shaping influence on AIM use as music workers take responsibility for socio-musical choices – whether made by a non-human AI model, or a human AI practitioner – that are not their own. That responsibility continues beyond the agency of the designer and the artefact, where Dennis, a media composer who has used AIM for personal artistic projects, describes how he felt obliged to alter the data on which AIM models were trained based on his own positionality:

> we are both Caucasian men, and the the history of music is in large part people taking other people's culture and art and calling it ours. […] So, because of that we have decided to not use particular artists in the data, like we we [3 seconds] combined, like two or three different data sets like Dolly Parton and Beach Boys and like the result is, is kind of both or neither.

As prominent machine learning approaches to AI design rely on real-world data sets, Dennis believes that his use of AIM also brings new considerations for the musical influences on AIM output. Music produced by/with AI is often met with uncertainty by listeners who perceive it as an appropriation of real-world musical training data (Hong *et al*., 2021; Morreale, 2021). Because responsibility is shifted to (and accepted by) the worker through AIM development and use, Dennis therefore integrates the consideration of this appropriation within his practice by curating the data on which AIM bases its generations. Wajcman argues that agency can be exercised by the user because they interpret technology's meaning and uses for their own context, however, these interpretations in use are shaped by meanings already inscribed in the technology itself (Wajcman, 2004: 47-8; 2006: 779). Dennis' concern regarding appropriation, for instance, is not wholly quelled by his actions as the model he uses is pre-trained, meaning although Dennis curates the data for his own generations using the model, the capabilities of the underlying model exist because of all the music it is previously trained on (Sturm & Ben-Tal, 2021: 439). He responds to the implications of agency at the point of interaction with AIM, but the issues of opacity within the design of

AIM discussed in the previous section continue within the material agency of the data that define it.

Furthermore, Dennis' ability to take responsibility for the identity communicated within his AIM use is only possible because his musical project is a partnership between himself and an engineer. This enables him to make choices about data influences, but also reproduces the introduction of new forms of agency from engineering fields in music practices because new collaborators are necessary to maintain control over identity. This could be circumvented if an AIM model were completely transparent about training and/or allows universally accessible modification of its systems, however, this is unlikely as music training is often hidden for competitive commercial sensitivity and potential copyright infringements within the data used (Drott, 2021: 199), and music technology tools usually sacrifice controllability for ease-of-use (Pardue & Astrid Bin, 2022: 8-9). Instead, workers rely on collaborators to exercise agency unless they already have or can gain sufficient technical skills and understanding of AIM to make informed decisions and adapt the technology to their needs (Dahlstedt, 2021: 910; Morreale, 2021: 109). These impacts on agency and necessary skills or approaches to control them are all (in part) shaped by AIM practice, where design can affect how technology is used and therefore where agency is introduced to its use in music work. George is a user practitioner who designs AIM with the assumption that skills required to use his technology should be central to music workers' practices:

> part of my philosophy, is that you know you're a composer you can't sit at the piano anymore and hope to earn an income. You've got to also learn how computers work. So, mines a kind of I want to equip composers so that they can stay relevant

In AIM practice, user practitioners such as George construct technology based on users' needs and experiences, which are at the centre of this approach. The view of diminishing need for musical skills is backed by Thomson who finds that, for example, 'the most successful jazz musicians are not the best musicians, but often the best entrepreneurs' (Thomson, 2013: 522). However, the construction of AIM practice discussed in Chapter 4 continues to shape what George views as the necessary skills for workers. He acknowledges that in his practice: 'the easiest way to get research time and funding is definitely to say

you're supporting digital literacy', and he projects these conditions on to the context of music work in his design strategy. Beyond identifying the user and their context of diminishing need for musical skills, George is 'configuring the user': defining and delimiting what their actions should be by encouraging certain forms of access and use (Woolgar, 1990: 61; see also: Sterne, 2003: 376). This configuration is not simply the result of George's action, but a reproduction of the technical discourses that shape AIM practice outside of his control, and by extension shape music workers' practices.

In section 6.2.2, the compartmentalisation of AIM for efficiency was seen to impact workers' perceived requirements of work, placing pressure on time-consuming autonomous tasks and limiting opportunities for developing traditional creative skills. Approaches to AIM as a creative collaboration highlight how these skill priorities change as workers exercise autonomy through different means, avoiding becoming mere 'monitors' of AIM (Salento, 2018: 375). They instead become creative partners to technology and technologists, or controllers of the technology themselves through technical skills. However, a final approach to AIM augmentation shows how workers can maintain their position without changing their own tasks and skills but expanding their practices through new capabilities.

6.2.3.2 Augmentation as Replacement?

The approach to authorship alongside creative AIM uses was introduced above as an artistic decision where workers introduce the possibilities of AIM to their work as a collaboration. By using AIM to add new capabilities alongside their own action, however, workers can also make sense of AI through economic decisions to compete for advantage over others in the field, replacing human collaborators through technological augmentation. Melvyn, for instance, is an artist and producer who describes how the economic conditions of music led to his own use of AI:

> one of the main things I use in AI technology is a writer assistant… it gives me the opportunity to, to write great lyrics without using another writer, you know? And in France, the royalty system is made amazingly well for the writers. And so, that's one of the reasons they [writers] don't want to use it because they're like, okay, so if we,

> we start to give this role to people that are not writers, we are somehow losing these amazing advantages we have right now.

Melvyn makes an economic decision to use AIM to perform a task outside of his remit; an AI lyric generator takes the place usually held by 'another [human] writer.' He does this for financial gain, assessing and taking advantage of the conditions of professional music work, where performers and writers are seldom paid for their labour, but for the value placed on the sale and use of their intellectual property (musical creations) that they hold rights to (Cohen, 2012: 150; Hesmondhalgh, 2019: 105; Drott, 2020).

Although Susskind & Susskind (2015: 15) would not label music as a 'profession' – work that requires institutional credentials for access (e.g., lawyers, doctors, accountants) – Melvyn's use of AIM in music does reflect their view of a transition to post-professional practices. This is where roles are de-professionalised by breaking them down into tasks that can be routinised or liberated away from traditional gatekeepers (e.g., composers), making their knowledge and skills (in this case, lyricism) more accessible to unskilled people (ibid: 105-6; 119; 196). AIM, like recent digital innovations, is often argued to make composition more accessible to lay people and reduce the dominance of cultural gatekeepers (e.g., Lewis, 2018: 126-7; Silverstein, 2019), but established actors like Melvyn can also utilise the routinising effect to strengthen their own competitive position in the field. The decline of specialists and growing importance of generalisable creative meta-competencies in the music industry is therefore extended through such uses (Lingo & Tepper, 2013; Haynes & Marshall, 2018). AIM enables workers like Melvyn to be economically competitive generalists without the need to develop new skills that music workers in section 5.2.1.1 perceived as a constraint on maintaining workflows.

Amber, a composer and session vocalist believes that technology enabling workers to carry out new creative tasks "is not enhancing the composer… it's making someone else's skill more accessible." Rather than automating or 'enhancing' his own abilities, Melvyn uses technology to access others' skills as Amber argues, replacing his past reliance on human collaborators and reducing demand for workers who provide such services. At a macro level, these reductions in labour demand are countered by output growth and consequent renewed

demand for labour (Autor, 2015: 5; Mokyr *et al*., 2015: 33; Vermuelen *et al.,* 2020: 57). However, in music a long-observed surplus of both producers and output has not increased demand but instead normalised underemployment for engaged workers (Hirsch, 1972: 645; Menger, 1999); this has been exacerbated by increasing supply on streaming platforms where 90% of available music isn't listened to enough to earn a living from (Hesmondhalgh, 2021: 3606-8). Melvyn observes that writers who oppose or are uncertain about economic uses of AI are protecting their dominant position and ability to accumulate capital through their specific skills within this saturated market context. At a micro level, however, the approach to augmentation through new capabilities enables Melvyn to depart from the identity issues in the previous section as he maintains a sense of his own identity within his work:

> in the end I will be the one who chooses what I will keep… AI still still gives me the opportunity to be the creator without hurting anybody's feelings. And and when working with other people, I mean you still are the creator of your song, but it can be trickier

Edmond (2022: 89) argues that where tasks are delegated away from workers to technology, job satisfaction is reduced through a dehumanising process, as was seen in section 6.2.2.2. Melvyn's expansion of tasks through technology circumvents this dehumanising process, however, by drawing boundaries between his work as the creator and the affordances of AIM. In doing so, he locates agency within his economic use of AIM through similar rationale that enables that economic benefit. To gain the financial reward of using AIM, Deltorn and Macrez assert that 'as long as the user can manifest some control in the form of a choice… it is conceivable that he or she could be granted authorship' (Deltorn & Macrez, 2021: 16). Melvyn utilises these conditions to gain both economic benefits and a perception of artistic agency through authorship despite the common view that that increased emphasis is placed on technological design and affordances when the user is a non-expert in its output (e.g., Wajcman, 2006: 780; Dahlstedt, 2021: 910).

6.2.4 Summary: Distance from AIM Agency

Although music workers make sense of AIM augmentation through differing lenses of artistic, practical, and economic value, each use is characterised by boundaries between AIM action and their own autonomy, reflecting common struggles of practice to classify and position action as culturally and contextually legitimate (Gieryn, 1999: 4-5; Prior, 2008: 310). Practical decisions are made both to separate non-creative actions from the worker's practice, and to reclassify creative tasks that have been delegated to AI as arbitrary, enabling them to align personal input with the autonomous pole while delegating the heteronomous needs of careers to machine action for greater efficiency. Artistic decisions exercise a clear identification of roles between the worker and technology, enabling a location of the music worker's authorship alongside AI use to incorporate new approaches to creativity within their work. Finally, economic decisions are made to add remunerable capabilities to workers' practices while protecting their own skills from augmentation, replacing dependency on other human workers with technical solutions.

This is not an exhaustive account of the approaches that music workers take to the augmentation of their work using AIM. Instead, it illustrates how workers make meaning of AIM through existing sociotechnical relationships while introducing a common desire to maintain a degree of autonomy from AI in practice. AIM introduces new agency within music practices that can have both positive and negative impacts despite the arguments of AIM practitioners that augmentation is a solution to the negative impact of AIM: replacement.

Chapter 7 Conclusions

In this final chapter I summarise (7.1.1) the findings of the three previous chapters to make clear their relation to the research questions introduced in Chapter 1 and the literature introduced in Chapter 2 (7.1.2), while also acknowledging their limitations (7.1.3). Its most important function, however, is to set out how the actions and outcomes of this research contribute (7.1.4) to theory and practice surrounding AIM. I began this project with a partial view of AIM resulting from internal reflective and external critical accounts of its development practices to which these contributions add. Through these accounts, I argued that music was seldom approached as an area of work despite widespread expectations that AI with cause radical sociotechnical change in the workplace and a perceived need for 'responsible' AI both in and beyond AIM practice.

I therefore argue in this chapter that my examination of AIM using this underused lens of workplace technology demonstrates how a sociological approach to the analysis of AIM development contributes to the interdisciplinary understanding of AIM in and beyond its practices. The value of outside disciplines' views for future collaborative progress lies in the expansion of perspectives in AIM practice towards stated goals of responsible AI, while identifying, explaining, and promoting mutually beneficial goals of AIM technologies for developers and music workers without placing responsibility solely on individual workers to adapt to deterministic technological change. I also show how I have further contributed to the discourse surrounding AIM by identifying the social and material barriers to expanded interdisciplinary development in AIM practices and explaining their meaning for music work in the western recording industry.

Finally, I show how my use of sociological theory in this analysis has – as a by-product rather than a strict stated aim of the thesis – contributed to wider theoretical sense-making of AI in society. I have used Bourdieu's concepts to identify the function and effect of deep learning as cultural capital, and I have introduced AI as a new form of meta-capital that functions across fields, expanding Bourdieu's concept of non-specific capital.

7.1 Discussion

7.1.1 Summary of Findings

From the outset of this analysis, I used an ethnographic account of the field site of AIM to draw attention to my difficulties observing its limits and boundaries. Practitioners' varying accounts of their environments demonstrated that AIM is not a defined field, it is a practice that is constructed through competition for AI meta-capital – the inherent value placed on AI across disciplines and fields. Funding and interest in AI across society have therefore created conditions for AIM to emerge, but practitioners each attempt to position their own skills as central in AIM development to benefit from AI meta-capital, creating conflicting perspectives of what the practice is/should be. Within these constructions, technical approaches that prioritise the development of universally applicable technical models are found to be dominant as they do not confine the scope of their practice to musical contexts. However, the self-preserving measures of other practitioners who defend the paradigms of their own disciplinary background and expertise also enables applied and user practices where innovations in musical functions and user experience are developed.

Despite this diversity of approaches, innovation is centred around the development of AI models that are trained with musical data but intended to enable technical progress beyond their musical context. This is because as the largest and dominant voice, the technical approach produces the greatest output while limiting innovation in the other approaches through social and material constraints. In the first instance, applied and user practitioners perceive an alienation of their own expertise and objectives in favour of dominant technical discourses. In the second, these types of practice are separated as stages of technological development with little collaboration between them. This restricts applied and user practitioners' ability to cumulatively build on the innovations of the technical approach because their output is too opaque and/or complex for other AIM practitioners to understand and use.

These conditions of AIM create a culture where responsibility for materials and their consequences are shifted between stages of development: foundational learning models, their

application to musical tasks, and the optimisation of these applications for users are often developed in isolation then passed along to the next stage. Individual practitioners therefore view the impact of their technology only through the isolated functions that are designed in their own approach: for example, the impacts of a chord progression generator could be faster composition or access to new ideas within composition. In this context, AIM practitioners argue that AIM is beneficial for users because its functions are designed to augment rather than replace the user – the former is presented as a solution to the risks of the latter. However, when discussing the impact of the technology beyond these direct functions, practitioners perceive technological design as a neutral practice by continuing and extending shifts of responsibility away from themselves and beyond AIM practice. Practitioners acknowledge that AIM does have possible negative consequences for music workers, but they locate the cause and therefore responsibility for these impacts at the site of use rather than technological design. They acknowledge that until the suboptimal conditions of the music industry change, these impacts will remain.

Individual music workers are, however, unable to change the conditions of the industry at large, so they also act in self-preservation just as AIM developers do. They believe they must accept the responsibility shifted away from AIM practice as an extension of their existing competition in the musical field. By competitively pre-empting and adapting to technological change, workers can reap the benefits of AIM's functions that its developers argue for, and benefit from the AI meta-capital theorised in this thesis. In doing so, however, they contribute to the stabilisation and normalisation of AIM technologies, with their use increasing pressure for other workers to follow their example. This highlights the differences between AIM practitioners and music workers' perceptions of music practice and their meaning for technological impact. AIM practitioners argue that the functions of their augmenting technology provide *optional* benefits for musicians, but the integration of technologies is seldom influenced by, or influences isolated options in music work – it is instead a balance of artistic, practical, aesthetic, and economic values. Artistic decisions to use technology develop workers' embodiment of creativity in the long-term; practical decisions enable workers to conduct and maintain work in the short-term; aesthetic decisions provide

fulfilment through technology that relates to the workers' tastes; and economic decisions enable financial gain through competition with others.

The benefits of AIM functions and meta-capital in the early stages of its emergence can be gained through personal interest and fulfilment in AIM use. But they can also be incidental effects of workers' responses to market pressures where AIM is used regardless of the technology's implicit value to them. In the long term of this approach, practitioners use technologies once they are normalised to stave off obsolescence, but this reduces the competitive value of AI meta-capital and functional benefits as all workers are similarly augmented through new practice standards. Furthermore, AIM can have knock-on effects beyond its beneficial functionality that provides positive use-cases but also changes other aspects of music work. Workers view these changes both positively or negatively because of the quantity of AIM products and uses (experienced and expected). The common meaning generated across these AIM-augmented practices, however, is a perceived necessity to balance the agency of AI functions and its associations through new strategies to assure workers' own autonomy and maintain control, authorship, and fulfilment in their work. AIM practice is meaningful for music work because the conditions of both development and use normalise the use of AI as a method of remaining in music work. However, regardless of workers' positions on AIM they perceive a need to reconsider and renegotiate their autonomy that is required as a driving motivation for participation in music work.

7.1.2 Relation to the Literature

I have approached the main aim of this thesis – to understand the meaning of an emergent AIM practice for music work – through two guiding research questions that probe into the construction and structures of AIM practice and sociotechnical music work. I present here how my findings answer these questions and how they relate to current knowledge in the existing literature.

7.1.2.1 Understanding AIM Practice

Towards its research aim, the first research question of this thesis asked: 'how has AIM developed as an emerging practice of technological and musical innovation?'. My findings build on Born's (2020: 196, 199) argument that the methodologies and epistemologies of the computer sciences are dominant within the music information retrieval/research community (a subsection of AIM). Although traditional computer science approaches were indeed dominant and focused on technical development rather than musical context, I found other approaches within AIM practice that begin to widen this view. Practitioners with interdisciplinary backgrounds and knowledge, for instance (1) use their own understanding of musical context to inform design in applied practice; and (2) use design practices that examine and tailor functions of AIM based on contextual user interaction.

Born (2020: 200) continues that musical and social disciplines are 'subordinated' in MIR because their methods and perspectives are integrated in a tokenistic way that doesn't threaten the needs of the 'master' computer science discipline. She therefore argues for an 'agnostic' interdisciplinarity that enables the cooperation of these disciplines without a hierarchy to enable contextual representation and diversity in design. Her call though, is frequently repeated in AIM practice (e.g., Porcaro *et al.,* 2021; Huang *et al*., 2023: 47), suggesting that such moves are not being made. Morreale (2021) similarly argues that growing publications on responsible AIM practice are seldom connected to practical development and output. My observations and findings of an AIM typology highlight why such change is limited in practice beyond Born's disciplinary observations – the norms of practice are also enacted at the micro and meso level. Practitioners who undertake interdisciplinary approaches to computer science from within – although they do not represent the 'agnostic' collaboration of musical and social epistemologies that Born and Huang *et al*. advise – are also subordinated in practice to the dominant technical approach that most strictly adheres to the computer science ideals of Born's 'master' discipline.

The impact and progress of these alternate approaches that attempt to contextualise technical innovation for musical functions and users is therefore limited. Holzapfel *et al.* (2018: 49) hint at these limitations through their assessment of a 'value chain' in AIM where technical

researchers are distanced from users because subsequent stages of the chain (e.g., software development and product design) do not provide feedback to them, meaning technical researchers cannot build on knowledge of AIM in context. My findings, however, add a different perspective to this diagnosis of (non-)communication in AIM. Beyond the dominant technical approach, I find that practitioners are expected to explain the value of their own work within technical discourses, which alienates the contributions of non-technical types within the practice. But they are also unable to build on the complex and opaque models of the isolated technical approach because technical practitioners are not similarly expected to rationalise their work within the discourses of the other approaches. The consequences of these findings are significant: they demonstrate how the conditions of 'subordinate' interdisciplinarity in AIM that Born (2020) discusses impacts its direction and output. The alienation of dominated non-technical researchers limits *collaborative* work between the types of practice within AIM, a demarcation that also extends to stages of technical development by limiting *cumulative* innovation – AIM practitioners who are interested in contextualising and applying technical innovations are isolated from its development to the degree that they do not believe they can build on its output. Instead, they often rely on their own technical foundations that they acknowledge are not state of the art in the field, or they use opaque commercial models that are more user friendly.

These limitations exist because AIM is a practice largely characterised by competition for capital related to the AI rather than the music field. The practice is structured through competition for specific deep learning (DL) capital that is achieved through the development of learning models with the greatest technical capacity, thus favouring technical approaches of isolated foundational development. This competition for capital supports the observations of Selbst *et al.* (2019: 62) that in wider AI development contexts, abstraction is valued highly by practitioners because it maximises that value of models by increasing their likelihood of portability across a higher number of applications and contexts. But the struggles for capital in AIM also extend this view as it is not just the technology that is portable but the practitioner. Beyond the dominant technical approach, practitioners' AI experience and skills are also valuable within other fields because of the portability that Selbst *et al.* describe.

Despite the lower DL capital accumulation of applied and user approaches to AIM practice, practitioners therefore still compete for AI meta-capital through the general experience and skill they gain. Through overarching competition for these forms of AI capital, AIM is therefore a field of technical, rather than musical innovation. The practice is not primarily constructed through objectives and impacts in musical contexts but the accumulation of forms of AI capital that enable either the interoperability of technical output (DL capital), or the employability of the AIM practitioner as an AI worker in technical fields (DL capital) and beyond (AI meta-capital).

Born (2020), Holzapfel *et al*. (2018), and Selbst *et al*. (2019) argue that the current conditions of AI development risk creating technology that disrupts existing sociotechnical systems when introduced to social contexts because the technical is isolated from its context. My findings show that these conditions are entrenched at the micro-level where AIM practitioners compete for specific deep learning capital in the AI field, and for AI meta-capital as a transferable value across society. Beyond broad narratives of user and human-centred approaches that emergent responsible AI frameworks impose from the top down – often to the dismay of developers – I have found little incentive for musical innovation in the practice. Even individual practitioners with interests and objectives for musical innovation often prioritise technical innovation as a method of accumulating emergent deep learning capital and/or AI meta-capital – i.e., self-preservation tactics that are necessary to build careers. AIM is therefore a practice of technical rather than musical innovation; the significant growing investment in AIM influences musical innovation, but as a by-product of technical interests that guide the practice through technical capital. The following section presents findings for my second research question, probing these authors' warnings of disruption and investigating the musical contextualisation of AIM that they advocate for. In doing so I demonstrate why the conditions of technical rather than musical innovation in AIM are meaningful for music work.

7.1.2.2 Sociotechnical Music Work

The second research question of this thesis asked: 'How does the emergence of AIM relate to the existing relationships between workers and technology in music creation careers?'. Findings for this question are spread across Chapters 5 and 6: the former identifies the value of the worker's perspective by detailing existing conditions and relationships as a contrast to assumptions about music users in AIM; the latter demonstrates how AIM use is constructed in the context of these existing structures of music work and AIM development, shaping its introduction and impact within sociotechnical music practices.

7.1.2.2.1 Chapter 5: Existing Sociotechnical Music Practice

The findings of Chapter 5 show that in the current sociotechnical landscape, there are distinct values that workers balance when making decisions to use technology in music: artistic, practical, aesthetic, and economic. Aspects of these technology decisions are visible in Hoedemaekers' (2018) logics of employability, craft, virtuosity, and autonomy in music work: employability overlaps with practical and economic decisions, craft and virtuosity with artistic decisions, and autonomy with artistic and aesthetic decisions. However, Hoedemaekers mixes high-level and practice-level concepts within his framework, requiring an explanation of their hierarchical relationship despite their equal classification as 'logics' – autonomy, for example, 'both institutes and undercuts' virtuosity in his analysis (ibid: 1367). My findings contest the relationship between these logics in sociotechnical practice by conceptualising decisions in music careers in the context of Bourdieusian field-theory. Rather than viewing these influences as logics that undercut one another, I theorise how approaches to technology within careers at the practice level are balanced within a wider context of autonomy and heteronomy. Workers therefore make decisions that are varyingly influenced by these poles. For example, artistic decisions (i.e., virtuosity and craft) are made by workers in practice, guided by competition for cultural capital that can be gained from autonomy in the musical field. This provides a more nuanced view of technological decision making in music work practices where careers are constructed within wider structural contexts.

The structural influences of autonomy and heteronomy that shape technological decisions reflect a tension between art and commerce that is theorised frequently within music work literature (e.g., Caves, 2003; Gibson, 2003; Hagen, 2022: 195). However, I follow Banks (2010: 259) and Haynes & Marshall (2018: 469) who argue that although both artistic and commercial perspectives exist in music work, a binary lens of the two as separate is not observable in real-life data because their relationship is often more fluid, with simultaneity rather than tension between the two more routine than suggested in the literature. The empirical perspectives of workers within the lens of Bourdieusian field theory build on this position. I show that contrasting influences do exist and can be conceptualised through cultural capital [art] and economic capital [commerce]; however, the nuances that Haynes & Marshall argue for can be observed within workers' individual decisions that operate within the structural influence of art and commerce, or types of capital accumulation, rather than defining their practice through one or the other.

These nuances of technological use are valuable for the second research question of this thesis as they provide a contextual frame of reference to examine workers' approaches to AIM. Furthermore, the findings highlight the disparity between the complexities of technological use and the common assumptions in AIM development that workers use and subvert technology based on their own personal taste and enjoyment. In this way they strengthen calls from authors like Hesmondhalgh (2019: 116) and Harkins & Prior (2022: 98), who argue that the optimistic narratives of technological change in music such as the democratisation of practice often fail to engage with contextual factors in the real world, such as how technologies relate to existing pressures of free time, knowledge, and technical capacity. These findings are therefore a valuable first step in answering the research question of these chapters and are expanded on through the findings of Chapter 6.

7.1.2.2.1 Chapter 6: The Emergence of AIM in Music Work

The findings of Chapter 6 are consistent with Ashton's (2022: 103) observation that creative workers are widely believed to be safe from and/or complimented by AI rather than replaced by it. I find that AIM practitioners use this framing to argue that their technology is neutral or beneficial. They use human replacement as a totemic negative impact of AIM that they

almost universally argue against; this enables them to characterise their objectives for augmenting AI as a binary opposition that is positive for human workers. Ashton (2022: 105-6) continues, however, that the 'complimenting' argument assumes all augmented work results in enhanced creative practices, often without contextualised evidence of the 'processes, practices, possibilities, and precarities of creative work'. He claims that this overlooks the possibility that human-AI work can also be mundane, repetitive, and boring. My findings build on this by providing evidence of music workers' experience and meaning making of augmenting AIM technologies. I show how they approach the technology through lenses of their existing sociotechnical practices to gain the benefits of AIM use-cases: artistic decisions are made to use AIM for novel musical ideas, and practical decisions to meet tight deadlines, for instance. Such examples are argued as benefits of the technology in AIM development. However, pre-existing needs and conditions show that these isolated functional benefits of AIM can have positive and negative impacts for the individual worker and the wider field. For the individual worker, augmentation can alter the meaning and identity of musical output in a field where success hinges on individualism and image; in the wider field, augmented workers place higher demand on productivity and competition in an already saturated market, necessitating and normalising AIM use at scale to compete.

These individual examples of experienced or perceived impact of AIM on workers do not answer my second research question: 'How does the emergence of AIM relate to the existing relationships between workers and technology in music creation careers?'. However, the commonalities of these workers' approaches to AIM when viewed together demonstrate their relation to existing sociotechnical practice: workers approach and make sense of AIM through known lenses but draw new boundaries between themselves and the technology to maintain their own agency as separate regardless of positive or negative impact. This represents a continuation of current sociotechnical conditions where creative workers entrepreneurially tap multiple revenue streams while concealing the mundane necessities of practice that enable them to succeed, reinforcing the image of creative work as impervious to technological change (Lingo & Tepper, 2013: 351; Thomson, 2013; Haynes & Marshall, 2018). These findings challenge previous studies into AIM and agency that attempt to isolate

and explain how and why musicians can have agency alongside AIM (e.g., Dahlstedt, 2021: 910; Edmond, 2022; Savery & Weinberg, 2022). Because each worker's view of their own and AIM's agency is dependent on their own individual practice, the boundary work of exercising agency is numerous and varied, reflecting the multiplicity of strategies for maintaining artistic autonomy while meeting heteronomous needs of careers discussed in Chapter 5 (see also: Banks, 2010: 259). AIM use, therefore, does not redefine sociotechnical practice as a struggle to gain agential dominance over technological functions but does necessitate negotiated positioning of those functions within careers, expanding the existing complexity in balancing art/autonomy/cultural capital and commerce/heteronomy/economic capital in music work.

7.1.3 Limitations, Reflections, Learnings

Although this thesis contributes to the literature surrounding AIM, there are areas that have been overlooked to enable focus within the study. Firstly, as set out in my foundational research problem, this thesis is concerned with the meaning of technological change in music through the influences, perceptions, and experiences of AIM developers' and users' practices. This approach has enabled findings of the influences and purposes of AIM development, workers' sense making of emergent AI technologies, and the shaping effect of both conditions on the place of AIM in music work. However, there are limitations of this approach as it cannot provide definitive answers to how specific AIM technologies will impact work. The study of specific technologies like autonomous song generation services (e.g., Bown, 2024), or automated audio engineering (e.g., Birtchnell & Elliott, 2018; Sterne & Razlogova 2019; 2021) could have produced more definitive discussion of the impact of that technology on specific workers. However, these views of AIM are seldom applicable beyond their specific context; focusing on technological artefacts and their functionality then, is not representative of all AIM and is not guaranteed to remain the same as the technology progresses. I also do not assess or discuss the current or expected capacity of AIM technologies to undertake musical tasks for similar reasons. Other authors have attempted such investigations of AI's technical capacity in creative tasks (e.g., Anantrasirichai & Bull, 2021), but this thesis is principally focused on the meanings and motivations of developers

and music workers to contextualise such discussions of capacity with their meaning in society.

In the context of music work research, I have not discussed AIM through the lens of organisational and state policy that often influences work impact by driving technological uptake (Salento, 2018; Kadir *et al*., 2019: 3-4; Bearson *et al.,* 2021). At the state level, this is well researched through generative AI and copyright law. Because the ability for creative and cultural producers to maintain careers depends on the ability to generate income from intellectual property, state positions on copyright are tantamount to policy decisions on the integration of AI to the musical labour market (Pratt, 2016: 208; Sobel, 2017: 81). Research into this area is, however, better suited to researchers with legal backgrounds. Furthermore, as has been argued in this thesis, the freelance and gig work model of the music industry means workers are largely disconnected from state and organisational-level incentives (see also: Prior, 2010: 401; McRobbie, 2016: 45). Although discussions of state and organisational attempts to drive technological uptake can provide valuable insight to AI futures, they have not therefore been integral to this discussion of emergent AIM practices in the habitus of individual workers.

Finally, the reflexive methodology employed throughout this study also enabled me to identify some limiting factors that resulted from both my own actions and the conditions of the research site. Although I worked to address these limitations, I and future research can benefit from designing studies from the ground up with these learnings. During data collection, for example, some demographics were more difficult to include than others, particularly technical practitioners who were less likely to respond and participate in the study. I therefore tailored my framing and language when contacting participants from ‘hard’ science backgrounds to reduce the distance between myself and the practitioners while ensuring I didn’t misrepresent myself or the study. However, an imbalance between these demographics remains in this study. I was told by participants that this could be because they are less inclined to engage with ‘soft’ scientific research because they are not familiar with it, but this could have been mitigated to an extent if I began using strategies of adapting language within sampling requests earlier. The study is therefore limited in its representation

of the AIM field site because my sample has a high proportion of 'applied' and 'user' type practitioners despite all evidence suggesting that technical practitioners are dominant. I have attempted to overcome this limitation by discussing the differences between approaches to practice with all participants, particularly senior members of the MusicEngine department who described and explained their knowledge of the practice and departments they supervise, but future research could benefit from a greater diversity of technical researchers from the AIM field.

In addition to these limitations, future research could benefit from greater focus on commercial AIM practices. Although a mix of both industry and academic AIM practitioners were included in this study, the thesis has not followed industry structures in the same depth as academic practice. This is largely the result of difficulties contacting and securing participants operating under commercial sensitivities, and the study was designed with this in mind. However, my limited access to commercial AIM practice presents a clear opportunity for expanded examination of AIM, not just the companies developing it, but institutions that fund and hire AIM researchers in academia. In this way, future research can build on the findings of this study regarding the influence of deep learning capital and AI meta-capital, identifying why and how these forms of capital are institutionalised, and following them to understand the narratives and directions that are propelling the development of AIM.

7.1.4 My Contribution

This thesis makes key theoretical contributions to the understanding of AI; empirical contributions to the study of AIM, and finally contributes recommendations for future responsible AI development practice. Beginning with its theoretical significance, this investigation of AIM practice has applied and built on Bourdieusian conceptualisations of forms of capital. By identifying deep learning as a type of specific capital that is constructed by the priorities of dominant technical discourses and the structural conditions in which industry science is investing in the state of the art, I apply Bourdieu's conceptualisation of cultural capital as the embodiment and materials of practice that are exchangeable for economic capital (Bourdieu, 1986: 20). However, I have also expanded Bourdieu's theory of

capital by arguing that actors are competing for *AI meta-capital.* This is where individuals, institutions, and state bodies prioritise AI regardless of field-specific deep learning capital because association with AI is valued beyond the AI field itself. This builds on the work of Couldry (2003) and Lundahl (2022: 1441) who argue that Bourdieu's concept of non-specific capital can be expanded beyond its narrow designation as economic capital to anything that grants power, status, and is a cultural resource across multiple fields. The theory of AI meta-capital presented in this thesis is significant because it is bound up with the construction of AIM practice: investment in AI with subject ambivalence enables the development of AI in a diverse range of contexts such as music. But it also discourages allegiance to those subjects/contexts, placing 'AI' as a priority both above field-specific deep learning capital and the application and impact of AI on its context. Focus on the state of the art – currently deep learning – is subsidised by internal competition for deep learning as cultural capital, but there are few incentives to understand and address the impact of AIM on music. The emergent forms of AI capital therefore perpetuate the development and deployment of AI across fields, shaping AIM as a practice of technical rather than musical innovation.

Beyond theoretical lenses of AI development, I contribute to an area of academic discourse that has continually called for interdisciplinary perspectives on AI and Music throughout the duration of the project, most recently with a paper aiming to establish 'a new kind of music studies' (Sturm *et al*., 2024). Within these approaches to AIM studies, however, I argue that music as a creative/cultural thing or practice (e.g., musical pieces/works, cultural traditions/styles/genres) has overshadowed its importance as a field of work (e.g., composition, studio/live performance, production, audio engineering). For example, interdisciplinarity is argued for because isolated AIM engineering has led to simplified representations of musical output based on western popular standards (Holzapfel *et al.,* 2018; Born, 2020; Huang *et al.,* 2021). These arguments are crucial in ensuring AIM development is representative of the complexities of real world 'musicking'. However, this critical analysis of AIM through its relation to geographic and stylistic lenses is a good example of treating music as culture rather than labour; the musical thing being done overshadows its position as a task within the wider careers of music workers. This thesis operates within the 'western

popular music' lens that these authors advocate for moving beyond, but my sociological approach to music labour highlights the understudied complexity within this already narrow frame. Where music is approached as a profession, for instance, discourse is limited to the legal complexities of copyright that enable direct remuneration for production and consumption of musical artefacts (e.g., Ramalho, 2017; Deltorn & Macrez, 2021; Dornis, 2021; Drott, 2021; Clancy, 2022). I therefore contribute to this discourse of AIM in two ways:

1) by identifying the social and material barriers to expanded interdisciplinary development in AIM practices,
2) by explaining the meaning of these emergent AIM practices for existing practices of music work in the western recording industry.

My theoretical contribution of deep learning capital and AI meta-capital discussed above are a source and consequence of the first of these contributions to AIM discourse. The interdisciplinary development of AIM is limited because the incentives of practice are centred around the technical: practitioners do not make competitive gains through cumulative, collaborative, or contextualised innovation, so they concentrate energy on the technical output and skills they can develop in their own stage of AIM development. This understanding of the barriers to interdisciplinary development of AIM also contributes to wider AI. Moves towards 'responsible' AI, for instance, argue that information like the data, testing, assumptions, and reasoning of AI is lost between stages of development, and in response develop guidance for developers who build on others' AI, 'allowing them to clarify the origin, capability and limitations of the tool, and apply it appropriately' (Sense about Science, 2024: 1). However, such frameworks address the outcome rather than the cause of irresponsible AI development, demonstrating methods of better practice without asking and addressing why they are needed. Through the examination of AIM, I argue that the responsible development of both AIM and wider AI is constrained by the incentives of emergent AI capital.

My second contribution to AIM discourse builds on Bown's (2021: 9) call for a view beyond the functionality of AIM use-cases through sociological perspectives that contextualise the

impact of AI functionality in existing patterns of behaviour. At this early stage of development, I have not examined AIM as a fixed technology but as an emergent practice in the context of existing music work, drawing together Bourdieusian practice with an STS approach to technology as ongoing constructions of sociotechnical networks. This has enabled me to contribute a perspective that highlights why AIM is meaningful for music work and the value of this perspective in understanding its impact. This expands reflections and examinations of AIM practice where a need is identified for AIM to be developed in consultation with music practitioners (e.g., Sturm *et al.,* 2021b: 11), as I argue that such stakeholders should not be approached just as music practitioners but musical *labour*. AIM development without the perspective of labour risks extending the limited subject allegiance to music shown by AIM practitioners as a result of emergent forms of technical AI capital. However, music workers are dependent on music as a source of income; to disregard music as labour is to disregard this fundamental distinction between AIM practitioners' and music workers' perspectives on music.

7.1.4.1 Impact, Recommendations, Futures

These theoretical and empirical contributions to AI and AIM can be used to inform future development in an expansion beyond competition for emergent AI capital. This could enable a move beyond technical innovation with a relative disregard for the innovation of its contextual subject. Although some individual practitioners do balance contextual goals with competition for AI capital, I find that the latter is prioritised over the former within the habitus of practice. Using the findings of this thesis, I argue that ongoing research in the area should place goals for music innovation on an equal footing with the technical in AIM by establishing music (or any subject/application that AI is developed towards) as a form of capital that is competed for alongside AI capitals. My findings also enable me to predict some of the obstacles of such contextual capital; the forms of AI capital influencing AIM have emerged through both the construction and structure of the practice, meaning the establishment of musical capital also requires both ground up construction, and top-down structure. I explore some examples of such contributions to practice and their impact here through inclusive interdisciplinarity within AIM, financial/cultural incentives for extra-

technical innovation alongside AI capital, and collaborative input from domain expertise beyond AIM.

I first argue that the construction of contextual musical capital in AIM requires a reduction in the reliance on deep learning cultural capital as the dominant measure of success, reflecting the calls by Born (2020), Porcaro *et al.* (2021), and Huang *et al*. (2023) for an agnostic interdisciplinarity that challenges the current subordination of socio-musical disciplines by the dominant computer sciences. This could be achieved through more inclusive culture between the types of practice that already exist within AIM. Applied and user practitioners who currently feel alienated by the dominant type, for example, could be better integrated through a renewed focus on interoperability, not of technical models but of sociotechnical research objectives between the types – or alternately put, practice wide collaborative and cumulative innovation.

However, current funding and investment in AI emphasises general technical advancement through competition for AI meta-capital that does not incentivise development beyond the technical. Musical capital could therefore be structurally integrated as a key consideration by negotiating funding and targets for AIM between *all* strands of the practice. This does or *has* already existed: during my ethnographic visits to MusicEngine, a practitioner expressed their discontent that the funding in their department had once come from arts, humanities, and engineering sources simultaneously but now only came from the latter, reshaping its priorities. If state, industry, and institutional funding is centred around one discipline, then the practices that emerge as a result are likely to be dominated by that discipline (as has been identified in AIM). I therefore argue that the establishment of music capital in AIM practice is dependent on structural moves towards collaboratively funded and negotiated objectives for AI development that emphasise innovation of both AI and its contextual application. This approach to innovation would align AIM with wider movements towards responsible AI such as the ‘Edinburgh Declaration on Responsibility for Responsible AI’ that argues:

> “[AI creates] new stresses on social and economic resilience, and growing challenges for security, human rights and social cohesion. These costs and stressors must be managed responsibly and *holistically* [my emphasis], with an eye to AI/AS innovation

> that can take us all much *farther,* not simply *faster* [author's emphasis]" (Vallor, 2023).

Further to this point, beyond interoperable approaches to AIM within the practice, through this study I present benefits of and argue for a particular vision of interdisciplinarity that focuses on collaboration between disciplines with different domain expertise. For example: it is not the role of a car engine designer to investigate climate change; the impact of internal combustion is understood through the combined efforts of climate, health, social scientists and beyond. The problems and needs identified through the expertise of surrounding disciplines can then be addressed through collaborations with and targets/regulations/etc. for engine designers. Nor should we, then, expect AI engineers to be the sole experts on the implications of their technologies on the social world. Although I have argued that responsible AI development should not be isolated from its context, the risks and benefits for these contexts should also be expanded upon beyond the AIM field. This would enable contextualisation free of the ideologies and vested interests of technology developers.

Through this thesis I have demonstrated how a sociological approach to the ongoing, emergent development and use of technology can be used to investigate these impacts before they are felt in society. Beneficial technological change can therefore be built through studies such as this in the social sciences and humanities – disciplines that have long examined sociotechnical innovations and change in society – and their communication and collaboration with technology developers. In this way, I reproduce the calls above for interdisciplinarity, but unlike Sturm *et al*. (2024) for instance, who argue for 'a new kind of music studies' to engage with AIM, I argue that AIM can be treated as simply a new object of study in *existing* disciplines which can inform one another and AIM practice. This thesis therefore demonstrates the need for granular views of AIM in the sociotechnical world while arguing for the value of practice approaches; these findings and calls can be expanded upon by researchers in sociology and (ethno)musicology. AI meta-capital can incentivise such research in these fields – as indeed, it enabled my research as a socio-musicologist through Web Science department funding for 'Human-Centred AI' – but to achieve inter-practice collaboration with these perspectives, the incentives discussed above are needed to introduce

value and competition within AIM beyond these specific deep learning capital and AI meta-capitals.

In this thesis I have argued that the perspective of music as work should be included in AIM practice to exemplify the need for greater engagement with the complexity of sociotechnical context in AI development. I have also identified and argued that this can be achieved through a greater diversity of approach within AIM and interdisciplinary collaboration with external disciplines, extending the objectives of innovation in AIM beyond the technical to include socio-musical impact. In this way, both of my research questions highlight the distinction between perspectives of music as incidental (as data; as a hobby; as an application) and vital (as a livelihood; as a vocation). By expanding interdisciplinarity in AIM, the practice can gain a stake in the latter vital view by adopting musical innovation as an objective. AIM is meaningful for music workers because they depend on music in a way that developers do not. I therefore call for this difference to be acknowledged and addressed through a perspective of music-as-work in AIM practice, using both an expanded view of AIM users to include the complexities of musical labour, and expanded objectives of AIM practice to include music as a key consideration of AIM labour. Such responses are necessary to ensure that the responsibility for beneficial AIM in music work does not fall to individual workers, who have seen declining conditions of work through past struggles to maintain careers through technological change.

7.2 Conclusion: Final Remarks

In this thesis I have explored why Artificial Intelligence and Music (AIM) is meaningful for music work through ethnographic observations and interviews that probe into the actions, influences, and experiences of AIM developers and music workers. Through this, I have identified how social and material barriers like an alienation of non-technical discourses and responsibility handoffs between stages of technological development restrict collaborative and cumulative innovation within AIM practice. This acts as a barrier to expanded interdisciplinary development that is called for in and beyond the practice and exposes AIM as a field of technical, not musical innovation. I have also argued that these conditions are meaningful for music work in the western recording industry because they shift power to new agents (AIM technologies, developers, and owners) that are shaped by the technical capital and narratives of wider AI markets. Regardless of workers' positions on AIM, the technology and its power shifts necessitate new strategies for maintaining their own agency within and beyond the existing frameworks of sociotechnical careers. These inquiries have produced a long-sighted view of AIM development and music work practices that shape the meaning of emergent AIM. Through this case study of AIM and music work I have demonstrated the value of, and argued for expanded interdisciplinarity that foregrounds contributions and collaboration with domain expertise in the arts, humanities, and social sciences for the mutually beneficial development and study of AI(M).

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